STUDENT CAPSTONE PRESENTATION PROGRAM

APRIL 8TH, 2025

UNIVERSITY OF TORONTO MISSISSAUGA

FORENSIC SCIENCE PROGRAM

EVENT ITINERARY

8:30 AM **REGISTRATION**

Kaneff Centre, Room 108

COFFEE & REFRESHMENTS

Kaneff Centre Rotunda

9:00 AM **WELCOMING ADDRESS**

VIVIENNE LUK

Interim Associate Dean, Academic Experience
University of Toronto Mississauga

Kaneff Centre: Room 137

9:05 AM **KEYNOTE PRESENTATION**

STÉPHANIE NOWAK

Executive Director, Innocence Canada

Kaneff Centre: Room 137

UNIVERSITY OF TORONTO MISSISSAUGA

FORENSIC SCIENCE PROGRAM

STUDENT PRESENTATIONS: KN137

9:30 AM **RESEARCH INTERNSHIP PRESENTATIONS**

SESSION CHAIR: ASHLEY MOO-CHOY; NOOR ABBAS

PhD Candidates, Department of Anthropology, University of Toronto

10:35 AM **COFFEE BREAK**

Brief intermission, presentations resume at 11:00 AM

FSC483, FSC485, FSC407, FSC489
POSTER AND BOOTH SESSION

INSTRUCTIONAL CENTRE ATRIUM

Speaker Presentations Resume at 2:00 PM

FORENSIC SCIENCE AT THE UNIVERSITY OF TORONTO MISSISSAUGA

The **UTM Forensic Science Program** attracts some of the brightest students from across the country and the world to take part in our unique educational experience. Applied learning, combined with a first-class science degree, is the keystone of their education. All graduates of the Forensic Science Specialist Programs at UTM complete a capstone experience that applies their acquired skills and knowledge, preparing each student for the next step in their own unique career pathway.

Successful capstone experiences benefit the student, the mentor, and the agency through an exchange of ideas, learning opportunities, and new solutions for current problems.

Forensic Science Day is the culmination of these partnerships. The guidance of our mentors contributes to the growth of our students' professional skills, in combination with in-class experiences such as the submission process of ethics approval, job interview training, and CV development. Many of these students and their mentors present and/or publish their research at conferences and in peer-reviewed journals. It is our pleasure today to thank the mentors, and to praise the initiative and efforts of these exemplary students.

Today, we celebrate the hard work and success of our forensic degree students.

UNIVERSITY OF TORONTO MISSISSAUGA

FORENSIC SCIENCE PROGRAM

FSC481Y5

RESEARCH INTERNSHIP IN FORENSIC SCIENCE

KN137

SESSION CHAIRS:

ASHLEY MOO CHOY
PhD Candidate, Forensic Biology
University of Toronto

NOOR ABBAS
PhD Student, Evolutionary Anthropology
University of Toronto

KATHRYN KOCEMBA

Preventing wrongful convictions: it starts with police (training)

ABSTRACT

Background: Wrongful convictions stem from a variety of underlying causes, and although those causes differ across cases, police are often key players. Police are uniquely situated as gatekeepers to our criminal justice system. They can impact the trajectory of a wrongful conviction—both in contributing to their incidence but also in preventing them. *So how do we reconcile this duality? Education*. **Research Problem**: Police can only be as effective as they are trained to be, yet wrongful conviction prevention remains absent from basic training. This research explores how to effectively equip police with the necessary skills and mindset to help prevent wrongful convictions. **Methodology**: Police training largely differs throughout the country (provincially, municipally, etc.) and training materials are not publicly available. Hence, an exploratory literature review was conducted synthesizing effective police instruction practices to develop recommendations for wrongful conviction training. **Key Findings**: The literature review (n = 25) identified 6 recurring themes in police training methodologies: collaboration, technological integration, active learning, reflection, real-world application, and lecture. **Implication**: Through this research it became apparent that there is no universal standard for police education in Canada. Yet, one commonality can be observed across all regions—the lack of exposure to wrongful conviction prevention training. As such, the findings from this research could help inform future police training programs about wrongful conviction prevention. **Conclusions:** This preliminary research acts as an effective steppingstone in creating strategic training materials for police about mitigating wrongful convictions.

Keywords: police training, wrongful convictions, effective training methods, wrongful conviction prevention, police education

Supervisor: Pamela Glatt; Innocence Canada

SANG HOON KIM

Examining the differences in psychopathy between criminal and non-criminal populations

ABSTRACT

Background: Psychopathy has been studied in criminal and forensic settings, commonly associated with dangerous offenders. Research suggests, however, that psychopathy exists in both criminal and non-criminal populations, despite limited comparative studies across both. **Research Problem**: How is psychopathy expressed differently in criminal and non-criminal populations, and how do these differences manifest in psychopathic personality and behavioral traits? **Methodology**: A meta-analysis was conducted, utilizing five psychopathy assessments (PCL-R, LSRP, PPI-R, SRP, PPTS). Using two-factor structure (personality and behavior) of assessments, statistical analyses were conducted to compare psychopathy scores across and within both populations. **Key Findings**: (1) Criminal populations had higher total psychopathy scores than non-criminal populations; (2) criminal populations scored higher in both personality and behavioral traits; (3) non-criminal populations showed higher ratio of psychopathic personality to behavioral scores. **Implication**: Results promote a more nuanced understanding of psychopathy, not only manifesting through behavioral traits (e.g., crime) but also through personality traits that do not necessarily lead to criminal behavior. Understanding this distinction between populations may improve risk assessments and reduce biases associated with psychopathy. **Conclusions:** While psychopathy is expressed differently between populations, variability in characteristics and underrepresentation of non-Western samples must be addressed. Future research should explore higher-factor models, conduct large-scale and longitudinal studies, and examine cultural differences in psychopathy.

Keywords: psychopathy, criminal, non-criminal, psychopathic personality, psychopathic behavior, meta-analysis

Supervisor: Richard Schneider; Ontario Court of Justice

JESSICA YANG

The sensationalization of 'Not Criminally Responsible on Account of Mental Disorder' (NCRMD) in the media

ABSTRACT

Background: The topic of true crime has become more popular; encountering media about 'Not Criminally Responsible on Account of Mental Disorder' (NCRMD) may contribute to the pre-existing stigma towards mental disorders. Inaccuracies and misinformation can be spread due to sensationalizing stories in the news. **Research Problem**: There has been limited research on the tones and terms the media uses in their news articles about NCRMD. **Methodology**: News articles (n = 30) were examined on 1) the positive, neutral, and negative tones used, 2) misinformation or exaggeration in the title, 3) rehabilitation mentioned, 4) violence as being rare for those with mental disorders, and 5) patients being called criminals. **Key Findings**: The articles' tone usage was 7% positive, 50% neutral, and 43% negative (χ^2 = 7111357.64, df = 2, P < 0.001). 93% mentioned rehabilitation. None had misinformation or exaggeration in titles. 13% mentioned violence was rare by those with mental disorders. 10% mentioned the patients were criminals. **Implication**: This research can educate the public about the false beliefs about NCRMD individuals, and help the public understand the actual ramifications of an NCRMD verdict. Furthermore, it reveals the need for more statistics and balanced reporting within NCRMD articles. **Conclusions:** The articles about NCRMD individuals have a negative-neutral tone, mention rehabilitation, and do not write that the patient is a criminal. However, they rarely have misinformation or exaggeration in their titles, and often omit violence is rare among those with mental disorders.

Keywords: Not Criminally Responsible on Account of Mental Disorder (NCRMD), mental disorder, media, news articles, forensic psychology

Supervisor: Richard Schneider; Ontario Court of Justice

REBECCA PAVAO

Serial murder typologies and Canadian serial murderers: an exploratory study

ABSTRACT

Background: Serial murder typologies are classification systems used by law enforcement and researchers to help understand and profile serial murderers. These typologies organize suspected serial murderers based on the recorded behaviours, methodologies, and motivations of past serial murderers. However, past research using serial murderer samples from the U.S. have yet to find empirical support for typologizing serial murderers. **Research Problem**: To date, serial murder typologies have not been tested using Canadian serial murderer samples, raising concerns regarding their use by Canadian law enforcement. This study aims to address this knowledge gap. **Methodology**: Of 51 Canadian serial murderer cases screened, the data related to 34 cases were coded. Using an exploratory content analysis, characteristics of their personal lives, criminal behaviours, victimology, mental health status, and substance misuse history were collected from publicly accessible sources. **Key Findings**: Approximately 58.82% (*n* = 20) of the serial murderers examined appeared to have at least one clear motivation for their homicides. Of these 20 cases, only 45% (*n* = 9) fit within a prescribed category – while others fit within multiple categories of a typology. Interestingly, 58.82% (*n* = 20) of the serial murderers had a history of substance misuse. **Implication**: These findings raise concerns for the validity of serial murder typologies and its effective utilization by Canadian law enforcement. **Conclusions:** There is weak evidence to support the existence of typologies in this dataset. Future research should explore substance misuse and serial murder in greater detail.

Keywords: forensic psychology, serial murderers, serial murder typology, Canada, exploratory analysis, content analysis

Supervisor: Rasmus Rosenburg Larsen; University of Toronto Mississauga

CAELIN MASON, MARTINA RUBINO

Compassionate care and rehabilitation among underserved populations with traumatic brain injury: A scoping review

ABSTRACT

Background: Traumatic brain injuries (TBI) are the leading cause of disabilities worldwide. They disproportionately affect underserved populations including people experiencing homelessness (PEH) and those who intersect with the criminal justice system (CJS). Compassionate care can improve healthcare experiences and outcomes for these populations. **Knowledge Gap**: The extent to which compassionate care is provided and/or considered in rehabilitation for underserved populations with TBI is unknown. **Methodology**: We conducted two scoping reviews to assess compassionate care in rehabilitation for (1) PEH and TBI and (2) individuals with TBI who intersect with the CJS. Through a systematic search of multiple databases, articles that met predetermined inclusion criteria were identified. A descriptive numerical summary and qualitative analytical techniques were applied to analyze our data. **Key Findings**: For the PEH review, 20 articles met inclusion criteria and 40% (n=8) of the included articles provided/considered compassionate care. For the CJS review, 25 articles met the inclusion criteria and 20% (n=5) of included articles provided/considered compassionate care. **Implications**: The current literature on rehabilitation for underserved populations indicates a lack of routine consideration/provision of compassionate care. **Conclusions:** It is imperative to consider compassionate care in rehabilitation of underserved populations with TBI to improve healthcare experience and outcomes. This can be done by embedding compassionate care as a foundation of current and developing rehabilitation programs and training.

Keywords: traumatic brain injury, rehabilitation, compassionate care, homelessness, criminal justice system

Supervisor: Vincy Chan; KITE Research Institute, University Health Network

NAVYA MATHUR

Witness the future: using GenAI to improve and evaluate expert testimony delivery

ABSTRACT

Background: Forensic expert witnesses are vital to the justice system, but students and early-career professionals often lack practical, interactive training to present complex science effectively in court. Any existing training lacks interactive components, making it difficult to develop critical skills. **Research Problem**: Can an AI-driven simulation serve as an effective, accessible, and interactive substitute for preparing for expert testimony, refining scientific explanations, and improving courtroom readiness through structured feedback? **Methodology**: This project uses Google's Gemini, a large language model, to simulate the cross-examination of forensic experts. User responses are assessed on clarity, accuracy, and credibility using criteria from legal precedents. **Key Findings**: The AI evaluates user responses using Canadian legal precedents, providing feedback through follow-up questions to elicit expert-level details. Play-testers noted how choosing prosecution or defense mirrored real challenges of opposing counsels. **Implication**: This AI-driven platform could support forensic education by offering opportunities to practice and refine courtroom communication skills in an immersive and controlled environment. This enables students to make mistakes without consequences, bridging education with practical experience. **Conclusions:** AI can improve forensic education through repeated practice opportunities, reducing both student anxiety and instructor workload. Future work includes surveying relevant stakeholders, integrating this level into a broader forensic simulation game, and evaluating its effectiveness as a whole.

Keywords: forensic science, artificial intelligence, expert testimony, expert witness, AI-driven learning, scientific communication

Supervisors: Steve Engels; University of Toronto. Caitlin Pakosh; University of Toronto Mississauga

COFFEE BREAK

Brief intermission, presentations resume at 11:00 AM

LUCAS CRISPINO, JACKY QUE

The effect of weapon shape and velocity on bloodstains deposited on the wielder

ABSTRACT

Background: Bloodstain pattern analysis (BPA) is a forensic identification discipline that studies blood patterns deposited on surfaces to determine bloodstain origin and creation. Bloodstains located on an individual's clothing may provide evidence that a person was present at the crime scene during the offence. **Research Problem**: Given the limited research exploring bloodstains deposited on people and their clothing, this study investigates how weapon shape and velocity affect the number of bloodstains deposited on individuals. **Methodology**: Volunteer participants (n=29) struck two pools of blood using a hammer and tire iron, wearing white protective suits for each strike. The number of bloodstains on each suit were manually counted, and the velocity of each impact was determined by high-speed video analysis. **Key Findings**: The ball-peen hammer generally deposited more bloodstains on the torso and arms compared to the tire iron. There was no correlation between the velocity of the weapon and the number of bloodstains deposited on the wielder's clothing. **Implication**: These results may inform the type of weapon used during an offence based on bloodstains deposited on a suspect's clothing. **Conclusions:** The shape of a weapon may affect the number of bloodstains deposited on the wielder, but velocity does not have an effect. Further research may explore the effect of different blunt weapons, such as a baseball bat.

Keywords: forensic science, bloodstain pattern analysis, forensic identification, impact pattern, weapon blood interface, impact velocity, blunt weapons

Supervisor: Irv Albrecht; Forensic Identification Services, Toronto Police Service

TAYLOR STRACHAN

Comparing two Leucocrystal Violet formulations for enhancing bloody footwear impressions

ABSTRACT

Background: Leucocrystal Violet (LCV) is a chemical reagent widely used to enhance bloody impressions at crime scenes. Since its introduction in 1993, various manufacturers have produced proprietary LCV formulations, but no studies have compared their efficacy to each other or the original formula. **Research Problem**: This study aimed to examine differences in effectiveness between a homemade LCV formula based on the original 1996 published recipe and a commercially available LCV product in order to inform best practices for enhancing bloody footwear impressions. **Methodology**: Bloody footwear impressions were deposited on six surfaces—drywall, hardwood, laminate, rough ceramic tile, smooth ceramic tile, and vinyl. Each impression was split in half and developed with either the homemade or commercial LCV formula. A grading matrix was used to score impression quality, and a Wilcoxon Signed Rank Test determined statistical significance. **Key Findings**: The homemade LCV formula significantly outperformed the commercial version, both visually and statistically, on all surfaces except drywall, where results were comparable. The homemade formula was also more effective on less saturated impressions. **Implication**: The results indicate that formula modifications can significantly impact the visualization of bloody footwear impressions. Future research should expand the sample size and number of formulations tested. **Conclusions:** Given cost and storage considerations, forensic identification services should consider preparing fresh LCV mixtures using the original 1996 recipe rather than purchasing commercial products.

Keywords: forensic science, forensic identification, Leucocrystal violet, LCV, bloody footwear impressions, blood enhancement

Supervisors: Robert Hofstetter, Malak Elayas, Michael Ho, Tamara Newell-Bell, Meriah Woodhouse; Peel Regional Police .

CHANELL NG

The comparison between commercial bullet testing kit (BTK) and lab mixed in-house sodium rhodizonate tests for lead detection on various substrates

ABSTRACT

Background: Gunshot residue(GSR) is ejected during the firing process and can transfer to surfaces upon bullet strikes. Sodium rhodizonate test is a colorimetric test that presumptively detects lead found in GSR, producing a purple colour change. While commercial bullet testing kits(BTK) are known to be efficient, they can be costly. **Research Problem**: This study aims to broaden the benefits by creating an effective and cost-efficient lab-mixed sodium rhodizonate alternative (acetic acid(10%) and sodium rhodizonate(~0.3%)) compared to a BTK. **Methodology**: A Glock 22 handgun, using 9mm full metal jacket cartridges were fired at an indoor gun-range. Bullet strikes (n=120) were tested using two methods (n=60 per method) across three substrates: wood(n=40), car door(n=40), and drywall(n=40). A Fisher's exact test (α=0.05, 95% confidence level) was used to evaluate the statistical difference between the two methods. **Key Findings**: Both methods detected positive results (n=120) for lead. The statistical test failed to reject the null hypothesis ($p = 1$, $p \geq 0.05$), suggesting no statistical difference between the methods. Cost analysis revealed the in-house test totaled $11.67 for over 60 tests, solution cost of $0.02/mL and reagent cost of $0.13/ml. The BTK vials used for this research cost $80.49, $1.34/test. **Implication**: The results suggest the in-house concentration is just as effective at detecting lead and can serve as a cost-effective alternative to the BTK**. Conclusions:** This test is a valuable tool that can be utilized in shooting investigations. Future research can focus on optimizing concentration to reduce error rates.

Keywords: gunshot residue (GSR), presumptive test, sodium rhodizonate, crime scene investigation, forensic science

Supervisors: Robert Hofstetter, Michael Ho, Malak Elayas, Meriah Woodhouse; Peel Regional Police

MARK GAYO

Accurate and repeatable method of scanning roadways using Recon-3D in comparison to a terrestrial laser scanner

ABSTRACT

Background: Recon-3D is an application in Apple devices containing the light detecting and ranging (LiDAR) sensor. It stores data (point cloud) in 3D coordinate spaces, constructing 3D models. Recon-3D has publications involving small crash scene documentation, bloodstain pattern and bullet trajectory analysis. Currently, no study exists using Recon-3D solely on maximizing area coverage or field of view (FOV). **Research Problem**: This research aims to maximizes Recon-3D's FOV on two-lane roadways while maintaining accurate data. Factors affecting FOV was investigated (height and angle of the device relative to the ground). **Methodology**: The iPhone 13 Pro Max assessed FOV on the height and angle of the device. Accuracy was compared to ground truth measurements within models. Optimal settings were tested on controlled roadways to assess accuracy and scan time under two walk methods (assessed using Wilcoxon rank-sum test). Recon-3D's accuracy was compared to the FARO S350 for comparison. **Key Findings**: 225cm at 15° and 30° and 300cm at 15° and 30° maximized accurate FOV. On a 1099cmx2990cm roadway, 300cm at 30° gave the fastest and accurate data at 117.55±4.90s using the lengthwise line walk method. This setting against the FARO S350 displayed 99.52% against 99.92% accuracy. **Implication**: Recon-3D provides alternatives for efficient method for documentation of roadway evidence, giving variety for investigators to preservation. **Conclusions:** Recon-3D's efficient scanning setting is 300cm at 30° using a lengthwise line walk for scanning roadways, while the FARO S350 is superior in accuracy and quality data.

Keywords: forensic science, forensic identification, crime scene documentation, laser scan, 3D mapping, crime scene reconstruction

Supervisor: Jihwa Lim; ai2-3D Forensics

IRENE BIBIRIS

Determining the impact that spacing of burning wicker baskets has on fire spread in an outdoor environment

ABSTRACT

Background: This research examines the relationship between distance, heat flux and fire spread to improve fire origin determination in forensic investigations. Prior studies have established heat flux thresholds for auto-ignition of household materials, however research of fire spread in fuel-limited conditions is limited. **Research Problem**: Although 20 kW/m^2 is often cited as the minimum heat flux needed for auto-ignition, its applicability in fuel-limited fires remains unclear. This study aims to determine how object spacing affects the likelihood of secondary ignition. **Methodology**: Heat flux was measured between ignited wicker baskets and polyurethane foam sponges placed at distances of 6, 12, and 18 inches. A total of 15 trials were conducted, assessing maximum heat flux and secondary ignition occurrences. **Key Findings**: Spacing showed a significant influence on fire spread as no trials with a 12- or 18-inch distance underwent secondary ignition. All 6-inch distances ignited with three of them having a maximum heat flux lower than 20 kW/m^2 (16.3, 13.25, and 19.36 kW/m^2). **Implication**: These findings suggest that spacing affects the ignitability of a secondary object due to higher heat flux and direct contact with the flames. Findings have a potential influence on fire investigations by helping determine fire origins, spread patterns and fire safety guidelines in outdoor settings. **Conclusions:** This research provides critical data on object spacing and fire spread, aiding fire investigators in assessing ignition likelihood, and sets the stage for further exploration into fire behaviour and safety measures.

Keywords: forensic science, fire investigation, fire spread, forensic fire analysis, heat flux, ignition threshold, polyurethane foam

Supervisor: Jessica Reynolds; Office of the Fire Marshal

EILEEN NGO

Determining the impact of spacing on fire spread between wicker and polyurethane for indoor fires

ABSTRACT

Background: One significant challenge in indoor fire investigations is the spread of fire between objects which complicates the process of accurately determining the origins of a fire. Fire spreads through the fluctuating heat energy from one object to another, known as radiative heat flux, where a threshold must be met for autoignition. Better characterization of these parameters will assist investigators in developing and testing hypotheses on the area of origin at a scene. **Knowledge Gap**: There is minimal research specifically on the impact of spacing between common household objects and the potential for secondary ignition in an indoor setting. **Methodology**: Using a wicker basket as the ignition source, a polyurethane foam sponge placed 6, 12, and 18 inches away was observed for secondary ignition. Quantitative heat flux data was measured and compared to theoretical values and practical observations. **Key Findings**: Ignition occurred in all 6-inch and one 12-inch spacing trial. Heat flux values disagreed with literature and had high variability, showing error and unreliability in the data. **Implication**: Significant changes in values from adjusting the heat flux gauge suggested a height dependency for the heat flux received by an object. Additionally, flaming ignition rather than autoignition was hypothesized to occur at a 6-inch distance. **Conclusions**: The results highlight the importance of critically examining data when conducting research. The information in this study suggests phenomena that should be considered in tandem with heat flux in a fire investigation, provides direct precautions for similar research, and opens future research to explore different variables.

Keywords: forensic science, fire investigation, heat flux, secondary ignition, compartment fire, fire dynamics

Supervisor: Jessica Reynolds; Office of the Fire Marshal

LUNCH BREAK

A 90 minute recess at the Blind Duck, UTM Student Centre.

Forensic Science Day resumes at 1:30 PM with the Poster Session in the Rotunda of the (KN) Kaneff Centre.

Note: The Poster Session is open, and overlaps with lunch.

POSTER SESSION

60 minutes in the Kaneff Rotunda.

Speaker presentations resume at 2:00 PM

Note: The Poster Session is open, and overlaps with lunch.

FALLON HUNT

Taphonomic study of long-term burials

ABSTRACT

Purpose: The purpose of this research is to determine how burial conditions affect bone preservation from long-term burials (i.e. more than 30 years) by examining the remains of 60 dogs buried for at least 35 years, in order to provide forensic anthropologists with novel information that can be used to assist with the estimation of postmortem interval. **Background:** Accurate estimation of PMI is difficult no matter the stage of decomposition, however, it becomes increasingly complicated when the individual is completely skeletonized, due to the lack of research into the rate of decomposition of skeletal remains under different conditions. **Methodology**: The level of preservation of the skeletal remains of 60 dogs that were exhumed from long-term burials were scored from 1 to 5 using a bone preservation scale where 1 represents "Strong Complete bone" and 5 represents "Bone Meal/Ghost". **Key Findings**: A Kruskal-Wallis test showed that there were statistically significant differences between level of preservation of each individual depending on burial container (p <0.05). A Chi-Square test showed that garbage bags are associated with good perseveration and no external covering is associated with poor preservation (p <0.05). **Implication**: These results suggest that the level of preservation of skeletal remains from a long-term burial is dependent upon the container an individual was buried in. **Conclusions:** Different factors affect the way that skeletal remains decompose over time, resulting in bones that do not visually correspond with their actual PMI.

Keywords: forensic science, forensic anthropology, taphonomy, postmortem interval, skeletal preservation

Supervisor: Tracy Rogers; University of Toronto Mississauga

HAZIM BAKRI

A morphological assessment of determining the biological sex of individuals using the distal humerus of the Malaysian population

ABSTRACT

Background: Biological sex assessment is one of the most important components in constructing an individual's biological profile for identification. This method was first introduced as a means of providing a complementary analysis for morphometric assessment in determining sex based on the differences in the arm's carrying angle between male and female. **Research Problem**: This method has never been tested with the Malaysian population for its accuracy and the success of this research may contribute to the development of this field in Malaysia. **Methodology**: Three traits (trochlear symmetry, trochlear constriction, olecranon fossa shape) were scored from the distal humerus utilizing 100 X-Ray images (50 male, 50 female). **Key Findings**: Two traits (trochlear constriction and symmetry) produce accuracy of ~80% with the olecranon fossa producing 64% accuracy for both sexes. Statistical result indicates that the accuracy of both trochlear constriction and symmetry are significant between male and female ($p<0.05$). **Implication**: This method can be introduced as an alternative or complementary analysis to the existing sex assessments practices in Malaysia. **Conclusions:** It is possible to determine sex based on the traits present on the distal humerus, particularly in cases in which better elements such as pelvis or cranium are not present for morphological sex assessment, but further research incorporating morphometric analysis to score the traits is recommended.

Keywords: forensic science, forensic anthropology, morphological assessment, biological sex, distal humerus, 2D radiograph

Supervisors: Faridah Mohd Nor; National University of Malaysia Medical Centre. Tracy Rogers; University of Toronto Mississauga

ASHLEY BURNS

Assessing taphonomic influence on bone reflectance for remote sensing applications

ABSTRACT

Background: Unmanned aerial systems with multispectral sensors offer a faster, less labor-intensive alternative to traditional foot searches for human remains. While prior research has focused on detecting decomposition markers in soil, research is limited on their effectiveness in locating skeletonized and scattered remains. **Research Problem**: The effectiveness of multispectral sensors in detecting scattered remains is a critical challenge in forensic remote sensing. This preliminary study aims to determine how bone taphonomy affects the multispectral signature of skeletal remains. **Methodology**: Animal bone samples were scanned using a hyperspectral sensor. The data was then converted to represent multispectral bands. Finally, it was analyzed to assess reflectance variability across taphonomic categories, soil, and vegetation. **Key Findings**: Chemically treated bone reflected significantly more light across the visible and near-infrared bands than other taphonomic categories. Fresh bone exhibited the lowest reflectance, particularly in the near-infrared range. Vegetation- and soil-stained bones had similar reflectance patterns. These variations suggest that a single detection method may not be equally effective for all remains. **Implication**: These findings highlight the need for classification schemes that account for diverse taphonomic conditions. Reference samples for image classification must reflect real-world variations to ensure accurate detection. **Conclusions:** Bone reflectance varies based on taphonomic changes, emphasizing the need to refine remote sensing methods to improve the detection of scattered skeletal remains.

Keywords: forensic anthropology, unmanned aerial systems (UAS), remote sensing, taphonomy, skeletonized remains

Supervisor: Yuhong He; University of Toronto Mississauga

SUSAN CHAN

The use of thermal imaging to detect clandestine graves in southern Ontario winter

ABSTRACT

Background: The purpose of this research is to determine if the TOPDON TC-002 thermal camera can capture surface temperature differences from decomposition activity of turkeys buried at 30cm and 50cm depths. This is an exploratory study to see if the TC-002 can be used to aid in searching for human remains. **Research Problem**: Searching for illegal burials in terrestrial environments can be resource intensive, requiring trained personnel or specialized equipment such as aerial vehicles to scan larger areas of land. The TC-002 is a less expensive handheld thermal camera that can attach to phones or tablets for smaller localized searches, although it has not been tested for efficacy. **Methodology**: Heated food grade turkeys (*n*=6) were buried at 30cm and 50cm. The control was empty graves and undisturbed soil. Over the course of the month (December 2024), thermograms of the graves were taken at least 3 times a week, weather permitting. Temperature was then taken from the thermograms and the groups were compared using a one-way ANOVA test. **Key Findings**: It was found over the course of the month there was no statistically significant difference between the temperature and the depth of the burial. A limitation to these results is the surface temperature was affected by surface scatter such as fallen leaves and snow. **Implication**: The results of this research suggest a less expensive, mobile thermal camera can be used in preliminary searches within 24 hours of cooling. **Conclusions:** Future research should look into replicating thermal research in warmer seasons to avoid the technical issues and surface obstructions caused by freezing temperatures.

Keywords: forensic anthropology, thermography, decomposition, clandestine grave identification, taphonomy

Supervisors: Eugene Liscio; ai2-3D Forensics

AVERY SMITS-TALVING

Analysis of thermal modification of faunal bone from an archaeological site

ABSTRACT

Purpose: The purpose of this research is to determine the degree and frequency of thermal modification on bone from the Ellery site. This research aims to identify which elements from which species are more frequently burnt, and to what extent. **Background**: Ellery is a multi-component Late Woodland site located in Simcoe County, Ontario. Faunal bone was the focus of this research as it can be a useful cognate for human bones when trying to understand taphonomy. **Methodology**: Identification of faunal elements was done through comparison to modern reference specimens. Burning was categorized on a scale of 0-6 based on a classification system by Stiner et al. (1995). **Key Findings**: Burned elements are consistently present, making up between 11% and 35.5% of the faunal specimens by context. Thermal modifications were more frequently identified on mammal bone than on fish bones; very few bird bones were burned, however, birds made up a small part of the assemblage overall. No reptile or amphibian bones had any evidence of thermal modifications; the sample size for reptiles and amphibians was small. **Implication**: This research provides insight into human behaviour at the Ellery site. It implies that not all classes of animals were treated the same. **Conclusions:** A better understanding of the Ellery dataset was obtained through this research. Elements that showed burning were often less identifiable and more damaged. Faunal bone being less identifiable when burned is consistent with issues of identification in forensic anthropology.

Keywords: zooarchaeology analysis, taphonomy, archaeology, thermal modification, forensic anthropology

Supervisors: Alicia Hawkins, Trevor Orchard; University of Toronto Mississauga

PAYTON BOUVIER

An identification of animal bones that may be identified as possible human bone during initial assessment

ABSTRACT

Background: This research project discusses the analysis of animal bones from the Ellery archaeological site. Ellery is a multi-component Late Woodland habitation site located in Simcoe County, Ontario. Animal bones were the focus of this project as they may be mistaken for human bone in the field. **Purpose**: This project aimed to determine which skeletal elements from which species may, on first glance, hold the potential to be confused with human bone. **Methodology**: Faunal skeletal elements were identified through comparison to modern reference specimens in the Deborah J. Berg Faunal Collection. **Key Findings**: The results of this research indicate that the proportion of elements from the Ellery site that may be mistaken for human bone is very low. Skeletal elements that were flagged were strictly associated with mammals; and subsequent identifications indicated that most elements were identified as *Canis familiaris* (dog). **Implication**: This research provides an understanding of how bone identifications influence the practice of field assessments of skeletal elements conducted by individuals in archaeology. **Conclusions:** The findings from this project set the stage for further exploration into the species and skeletal elements that hold the potential to be confused with human bone across different sites within the Ellery site, and across other sites of this nature.

Keywords: zooarchaeological analysis, morphological comparison, archaeology, forensic science, forensic anthropology

Supervisors: Alicia Hawkins, Trevor Orchard; University of Toronto Mississauga

COFFEE BREAK

Brief intermission, presentations resume at 3:20 PM

MADS LOEWITH

Validation of a proposed method for approximating nose tip projection

ABSTRACT

Background: When performing forensic facial approximations (FFA), the nose is a critical feature. Numerous methods have been proposed to predict the position of pronasale with varying rates of success. **Research Problem**: The purpose of this research is to validate the FFA technique for predicting pronasale proposed by Rynn et al. **Methodology**: Our sample consisted of postmortem CT scans (n=40). The distances between key craniofacial landmarks were measured in 3D Slicer and used to approximate nasal dimensions following the described method. Predicted and observed nasal dimensions were compared. **Key Findings**: The regression analysis slightly overestimated each nasal dimension. The highest correlation was seen for Nasal Length, with a mean difference of 0.22 mm. This correlation was statistically significant, as was the correlation for ProVert (MD = 0.69 mm). ProAnt was moderately correlated (MD = 2.04 mm). The largest deviations between the predicted and observed values were for Nasal Height, ProP, and Nasal Depth. **Implication**: These findings are consistent with existing research on this method. **Conclusions:** The method proposed by Rynn et al. for approximating pronasale position yields consistent, accurate results across different sample pools.

Keywords: forensic anthropology, forensic facial approximation, nasal morphology prediction method, soft tissue prediction, nose projection

Supervisor: Marc Dryer; University of Toronto Mississauga

SABRINA AMUNDARAIN

A three-year review of THC and alcohol findings in impaired driving investigations in Ontario Canada.

ABSTRACT

Background: Driving under the influence of cannabis is a significant public safety issue. Cannabis can impair driving ability and this impairment is increased when cannabis is used in combination with alcohol. **Knowledge Gap**: Despite the scientific consensus regarding the potential of cannabis to impair driving ability individually and combined with alcohol, there is relatively little information available regarding blood concentrations and associated observations of impairment in authentic suspected impaired driving cases in Ontario. **Methodology**: Retrospective data analysis was conducted on suspected impaired driving cases in which THC and alcohol were the only findings in blood samples submitted to the Centre of Forensic Sciences occurring between 2021 and 2023. **Key Findings**: In cases where only THC was present, blood concentrations ranged from 1.1ng/mL to 72ng/ml (mean 11.6ng/mL). When both THC and alcohol were present, the average THC blood concentration was 12.7ng/mL and the average blood alcohol concentration was 145.1mg/100mL. The most common driving and DRE observations were collisions, erratic driving, eyelid tremors, and bloodshot watery eyes. **Implication**: Forensic toxicologists can use these findings to assist with interpretation of THC blood concentrations alone and in combination with alcohol in the context of impaired driving. **Conclusions:** This research provides valuable information regarding blood concentrations of THC and alcohol on driving in relation to observations in impaired driving cases.

Keywords: Cannabis, alcohol, blood concentrations, impaired driving, driving observations, DRE observations

Supervisors: Karen Woodall; University of Toronto Mississauga. Zachary Currie; Centre of Forensic Sciences

SUNNY KIM

Rapid Drug Screening at Canadian Borders Using Benchtop NMR and Single-Quadrupole ESI-MS

ABSTRACT

Background: The rise in drug smuggling presents a growing challenge to public safety in Canada. A rapid preliminary screening method is essential to detect illicit substances and disrupt the drug supply chain. **Research Problem**: Conventional drug detection methods are slow and require highly trained personnel, causing delays in identifying illicit drugs, issuing warrants, and tracking organized crime networks. A fast, high-throughput screening approach using single-quadrupole electrospray ionization mass spectrometry (ESI-MS) and benchtop nuclear magnetic resonance (NMR) is needed to address these challenges. **Methodology:** Various drugs were analyzed using benchtop NMR and single-quadrupole ESI-MS to assess their effectiveness for rapid screening. The total analysis time per sample was at or under 30 minutes. **Key Findings**: Both benchtop NMR and ESI-MS successfully detected all tested substances within the target timeframe. Additionally, spectral libraries of benchtop NMR data were developed to support future analyses. **Implication**: This study introduces a fast, reliable, and accessible drug screening method for border officers. The non-destructive nature of NMR allows for further confirmatory testing when needed. **Conclusions:** Combining single-quadrupole ESI-MS and benchtop NMR provides a rapid solution for preliminary drug detection in packages and at border checkpoints. Additionally, this research contributes to a user-friendly SOP, enabling personnel with minimal chemistry training to implement the method effectively.

Keywords: forensic science, border security, Single-quadrupole ESI-MS, NMR spectroscopy, preliminary screening method

Supervisors: Vivienne Luk; University of Toronto Mississauga. Advikaa Dosajh; Centre of Forensic Sciences

LUKE ST JEAN

A quicker path to explosive analysis using ESI-MS

ABSTRACT

Background: In forensic chemistry, mass spectrometry has become the gold standard for identifying unknown substances with high sensitivity and precision. Everyday, many illicit substances, including various explosives, are being trafficked across international borders, entering countries, and putting public safety at risk. **Research Problem**: Current techniques for explosive analysis require high degrees of training, as well as lack efficiency and accessibility. This research intends to improve on these shortcomings by using single-quadrupole electrospray ionization mass spectrometry (ESI-MS) to save time, be accessible in the field, and produce accurate results. **Methodology**: Explosive standard solutions were diluted using methanol to concentrations of 0.01 mg/mL. The solutions were then run through ESI-MS on negative ion scan mode at cone voltages of 12, 30, 50, and 80 V to observe varying levels of fragmentation. **Key Findings**: We found that ESI-MS can analyze various explosive solutions at low concentrations and produce unique mass spectra for identification in a timely manner. By compiling a library of mass spectra for explosive compounds analyzed at different voltages, unknown substances could be identified with greater confidence. **Implication**: Our results demonstrate how ESI-MS can be deployed in the field and be used by individuals with limited training and without a background in chemistry. **Conclusions:** This research is a small step towards accessible, efficient, and accurate explosive analysis being performed. Future research in this area can be directed towards analyzing explosives in powder form to create a more detailed library.

Keywords: forensic chemistry, explosive analysis, single quadrupole, ESI-MS

Supervisors: Advikaa Dosajh; Centre of Forensic Sciences. Vivienne Luk; University of Toronto Mississauga

BENJAMIN LOWTHER

The identification and classification of anemia via Prussian blue special staining and histomorphometry

ABSTRACT

Background: This research examines microscopic effects of anemia on bone to aid in the identification and characterization of anemias of differing etiology in human skeletal remains. Current histopathological methods can not distinguish between acquired and hereditary anemias. **Research Problem**: Human skeletal remains are often incomplete or damaged, making DNA analysis and other methods of identification impossible to perform. This study aims to aid in the identification process by differentiating acquired from hereditary anemias. Identifying a genetic condition may aid in narrowing the list of potential missing persons to which the remains may belong. **Methodology**: A sample of 15 human rib samples stained with Prussian Blue in a previous study were reanalyzed for validation of the results. Additional human rib samples from the same population were stained. 5 metric traits were measured in each sample and compared to healthy individuals. **Key Findings:** A partial reading of the data indicates staining alone is insufficient to establish etiology. Analysis is proceeding with respect to combining morphological and metric data. **Implication**: These findings would suggest that differentiating the type of anemia is not possible based solely on histomorphological traits. **Conclusions:** This research provides data on traits in bone present in anemic individuals, aiding in the identification of disease in bone, and providing a novel starting point for Forensic Anthropologists in aiding in the identification of human remains.

Keywords: forensic science, forensic anthropology, anemia, histomorphometry, Prussian blue special staining

Supervisor: Lilianna Watamaniuk; University of Toronto Mississauga

POSTER SESSION
PRESENTERS LIST

FSC483H5:

COLLABORATIVE RESEARCH INTERNSHIP

JESSICA PAISLEY

Optimizing low concentration ballistics gel for firearm classifications in Canadian law

ABSTRACT

Background: In the Criminal Code of Canada, a firearm is described as a barreled weapon that has the ability to cause death or serious bodily harm to an individual, with the accepted criteria for serious bodily harm being the "penetration or rupture of an eye". The implementation of ballistics gelatin has been used substantially in research as a proxy for human tissue. Based on previous testing the established V-50 threshold velocity that is needed for corneal penetration is 246 ft/sec. **Research Problem:** This research aims to establish a percentage of gelatin that can be used with these lower velocities and allow for penetration testing, and to format a methodology to support a pass/fail procedure that can allow for the classification of firearms. **Methodology:** BBs pellets were shot from a Crossman 760 Pumpmaster, from a distance of 2 meters, into the gelatin blocks that were made with varying concentrations of gelatin (4%, 6%, 7%, 9%). Each gel block had ~20 shots. The penetration depth was measured for each BB. The results were graphed, compared, and analysed. **Key Findings:** At an average velocity of 245.2 ft/sec, the 7% gelatin blocks had an average of 73.4 mm of penetration with a standard deviation of 3.2. The penetration for the 7% gel blocks was relatively consistent with the depth measurements ranging from 69-79mm. **Implication:** With future testing these lower threshold gelatin blocks can be utilized for low-velocity projectiles to predict human injury models and to aid in the classification of firearms. **Conclusions**: The 7% ballistics gel blocks produced consistent results and allowed for easy penetration calculations to be acquired for the lower velocities, and for a pass/fail range to be developed.

Keywords: forensic science, ballistics, ballistics gelatin, low velocity, BB, pellet, penetration

Supervisor: Eugene Liscio; ai2-3D Forensics

KIANA NOORBAKHSH

Evaluating the effectiveness of HemoSpat for cast-off pattern analysis

ABSTRACT

Background: Bloodstain pattern analysis (BPA) provides essential insights into violent crimes. Traditional methods are subjective, leading to potential biases and inconsistencies. HemoSpat, a software tool, offers an objective, quantitative approach to BPA by enhancing accuracy in bloodstain pattern reconstruction and trajectory analysis. **Research Problem**: This study assesses the effectiveness of the HemoSpat 2.01 update in analyzing cast-off blood patterns, an area with limited research. By evaluating its accuracy in differentiating trajectories, the research aims to improve BPA reliability and support investigations. **Methodology**: Controlled cast-off blood patterns were generated using a mechanical rig, producing linear, elliptical, and diagonal trajectories with 10 trials each for downward, upward, and diagonal patterns. These patterns were documented in HemoSpat 2.01, and analyzed for trajectory differentiation accuracy. **Key Findings**: Hemospat was able to distinguish between various cast-off patterns. However, statistical analyses measuring errors and deviations in cast-off patterns are needed, with particular attention to how these factors influence the accuracy and reproducibility of the analysis. **Implication**: HemoSpat 2.01 has the potential to standardize BPA, particularly in cast-off pattern interpretation, which has been underexplored in forensic research. Reducing subjectivity and improving precision can enhance the scientific validity of BPA and strengthen its credibility in forensic investigations and legal proceedings. **Conclusions:** HemoSpat is a step toward improving BPA's objectivity and reproducibility. Continued research is necessary to refine its application, especially in cast-off bloodstain analysis.

Keywords: forensic science, cast-off, bloodstain pattern analysis, bloodstain, digital analysis, photography, HemoSpat

Supervisors: Eugene Liscio; ai2-3D Forensics

MAJA TINGCHALEUN

Optimal standardization methods for ballistics gelatin — an experimental study

ABSTRACT

Background: Ballistics gelatin is used by Canadian law enforcement agencies to test and determine the legality of non-lethal ammunition weapons such as BB guns and airsoft guns. Thus, more research needs to be done into potential calibration and standardization methods for ballistics gelatin. Traditionally, it has been argued that ballistics gel should be calibrated to exhibit the same hardness, density, tensile strength, visco-elasticity, and compression strength of human tissue, which were explored in this study. **Research Problem**: This study sought to identify which test or series of tests can be most accurately, practically, and reliably implemented as standardization method(s) for ballistics gelatin. **Methodology**: 10% and 20% ready-made gelatin from Clear Ballistics and 8%, 9%, 10%, 11%, 12%, 13%, and 14% wt/wt gelatin blocks prepared from Texturestar 250 Bloom Type B gelatin were tested for hardness, density, tensile strength, visco-elasticity, and compression strength. **Key Findings**: Homemade gelatin displayed different properties from Clear Ballistics gelatin of the same concentration across each test. The relationships between each test were linear and predictable. **Implication**: Forensic laboratories and police agencies should perform standardization tests on any ready-made or homemade gelatin to ensure they exhibit the same properties before they use that gelatin as a basis to determine the legality of a non-lethal ammunition weapons. Ballistics gelatin manufacturers should also use a series of tests when calibrating their gelatin. **Conclusions:** Future research should focus on other properties that may affect the mechanical properties of gelatin, such as pH and stability.

Keywords: forensic science, ballistics analysis, ballistics gelatin

Supervisors: Eugene Liscio; ai 2-3D Forensics

BENJAMIN D'SOUZA, MAKAYLA WIJANTA, CLEMENT WONG

How the 'expert witness' title impacts perceived credibility

ABSTRACT

Background: Expert witnesses play a critical role in the justice system, providing specialized evidence necessary to educate the court. Jurors may rely on factors external to the expert's testimony to assess their credibility. Calling a witness an 'expert' may cause concerns as it biases jurors' perception of their credibility. **Knowledge gap**: The influence of jury instructions on jurors' credibility assessment of the expert witness requires research. This study investigates how the title of the witness and the scientific field impact how an expert witness' credibility is perceived. **Methodology**: Participants (n=48) were randomly assigned to one of four conditions where they viewed recordings of simulated mock trials. Each condition manipulated the title of the witness during testimony and in the charge to the jury ("expert" v. "opinion"). Scientific discipline was also manipulated (forensic biology v. forensic psychology). Participants then rated the witness using the Witness Credibility Scale. **Key Findings**: A two-way ANOVA found that biology testimony was perceived as significantly more credible than psychology testimony. Interestingly, participants rated "opinion" testimony as more credible than "expert" testimony. **Implication**: Despite previous concerns, the "expert" title of the witness did not bias juror perceptions of credibility. However, scientific discipline was an important factor when assessing credibility. The findings suggest that jury charges effectively reinforce the expert witness' infallibility, aligning with the court's priority to ensure jurors critically evaluate expert testimony.

Keywords: Expert witness, testimony, jury perception, opinion evidence, Witness Credibility Scale, forensic science, expert

Supervisor: Caitlin Pakosh; University of Toronto Mississauga

MARYAM ISRAR, TEGBIR HANS, FANNI PATAKI, EMMA BASIC

Exploring the role of forensic chemistry expert evidence in the Canadian criminal justice system: a retrospective case analysis

ABSTRACT

Background: Forensic chemistry applies analytical chemistry techniques to the law, with forensic chemists often testifying on drug analysis, gunshot residue, firearms, and explosives analysis. **Research Problem**: This research examines the understudied role of forensic chemistry expert evidence in the Canadian criminal justice system and aims to fill that gap in the literature. **Methodology**: Using the LexisNexis Advance QuickLaw database, Canadian cases involving criminal charges - including extradition cases - and forensic chemist testimony were identified (n=47). Each case was analyzed across ten fields with respect to both trial and evidence specifics. Using PAST statistical software, the Fisher's exact and chi square tests were applied to assess the significance of eight relationships between the fields. **Key Findings:** Three statistically significant relationships were found: type of evidence and charge at trial ($p<0.000001$), the purpose of evidence and type of evidence ($p<0.000174$), and the type of hearing and type of evidence ($p<0.000001$). **Implication**: These findings provide insight into how forensic chemistry is used in Canadian court cases involving criminal charges. **Conclusions:** The results show associations between certain fields, however, no associations were found for others, indicating that further research should be done looking closer at aspects like the party that called the expert witness and the reasons why admissibility was contested.

Keywords: forensic chemistry, forensic chemist, expert witness, expert evidence, criminal law, Canada, retrospective study

Supervisor: Caitlin Pakosh; University of Toronto Mississauga

MAX WONG

3D area of origin analysis of peripheral spatter generated by gunshots with FaroZone 3D

ABSTRACT

Background: There is an increasing trend with gunshot injuries and victims, however, limited research regarding area of origin analysis and characteristics for such patterns and even more limited for peripheral spatter patterns: blood spatter deposited adjacent to the source. **Research Problem**: This study aims to address the gap in the literature regarding peripheral spatter and its use for AO analysis as well as the use of FZ3D BPA's AO tool for gunshot patterns. **Methodology**: Ten trials were conducted with varying blood source distances from an adjacent pattern collection sheet (5, 10, and 20 cm, n=30). Blood sources consisted of ~3mL of sheep's blood in a pocket of a foam board and a bullet was then fired through the source. The resulting patterns were then analyzed in FZ3D, measuring the X, Y, Z AO estimates and subsequent displacement errors. Statistical analysis was then performed determining statistical significance between known and estimated AOs along with source board distances. **Key Findings**: Estimated AOs were within the accepted 20cm error range for all source board distances, however, a significant difference between known AOs ($p > 0.05$). Significant differences were found between source board distances illustrating increases in error displacement with increasing distance. **Implication**: Peripheral spatter and FZ3D can be used in crime scene investigation regarding gunshot victims and AO analysis, providing a methodology and literature for future casework. **Conclusions:** FZ3D can provide a general estimate for AOs using peripheral spatter generated by gunshots within acceptable standards.

Keywords: forensic science, bloodstain pattern analysis, FaroZone 3D software, 3D reconstruction, area of origin analysis, gunshot analysis

Supervisor: Eugene Liscio; ai2-3D Forensics

MICHAELA BONILLA

Penetration depth in ballistics gelatin as a measurement for projectile velocity and energy

ABSTRACT

Background: Commercially available air weapons like BB guns can cause serious injuries but are not all considered firearms based on the *Firearms Act* and the *Criminal Code*. BB guns are considered firearms if its maximum velocity is greater than 152.4 metres per second (500 feet per second), and its maximum energy is greater than 5.7 joules. This injury potential for firearms is measured by shooting into porcine eyeballs. **Research Problem**: Porcine eyeballs cannot be standardized unlike ballistics gelatin. Thus, can the velocity and energy of a projectile be determined from its penetration depth into a standardized ballistics gelatin? **Key Findings**: A linear relationship is expected between the BB penetration depth and gel concentration used. Average deceleration through a 10% w/w gel was 522 to 527 fps, with an average penetration depth of 2.15 to 2.25 in; the 10% FBI gel standard reported averages of 563 fps and 2.95 in. **Implication**: Homemade gels require a higher concentration of gelatin to mimic the properties of standard pre-made gel blocks. Further testing is required to investigate the sensitivity of velocity based on depth measurements, considering FBI calibration standards report depths of 2.95 to 3.74 in at 590 fps. **Conclusions:** Average deceleration and measured penetration depth can be used to determine the BB velocity and energy. We expect to conclude that a 15 to 16% w/w homemade gelatin is equivalent to a standard 10% FBI ballistics gel for calculating velocity via penetration depth.

Keywords: forensic science, ballistics, firearms, projectile, air weapon, BB gun, ballistic gel, safety, penetration depth, velocity, energy

Supervisor: Eugene Liscio; ai2-3D Forensics

SAVITA BRICKMAN-MAXWELL

Cast-off bloodstain pattern analysis with hemovision

ABSTRACT

Background: Cast-off bloodstain patterns are created when blood drops are released from a moving object. Hemovision is an automated bloodstain pattern analysis tool that can estimate area of origin. **Research Problem**: To assess the accuracy of Hemovision's new cast-off analysis feature by comparing estimated swing coordinates to ground truths. This is to provide a quicker method for bloodstain pattern analysis (BPA) at crime scenes. **Methodology**: Using a cast-off rig and sheep blood, multiple bloodstain patterns (n=30) of three swing types were created; vertical downwards, vertical upwards, and diagonal downwards (n = 10 for each). Ground truth measurements of the rig origin were obtained. HemoVision markers were placed around the bloodstain patterns and multiple photographs were captured. The photographs were analysed with HemoVision to determine the estimated swing path. **Key Findings**: HemoVision analysis estimated the centre of the swing as a 3D coordinate with average absolute errors of ~16 cm for downwards, ~27 cm for upwards, and ~17 cm for diagonal swings. One-sample t tests of the 3D coordinate errors found a statistically significant difference between the hypothesized mean ($\mu=0$), and the sample means for all three swing types ($p<0.05$). **Implication**: HemoVision can assist in some crime scene investigations, providing a faster analysis tool compared to manual analysis; however, there may be statistically significant differences compared to the true coordinates. **Conclusions:** HemoVision can provide a general estimate of the swing path coordinates that caused the cast-off bloodstain pattern.

Keywords: forensic science, bloodstain pattern analysis, cast-off bloodstain pattern, HemoVision, virtual analysis.

Supervisor: Eugene Liscio; ai2-3D Forensics

POSTER SESSION
INFOGRAPHIC PRESENTERS LIST

FSC485H5:

EXPERIENTIAL OPPORTUNITY IN FORENSIC SCIENCE

MATTEO ALMEIDA

Beyond the uniform: experiences as a summer student with York Regional Police

ABSTRACT

Experience: A summer student program was completed at the York Regional Police (YRP) Collision Reporting Centre in Richmond Hill, Ontario from May-August 2024. **Background**: YRP provides opportunities for students to work at various units throughout the summer. To be considered, students must be enrolled in a law enforcement program at an accredited institute, must continue their studies the following semester, and must have an interest in pursuing a career in policing (civilian or uniform). After an in-depth hiring process, up to 20 students were selected. Daily tasks included answering phone calls, educating the public on the online and in-person collision reporting process, ensuring the public has the correct documentation to complete the report (driver's licence, ownership, insurance), and assisting with the collision report writing. Additional tasks were assigned by the Sergeant and Staff Sergeant, such as designing a step-by-step handout to aid the public in completing an online report. **Conclusion:** This experience helped improve skills that can be applied to future careers in forensic science, such as communication, time management, customer service, attention to detail, report writing, and problem-solving. Upon completion, a performance review was conducted by the Staff Sergeant, and feedback was provided to the student and the talent acquisition staff. Working with York Regional Police helped build professional and personal relationships with individuals in law enforcement. This experience is strongly recommended to students who have an interest in pursuing a career in policing (civilian or uniform).

Keywords: law enforcement, collision reporting centre, summer student program, online collision reporting, performance review

Supervisors: Christopher Lewis; York Regional Police. Karen Woodall; University of Toronto Mississauga

ERIN BRIGGS

The long and winding road to EDI in UK higher education

ABSTRACT

Experience: A 12-week long research abroad at the University of Liverpool was completed through the University of Toronto. The research project, titled *Doing Diversity: A Study of Equity, Diversity, and Inclusion Experts in UK Higher Education*, aimed to explore the roles and experiences of EDI (Equity, Diversity, and Inclusion) experts across universities in the United Kingdom. This was accomplished through semi-structured interviews and subsequent data analysis. **Background**: The research project was part of the Summer Research Exchange Program (SREP), offered through the University of Toronto's Study Abroad program. SREP provides UofT students with a wide selection of locations and research opportunities. To participate, students must meet the eligibility requirements, including a minimum cGPA of 2.25 and completion of at least two years of study, though some institutions may have higher criteria. **Conclusion**: This experience was both rewarding and enriching, offering invaluable research exposure, while also allowing for the ability to travel, explore a new environment, and engage with a different academic institution. This opportunity is highly recommended to students seeking to broaden their research skills and gain cultural insight.

Keywords: Equity, Diversity, and Inclusion (EDI), research abroad, United Kingdom.

Supervisor: Tomi Koljonen; University of Liverpool

EMILY BRUNET

Psychopathy and substance use disorders, and profiling

ABSTRACT

Experience: Over the course of the year, two experiences were completed. The first was a twenty-hour online behaviour profiling course offered by ACS Distance Education. The second was research under the supervision of Dr. Larsen, where the goal was to examine whether the amalgamation of traits that make up the "psychopathic personality" can better be explained by other psychological disorders, such as substance use disorders. **Background**: The online course was asynchronous and involved five modules. Each module covered a different aspect of behaviour profiling and detailed various methods and types of assessments that one could use to profile. While the course did discuss forensic applications of behaviour profiling, it also covered its applications in marketing and job interviews. The research involved a sample of 130 Canadian case summaries from 1980 to 2022, where the defendant was identified as psychopathic or was assessed with the PCL-R. At the time of this writing, a method of utilizing large-language models to quickly and accurately code the case summaries for evidence that defendants had misused substances or had other mental health diagnoses was being tested. **Conclusion**: The online course is recommended for students who want to generally increase their knowledge of behaviour profiling practices and their applications. A research opportunity is recommended for students who wish to pursue a research-based career, or a career where they are required to interact with and be up to date on research.

Keywords: behaviour profiling, online course, research, psychopathy, substance use disorders, mental health disorders

Supervisor: Rasmus Larsen; University of Toronto Mississauga

SALMA EL-ETREBY

Preserving the past to shape the future

ABSTRACT

Experience: An experience at the Oakville and Milton Humane Society and the University of Toronto Mississauga's very own Forensic Anthropology Field School, completed over the course of six months. These experiences entailed excavating, cleaning, and inventorying pet graves and remains, as well as supporting students through recon, location, and recovery of a simulated missing persons case. Additionally, these experiences were a learning opportunity facilitating the observation of various teaching and management styles. **Background**: The Oakville and Milton Humane Society requested field exhumation technicians to clear out a neighboring pet cemetery to expand their facility and rehome the pet remains. The primary responsibility of the technician is to exhume a pet grave, recover pet remains according to established preservation protocols, and inventory and clean the remains that will later be sent off for pathological analyses. The Forensic Anthropology Field School welcomes Assistant Volunteers to support students through their two-week investigation by providing guidance, ensuring students remain safe, and tracking students' progress. **Conclusion**: These experiences are recommended for skill refinement in archaeology, practice with faunal remains and faunal archaeology, and propelling a career in forensic anthropology. These experiences are advantageous to anyone looking for early experience in forensic anthropology, or for anyone who wishes to remain in academia; in both cases, these opportunities provide a foundation to enhance practical knowledge while connecting with industry professionals.

Keywords: Forensic anthropology, bioarchaeology, faunal osteology, mentorship, volunteerism, professionalism, networking.

Supervisors: Lilianna Watamaniuk, Grace Greogory-Alcock; University of Toronto Mississauga

JEREMY GOSLIN

Brightening young minds

ABSTRACT

Experience: A volunteer experience in an elementary school in Calgary, Alberta, over 10 months and 80 hours of work was completed. This included teaching forensic science, history, and math classes and assisting small groups of students. The volunteer opportunity also brought the opportunity to go on field trips, network with police officers and teachers, and help manage a classroom of 30 students. Working in schools has helped develop an understanding of diverse learning styles, ways to adapt presentations to different populations, and how to connect with teachers and students at a personal level. **Background:** The Calgary Catholic School District welcomes volunteers to help classroom teachers and students and encourages them to share any unique experiences with the students. The main responsibility of the volunteer is to support the classroom teacher in providing education and instruction to the students. This includes helping students with their assignments, taking small groups to practice concepts, and supervising tests. Other responsibilities include joining class field trips and leading smaller groups. **Conclusion:** This experience is recommended to assist in many aspects of professional development, including but not limited to building confidence, learning networking skills, and interacting with different groups of people. It would benefit anyone who is interested in working with youth and children, who wants to make an impact, and enjoys sharing their knowledge with the next generation.

Keywords: volunteerism, mentorship, networking, positive role-modeling, professional development, education

Supervisors: Andrea Frape, Shannon Griffin; Calgary Catholic School District

MEIZHIZI GUO

Criminal law and forensic science in practice: an Oxford exchange experience

ABSTRACT

Experience: A four-week summer exchange program was completed at the University of Oxford through the University of Toronto. The course explored the evolution of legal rights, freedoms, and responsibilities within common law tradition, examining key legal developments and the evolution of legal policies in England and Canada. Academic study was complemented with practical experiences, including site visits and lectures from legal/forensic professionals. **Background**: Using a comparative approach, this program examined developments in forensic practices and legal principles. Topics covered included the emergence of common law, the development of policing in England and Canada, the history of the jury system, homicide law and the death penalty, feminist criminology, and psychopathy research. The influence of criminological theory on modern legal frameworks, dangerousness assessment, and developments in crime prevention measures was also covered throughout the course. Field trips included visits to the Tower of London, the British Museum, and the Foundling Museum. Additional experiences included a visit from a forensic psychology specialist and a Jack the Ripper walking tour. **Conclusion:** This exchange provided an extensive understanding of the intersection between forensic science and criminal law. The course provided valuable experiences in strengthening critical thinking and analytical skills in forensic psychology and legal policy. Ultimately, this program is highly recommended for students eager to explore international perspectives on criminal justice and forensic applications.

Keywords: forensic science, criminal law, forensic psychology, legal policy, global criminology, summer abroad program

Supervisor: William Watson; University of Toronto

PIPER JOHNSON

From lecture hall to lab: hands-on experience in analytical testing

ABSTRACT

Experience: An opportunity working as a lab technician was completed at *Testmark Laboratories Ltd*. This position was full-time from July to August 2024, and part-time during the academic year. **Background**: *Testmark Laboratories Ltd* is an environmental testing company with 5 locations across Ontario. It specializes in analyzing air, water, arson, geochemistry, and toxicology samples. In this role, responsibilities included performing quantitative and qualitative laboratory analyses, preparing samples, and maintaining laboratory cleanliness to ensure accurate, reliable results. Daily tasks included following standardized procedures, recording test results, and verifying data. This position strengthened technical skills, attention to detail, and laboratory best practices. Skills gained in professionalism included time management, organizational skills, and effective communication. Students interested in a similar opportunity can check *Testmark Laboratories'* careers page or job listings on platforms like Indeed. Coursework in chemistry or biology and lab experience would be an asset. **Conclusion**: This opportunity was worthwhile and is recommended to students who are interested in a career involving lab work.

Keywords: laboratory work, chemistry, environmental testing, analytical testing

MADELEINE KENNEDY

Dog graves and downpour: exhuming 657 domestic pet graves at the Oakville & Milton Humane Society

ABSTRACT

Experience: A four-month paid contract was completed, which included the removal of remains and artifacts buried at the pet cemetery at the Oakville & Milton Humane Society [OMHS]. In teams of two, (primarily) UTM students exhumed approximately 40 grave plots per week which contained caskets, urns, collars, dogs, cats, snakes, toys, blankets, and so much more. Students worked an average of 35 hours per week outdoors. **Background**: The pet cemetery was established in 1953 and filled up in the 90s when the OMHS had to reduce services to cremation and a columbarium. Over the years, the OMHS operation has outgrown the facilities in several ways, thus Dr. Tracy Rogers and UTM students were hired to remove the cemetery contents in preparation for relocation of the humane society. The OMHS also contacted pet owners to offer reclamation of any remains or artifacts. **Conclusion**: All 657 plots were successfully exhumed, cleaned, and stored one week before the intended end-date of the project. All participants gained experience with excavation techniques, documentation, bone cleaning, osteological inventories, teamwork, adaptable problem solving, and much more. While the experience is no longer available, a similar one would be well-suited to students interested in field excavations, faunal osteology, and prioritizing a summer job or an experience with income.

Keywords: summer job, paid contract, cemetery excavation, labour, outdoors, faunal osteology, community-oriented project

Supervisors: Tracy Rogers, Eman Faisal, Grace Gregory-Alcock; University of Toronto Mississauga

HIBA KHAN

Investigating persistence of trace DNA, and working on review articles

ABSTRACT

Experience: A research internship was completed at the International Centre for Forensic Sciences (ICFS) in Dubai, U.A.E. The research investigated the persistence of trace DNA, from lip impressions, over time and on a variety of materials. Additionally, a research volunteer position with Evidentia Institute was obtained, involving contribution to review article manuscripts about developing topics in medical research. **Background**: A research proposal was prepared for consideration of the ICFS. After approval, laboratory training and research begun. This experiment involved 3 participants depositing their lip impressions on paper cups, metal cans and cigarettes, using lip balm as a medium of secondary transfer. Swabs were taken of lip impressions from one of each item, from each volunteer, after 24-hours, 5 days, and 9-days. The DNA from these swabs underwent extraction, quantification, amplification and separation to yield DNA profiles. Optimum DNA profiles were retrieved after 5 days, and paper cups generally produced the most robust profiles. Additionally, volunteering at Evidentia Institute offered the opportunity to develop key research skills, including scientific communication reviewing literature. During this experience, a number of research articles were summarised in order to extract information for a review article manuscript about epigenetic influences in SUDEP and the *Introduction* and *Methods* sections were contributed to a manuscript about using artificial intelligence to detect Cholangitis. **Conclusion**: These opportunities have been valuable in developing holistic research skills, including lab techniques and scientific communication.

Keywords: Research, manuscript, DNA profile, lip impression

Supervisors: Reem Al-Lootah, Abdullah Albastaki, Mohammed Naji; International Centre for Forensic Sciences, Dubai

MUN HIN MAH

'Forensic Pursuit': revolutionizing forensic science training

ABSTRACT

Experience: A volunteer opportunity was completed as a part of the forensic team for 'Forensic Pursuit', a forensic themed video game. This game aims to tackle the negative perceptions surrounding mistakes made in forensic science training, and their impact on both trainees and professionals, by offering a safe learning environment through interactive video game simulations of forensic science training in areas like biology, chemistry, identification, psychology, and engineering. **Background**: This volunteer opportunity was provided by Dr. Vivienne Luk as a unique experiential learning experience for FSC485H5: *Professional Opportunity in Forensic Science* which allows students to tailor their capstone experiences according to their personal interests. In the forensic team, general tasks included providing forensic expertise on the accuracy of forensic science depicted and sourcing pictures or materials required for video game development. **Conclusion**: The Forensic Pursuit volunteer experience was useful as it taught useful teamwork and personal skills. Besides that, it introduced different perspectives regarding forensic science training that spark further thought. The experience is recommended for students who are interested in forensic science and video game development as it provides an interactive experience between both specialties.

Keywords: forensic science, video game simulation, computer science, forensic science training, negative perceptions, volunteerism

Supervisors: Vivienne Luk; University of Toronto Mississauga. Steve Engels; University of Toronto

PHILIP TOMCHYSHYN

Mortuary archaeology in Poland

ABSTRACT

Experience: Three and a half weeks were spent participating in an archaeological excavation in Giecz, Poland. **Background**: The Slavia Field School in Mortuary Archaeology provides students with the opportunity to excavate a 12th century medieval cemetery, and document both archaeological features and human burials. They ultimately follow the artefacts and human remains into the laboratory. Field activities included excavation, screening soil, creating sketches, using metal detectors, and using a levelling machine to determine the elevation of layers and artefacts. Laboratory activities included the cleaning and inventorying of artefacts and human remains. Students stay together in the field house where residence is provided, along with meals. Additionally, students are encouraged to travel on weekends, providing students the opportunity to explore Poland and experience Polish culture. **Conclusion**: Academic as well as individual growth was the result of this experience. Hands on experience excavating and documenting an archaeological site led to greater understanding of theories and procedures taught in undergraduate courses. Osteological knowledge was greatly improved through hours of hands on experience. Personal growth included improved time management and decision making skills as one learns to live within a small community. Navigational skills were also enhanced through international travel. Social interactions with an international group of dedicated students greatly enhanced the overall experience. This opportunity is highly recommended for anyone who wants the opportunity to travel while also gaining valuable experience in osteology, archaeology, bioarchaeology, or forensic anthropology.

Keywords: bioarchaeology, mortuary archaeology, osteology

Supervisors: Slavia Foundation for Polish History and Culture

POSTER SESSION
DEMONSTRATION BOOTHS

FSC407H5:
ADVANCED INDENTIFICATION FIELD SCHOOL

JACOB COSTA, JUSTINA LAMANNA

Use of dry chemical fire extinguisher powder to develop latent fingerprint impressions

ABSTRACT

Purpose: This booth exhibit demonstrates the application of dry chemical fire extinguisher powder as a means of latent fingerprint enhancement on surfaces within a small-scale fume chamber. **Background:** Small particle reagents (SPR) are particulate based mixtures that can be used to visualize latent fingerprints on non-porous (smooth, non-absorbent) surfaces by adhering small particles to fatty components of latent fingerprints. Class A, B, and C fire extinguishers expel a dry chemical material made of monoammonium phosphate with a similar particle structure to commonly used SPRs, suggesting application as a latent fingerprint enhancement tool on large or irregular surfaces. **Methodology:** Similar to typical SPR techniques, particles present in fire extinguisher powder adhere to the fatty components of latent fingerprints, allowing for visualization of the impression. Surfaces with latent fingerprints are sealed within a fume chamber and enveloped by dry chemical, making the latent impression observable. **Results:** There have been multiple established studies highlighting the application of dry chemical powder and SPR as a latent fingerprint enhancement tool. Fingerprints developed using dry chemical fire extinguisher powder yield similar results to other, commonly used SPR-based techniques. **Conclusion:** Dry fire extinguisher powder represents a straightforward and easily repeatable method of latent fingerprint enhancement, potentially representing an alternative method to typical fingerprint development techniques.

Keywords: forensic identification, crime scene investigation, latent fingerprint development, dry chemical, fire extinguisher powder, small particle reagent

Supervisors: Wade Knaap, Agata Gapinska-Serwin; University of Toronto Mississauga

ALSACE WU, MARYANNE HUANG, MISHA LEUNG

Revealing Hidden Marks: The Role of Small Particle Reagent in Latent Fingerprint Detection

ABSTRACT

Background: Since its introduction in the late 1970s, Small Particle Reagent (SPR) has been used to develop latent fingerprints on wet and non-porous surfaces such as glass, metals, and tapes. The method utilizes the oily residue of fingerprints to bind fine particles within the SPR solution, making the prints visible. **Knowledge Gap**: There is a need for more research and education on SPR within the forensic science community to enhance its application and enhancement in evidence processing. **Methodology**: SPR is prepared by combining 10g of molybdenum disulfide or black charcoal powder with three drops of a non-ionic surfactant and 300 mL of distilled water. It can be sprayed directly onto surfaces or used to immerse objects with latent prints. Once applied, the chemicals adhere to the lipid components of the fingerprints. The surface is then rinsed with distilled water to remove excess reagent while preserving the developed prints. This process reveals and maintains the integrity of fingerprints for forensic analysis. **Key Findings**: SPR ensures high-contrast visualization of latent prints and is versatile and effective**.** It remains robust across various environmental conditions, enhancing its field applicability. **Implication**: SPR enhances forensic capabilities by ensuring reliable fingerprint recovery from wet surfaces, which is crucial for crime scene investigations. Its simplicity and cost-effectiveness make it accessible to smaller law enforcement agencies. **Conclusions:** SPR is a straightforward, portable, and effective technique for developing clear fingerprint impressions on wet surfaces, essential for forensic identification.

Keywords: forensic identification, crime scene investigation, fingerprint development, wet fingerprints, small particle reagent

Supervisors: Wade Knaap, Agata Gapinska-Serwin; University of Toronto Mississauga.

YEONJUN PARK, LILYANA NAGY

Gun bluing on spent cartridge casings

ABSTRACT

Purpose: The purpose of this booth is to demonstrate the use of chemical gun bluing on spent cartridge casings as a method of latent fingerprint development. **Background:** Gun blue is a chemical solution that is used to improve the metal finish on firearms and protect them against damage like rust or scratches. However, gun bluing can also be used to detect latent fingerprints on metal surfaces like brass, which is commonly used to make ammunition casings. This allows for the development of friction ridges on spent cartridge casings found at crime scenes. **Methodology:** The cartridge case is submerged in a mixture of 50% gun blue solution and 50% distilled water. The cartridge is submerged for approximately 30 seconds. Once development occurs, the cartridge casing is rinsed in distilled water. The gun blue solution only reacts with the metal surface of the cartridge and causes it to darken. The fingerprint matrix deposited on the cartridge's surface prevents this reaction, and as a result the friction ridge areas are lighter and more visible. **Results:** Currently, there are no quantifiable results. However, gun bluing is a widely used technique in the field that has demonstrated sound results in comparison to other fingerprinting techniques. **Conclusions:** Gun bluing is a simple and effective technique that enables the development of fingerprints on surfaces that have been exposed to elevated temperatures.

Keywords: forensic science, forensic identification, gun bluing, fingerprinting, crime scene investigation, latent fingerprint development, firearm evidence analysis.

Instructors: Wade Knaap, Agata Gapinska-Serwin; University of Toronto Mississauga

POSTER SESSION
PRESENTERS LIST

FSC489H5:

ADVANCED INDEPENDENT PROJECT

ALISON DITCHBURN

A novel fluorescent SPR: improving affordability and accessibility in latent fingerprint detection

ABSTRACT

Background: Fingerprint development is vital in forensic investigations, but rainy outdoor scenes pose challenges, especially when exhibits cannot be removed or dried. Small particle reagent (SPR) is widely accepted, with research focusing on color variations for better contrast. However, practical limitations hinder its broader adoption. **Problem:** Fluorescent SPR enhances visibility but is often overlooked due to high costs and hazardous dyes. This study aims to develop a cost-effective, accessible alternative that retains effectiveness and expands forensic use. **Methodology**: Fingerprint development was tested at three time intervals—immediate, 24 hours, and 48 hours—using prints from two donors on six non-porous substrates: metal, plastic, glass, vinyl siding, painted wood, and tile. **Key Findings:** While statistical analysis is pending, initial observations suggest the novel SPR performed best on metal and plastic. Tile performed consistently well, glass varied but produced clear prints when successful, vinyl was inconsistent, and painted wood failed after 48 hours. Generally, fingerprint quality declined after 24 hours, with background residue affecting plastic, vinyl, and tile the most. These findings are preliminary and should not be interpreted as definitive. **Implications:** This study highlights the need for safe, affordable, and accessible SPR formulations for forensic use. Future research should refine application methods, expand donor samples, and minimize background residue to improve visibility. **Conclusion**: This study demonstrates the potential of a novel SPR formulation, but statistical analysis is still needed to understand its effectiveness and forensic applicability.

Keywords: forensic science, forensic identification, fingerprint development, small particle reagent (SPR), fluorescent SPR, crime scene investigation, evidence processing, cost-effective methods

Supervisor: Wade Knaap; University of Toronto Mississauga

HAILEY ARMSTONG

Cocaine induced psychosis: forensic toxicological interpretation

ABSTRACT

Purpose: The purpose of this research was to examine the forensic implications of cocaine-induced psychosis (CIP), in criminal cases and the role of forensic toxicology in investigations involving cocaine-induced psychosis. **Background:** Cocaine is a widely used illicit stimulant with severe psychological effects that may result in psychosis. CIP can induce paranoia, hallucinations, and delusions, often resembling primary psychiatric disorders. Forensic toxicologists are frequently required to provide opinions on CIP so understanding the contributing factors of CIP is important for forensic toxicologists when interpreting toxicological evidence. **Methodology**: A literature review was conducted based on PRISMA guidelines. A comprehensive search strategy was employed using multiple databases to identify original peer-reviewed studies from 1985 to 2025. Eligibility criteria focused on studies examining short-term psychotic symptoms induced by cocaine use while excluding primary psychotic disorders, mood disorders with psychotic features, and non-forensic studies. **Results**: CIP was reported more frequently in males, chronic users, and after consumption of high doses of cocaine. Crack cocaine and IV drug users were also at an elevated risk. **Conclusion**: This literature review provides key insights into the forensic implications of CIP by identifying the primary risk factors, routes of administration, and behavioral outcomes associated with CIP. This review enhances forensic toxicologists' ability to interpret toxicological evidence in criminal cases.

Keywords: forensic science, cocaine induced psychosis, behaviour, violence, risk factors, symptoms, forensic toxicology

Supervisors: Karen Woodall; University of Toronto Mississauga. Gillian Sayer; Royal Canadian Mountain Police

KATHRYN KOCEMBA

Comparison of fixatives for developing 3-D footprint impressions in sand with dental stone

ABSTRACT

Background: Footwear impressions left at crime scenes can serve as silent witnesses, capturing vital forensic evidence that may link an individual to a location. However, when these impressions are found in sand, their fragile nature poses challenges for preservation and forensic analysis. To mitigate these challenges, a fixative, most popularly hairspray, is applied to the impression before casting. **Research Problem:** The effectiveness of the traditional fine aerosol hairspray compared to thicker fixatives, such as rubber sprays, for preserving footwear impression details in sand remains unexplored. This research attempts to address this gap by evaluating hairspray compared to Flex Seal™ and Plasti Dip®. **Methodology**: Six trials were conducted, creating four impressions per trial, each treated with No Fixative (control), Flex Seal™, Hairspray, or Plasti Dip®. Impressions were recorded across development stages: Before Enhancement, After Enhancement, and Lifted. All impressions were visually analyzed using a standardized scoring system for class and unique characteristics. **Key Findings**: Flex Seal™ deteriorated class characteristics compared to the control ($U = 4.00$, $p = .018$). Flex Seal™ impressions underwent degradation between the Before Enhancement and Lifted development stages ($z = 2.40$, $p = .016$). Plasti Dip® performed better than Flex Seal™ ($U = 6.00$, $p = .038$) but did not outperform the control or Hairspray. **Implication**: This study highlights fixative options for professionals when faced with the challenges of preserving sand impressions. **Conclusions:** Findings support avoiding Flex Seal™ and suggest that Plasti Dip® or traditional methods may be more suitable.

Keywords: forensic identification, footwear impression evidence, sand footwear impressions, crime scene investigation

Supervisor: Wade Knaap; University of Toronto Mississauga

JACKIE GRACE LAU

Low-cost pole photogrammetry system for 3D roadway reconstruction

ABSTRACT

Background: In recent years, 3D technologies are used in many forensic applications, such as 3D reconstructions of crimes scenes and roadway documentation. One technique is pole photogrammetry, where a camera is attached to a long pole to simulate aerial photographs. It is a cheaper alternative to the 3D laser scanner which can cost up to $70,000 USD. **Research Problem**: Pole photogrammetry has more versatility over 3D laser scanners, yet studies related to its use in public safety applications are rare, which this study aims to address. **Methodology**: A GoPro HERO13 Black action camera was fixed onto a 5-meter-long pole. Two methods of taking photographs were tested with three trials each. 6 targets were placed at both sides of the roadway for distance measurements. 3D reconstructions were generated using 3DF Zephyr. The FARO Focus S350 laser scanner was used to obtain ground truth data, and the distance measurements of the photogrammetry models were compared. **Key Findings**: The paired t-test found statistically significant differences between the laser scanner and photogrammetry data. Hence, the pole photogrammetry system may not be an accurate alternative to the laser scanner. **Implication**: These findings suggest the possibility of using pole photogrammetry as a cheaper 3D technique, which influences the 3D forensic science field. **Conclusions:** This research provides the potential to have more accessibility to the 3D forensics science field and sets the stage for further exploration into using pole photogrammetry for public safety applications.

Keywords: 3D crime scene reconstruction, roadway documentation, pole photogrammetry, action camera, photography, 3D laser scanner, accuracy, reproducibility, 3D forensics, forensic science

Supervisors: Eugene Liscio; ai2-3D Forensics.

MADS LOEWITH

Exploring the impact of gender-affirming hormone therapy (GAHT) on forensic alcohol calculations

ABSTRACT

Purpose: The aim of this research is to explore the potential effects of non-traditional GAHT on forensic alcohol calculations and to determine the current practices of forensic toxicologists in Canada for calculating blood alcohol concentrations (BAC) in transgender individuals. **Background:** BAC estimates are performed using the Widmark equation, which differs based on an individual's sex. It is possible that gender-affirming hormone therapy (GAHT) in transgender individuals alters their body mass and total body water (TBW), affecting the accuracy of sex-based calculations of BAC. **Methodology**: *Study 1:* A rapid literature review was performed to explore the effects of non-traditional GAHT uses, on body mass and TBW. *Study 2:* Survey responses from forensic toxicologists were analyzed to assess the awareness of this topic. **Results**: *Study 1:* Limited research has been published but a recent study concluded that transgender individuals that have completed a year of GAHT are disadvantaged if traditional Widmark factors are used. *Study 2:* All survey respondents were aware that GAHT impacts the accuracy of the Widmark Equation, but only 33% had workplace policies for handling these cases. **Conclusions:** Despite widespread awareness, there is a lack of cohesive practices by forensic toxicologists in Canada for performing BAC calculations in cases involving transgender individuals. Additionally, different gender-affirming practices may require specific guidelines. Future research is required to broaden our understanding of the effects of GAHT and establish evidence-based guidelines for forensic toxicologists.

Keywords: forensic toxicology, alcohol calculation, BAC calculation, total body water, gender affirming hormone therapy, gender affirming care

Supervisor: Karen Woodall; University of Toronto Mississauga

RACHEL MEYEROVITZ

Enhancement of latent footwear impressions using fluorescent cornstarch powder and a sandblasting gun

ABSTRACT

Background: Two-dimensional footwear impressions form when pressure from an individual's weight transfers trace material from the shoe's outsole to the substrate beneath. Footwear impressions help infer details regarding the number of suspects, their involvement, direction of travel, and aid in crime scene reconstruction. **Research Problem:** Fluorescent starch powder and sandblasting offer a cost- and time-effective alternative to traditional powders, with fluorescent properties enhancing contrast on multi-coloured backgrounds. **Methodology:** Over 3 trials, 36 oil impressions were deposited using a four stage depletion series, across three substrates; engineered flooring, tile, and glass. 8 class characteristics and 5 unique characteristics from 18 footwear impressions were scored from 1-4 under ambient and UV light. Chi-square tests determined if there are statistical differences between lighting conditions and substrates. The average score was used to assess if this method meets the threshold for forensic identification. **Key Findings:** No statistically significant difference was found between lighting conditions or substrates. More class characteristics were identified than unique characteristics ($\bar{x}_{class}$ = 2.61, $\bar{x}_{unique}$ = 1.75), with tile showing more unique characteristics. **Implication:** The sandblaster offers a cost/time-efficient method for enhancing multiple footwear impressions spread over larger areas. **Conclusions:** This method is effective when a sufficient quantity and quality of characteristics are identified. Future research should compare it to other enhancement methods when formulating standardized procedures for forensic footwear identification.

Keywords: crime scene investigation, forensic identification, footwear impressions, sand blasting, corn starch powders, fluorescence.

Supervisors: Wade Knaap, Agata Gapinska-Serwin; University of Toronto Mississauga

JULIA MIGAS

Fentanyl-related causes of death in Ontario: Identification of co-occurring drug findings in 824 cases (2020-22)

ABSTRACT

Purpose: The purpose of this study was to investigate deaths classified as fentanyl-only and the significance of any co-occurring substances that were also identified. Analysis of fentanyl related deaths will provide valuable information about the importance of identifying and quantifying other drugs when fentanyl has been detected. **Background:** Fentanyl-related deaths in Ontario, Canada have been a significant problem over the past 20 years and interpretation of deaths attributed to fentanyl toxicity can be difficult due to the number of co-occurring drugs that are frequently identified in these cases, especially with the proliferation of Novel Psychoactive Substances (NPS). **Methodology:** A retrospective study was conducted of all cases where fentanyl was reported as being the primary cause of death between 2020– 22 in Ontario, Canada. **Results:** 824 cases were included in this study, with 78% being male decedents and 21% females, ages ranging from 0 – 76. Fentanyl concentrations ranged from 1.7 ng/mL to 148 ng/mL, with an average of 16.2 ng/mL. In addition to fentanyl, other drugs were frequently detected, with quantitated drugs primarily being CNS stimulants (n=600). Novel Psychoactive Substances were also detected but not quantitated (n=392). **Conclusion:** This study offers valuable insights into fentanyl use patterns and its common co-occurring substances, aiding the forensic and medical community in understanding its associated risks.

Keywords: fentanyl, opioid crisis, CNS depressant, toxicity, novel psychoactive substance, overdose, forensic laboratories.

Supervisors: Karen Woodall; University of Toronto Mississauga. Patricia Solbeck, Karlie Marshall; Centre of Forensic Sciences

MEGAN DANIELLE PON

Analyzing forensic psychology textbooks for definitions and constructs of psychopathy

ABSTRACT

Background: While psychopathy is traditionally associated with antisocial behaviour, callous personality traits, higher risk levels, and poor rehabilitation outcomes, these claims have been challenged by contemporary research. The purpose of this study is to investigate how the construct "psychopathy" is defined and represented in textbooks. **Knowledge Gap**: Academic textbooks serve as primary educational resources, but their alignment with current forensic psychology research remains unclear. There is a need for a comprehensive review of academic texts to assess accuracy and consistency. **Methodology**: A systematic review was conducted using the University of Toronto Mississauga library database: 13 university-level forensic psychology texts (1990-2024) were evaluated for definitions and descriptions of psychopathy. **Key Findings**: Definitions of psychopathy vary across texts, while descriptions of psychopathy and discussion around risk assessment and treatment were relatively consistent. However, the characterization of psychopathy generally did not align with the most recent research in the field. **Implication**: Definitions and constructs of psychopathy in forensic psychology textbooks must be standardized to facilitate consistency in academic and professional training in order to better apply these concepts in clinical and forensic settings. **Conclusions:** Significant discrepancies in definition and context exist between forensic psychology texts and contemporary research. Future efforts should focus on resolving these discrepancies, and updating text content to bridge the gap between resources and evolving research.

Keywords: forensic science, forensic psychology, psychopathy, textbooks, definitions, descriptions, risk assessment, treatment

Supervisor: Rasmus Rosenberg Larsen; University of Toronto Mississauga

CLOSING REMARKS: 4:10PM

DR. VIVIENNE LUK

FSC481Y5 Course Instructor,
Forensic Science Program
Interim Associate Dean, Academic Experience
Office of the Vice-Principal, Academic & Dean
University of Toronto Mississauga

RECEPTION IMMEDIATELY FOLLOWING UNTIL 5:30PM

(Cash Bar)

CONGRATULATIONS!
FORENSIC SCIENCE SPECIALISTS
CLASS OF 2025

Alison Ditchburn
Ashley Burns
Avery Smits-Talving
Ben Lowther
Benjamin D'Souza
Caelin Mason
Chanell Ng
Cheuk Lam Alsace Wu
Clement Wong
Eileen Ngo
Emily Brunet
Emma Basic
Erin Briggs
Erin Halter
Fallon Hunt
Fanni Pataki
Hazim Bakri
Hiba Khan
Irene Bibiris
Jackson Sprung
Jacky Que
Jacob Costa
Jeremy Goslin
Jessica Paisley
Jessica Yang
Julia Singh
Jun Park
Justina Lamanna
Kathryn Kocemba
Kiana Noorbakhsh

Lauren Chan

Lily Nagy

Lucas Crispino

Luke St Jean

Madeleine Kennedy

Mads Loewith

Maja Tingchaleun

Makayla Wijanta

Mark Gayo

Martina Rubino

Maryam Israr

Maryanne Huang

Matteo Almeida

Max Wong

Megan Pon

Michaela Bonilla

Misha Leung

Mun Hin Mah

Navya Mathur

Payton Bouvier

Philip Tomchyshyn

Piper Johnson

Rachel Meyerovitz

Rebecca Pavao

Sabrina Amundarain

Salma El-Etreby

Sang Hoon Kim

Savita Brickman-Maxwell

Sunny Kim

Susan Chan

Taylor Strachan

Tegbir Hans

Zhizi Guo

SPECIAL THANKS TO THIS YEAR'S MENTORS

ADVIKAA DOSAJH
Analytical Toxicologist
Centre of Forensic Sciences

AGATA GAPINSKA-SERWIN
Laboratory Technician
University of Toronto Mississauga

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Royal Canadian Mounted Police

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Innocence Canada

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Justice and Chair
Ontario Review Board

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Bloodstain Pattern Analyst
Peel Regional Police

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Laboratory Technician
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ZACHARY CURRIE
Forensic Toxicologist
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Forensic Laboratory Technician
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GRACE GREGORY-ALCOCK
Teaching Assistant, PhD Student
University of Toronto

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Outreach Coordinator

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JAMIE MCGREGOR
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DAX URBSZAT
Associate Professor, Teaching Stream, Department of Psychology

KAREN WOODALL
Associate Professor, Teaching Stream, Forensic Toxicology

SESSIONAL LECTURERS

CHRISTOPHER BALL
Forensic Anatomy; Forensic Pathology

ZACHARY CURRIE
Forensic Analytical Toxicology

ADVIKAA DOSAJH
Forensic Chemistry

LINDSEY FIDDES
Physical Evidence and Microscopy

JEFFREY MANISHEN
Mental Health and the Criminal Justice System

MICHAEL HO
Advanced Forensic Identification

SONYA MCLAREN
Forensic Psychopathology

BRETT MOODIE
Mental Illness and the Criminal Justice System

FORENSIC SCIENCE PROGRAM STAFF & FACULTY

ASHLEY MOO-CHOY
Seminar in Forensic Science

JESSICA PIEKNY
Techniques of Crime Scene Investigation

DIANA POLLEY
Forensic Biology

STUART SAGARA
Forensic Chemistry

SHELBY SCOTT
Research Design

ANTHONY TESSAROLO
Best Practices in Forensic Science

MERIAH WOODHOUSE
Advanced Forensic Identification

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