



**FORENSIC SCIENCE
PROGRAM**

FORENSIC SCIENCE DAY

www.utm.utoronto.ca/forensic

23rd Annual Forensic Science Day
Saturday, April 6th, 2019



UNIVERSITY OF
TORONTO
MISSISSAUGA

**FORENSIC SCIENCE
PROGRAM**

**FORENSIC SCIENCE DAY
STUDENT INTERNSHIP PRESENTATIONS**



SATURDAY, APRIL 6TH, 2019

THE 23RD ANNUAL FORENSIC SCIENCE DAY STUDENT INTERNSHIP PRESENTATIONS

8:00 - 8:30 AM REGISTRATION & COFFEE

Room KN108, Kaneff Building/Innovation Complex
(next door to the Second Cup Cafe)

8:30 - 8:35 AM OPENING REMARKS

Matthews Auditorium, Room KN137
Kaneff Building/Innovation Complex

DR. TRACY ROGERS

Director, Forensic Science Program
Department of Anthropology,
University of Toronto Mississauga

8:35 - 8:45 AM WELCOMING STATEMENT

PROFESSOR MICHAEL LETTIERI

Vice-Dean, Academic Experience
University of Toronto Mississauga



UNIVERSITY OF
TORONTO
MISSISSAUGA

**FORENSIC SCIENCE
PROGRAM**

THE 23RD ANNUAL FORENSIC SCIENCE DAY

STUDENT INTERNSHIP PRESENTATIONS

8:45 AM **STUDENT INTERNSHIP PRESENTATIONS**

MORNING SESSION CHAIR: VANESSA ROSSI

Department of Anthropology, University of Toronto Mississauga

	PAGE
8:45 AM TABITHA PALMER The impact of aqueous environment of Lake Simcoe on rates of decomposition	12
8:55 AM CAITLIN PENNY The decompositional effects of long-term submersion in Lake Simcoe	13
9:05 AM JONG IN KIM The wear effects of water velocity on chop marks on bone	14
9:15 AM ISABELLA POWER The effects of diagenesis on the Ca/P ratio in adult human bone	15
9:25 AM TESSA LEHMANN Northern Canadian Indigenous cranial ancestry assessment	16
9:35 AM JENNA BLACK Transgender death investigations in Ontario	17
9:45 AM OLIVIA LIU Sudden natural deaths in Ontario: A retrospective autopsy analysis (2012-2016)	18
9:55 AM OLIVIA GIACOBBO The frequency of anemia in natural deaths within modern forensic populations	19
10:05 AM SUKARMINA SINGH SHANKAR The benefit of autopsies in suspected drug overdose cases as seen in Nova Scotia, Canada	20

THE 23RD ANNUAL FORENSIC SCIENCE DAY

STUDENT INTERNSHIP PRESENTATIONS

10:15 - **COFFEE BREAK**

10:30 AM

Room KN108, Kaneff Building/Innovation Complex

(next door to the Second Cup Cafe)

10:30 AM	MIGUEL WALTERS The accuracy and repeatability of reconstructing single bullet impacts	22
10:40 AM	MEAGHAN CAMPBELL Evaluating the virtual lead-in-method for common handguns	23
10:50 AM	JESSE GARCIA Evaluating the effect of solution age on luminol-based blood detectors	24
11:00 AM	JIHWA LIM Infrared photography of diluted bloodstains	25
11:10 AM	ANTHONY LUISOTTO Visualizing bloody fingerprints on dark surfaces using infrared photography	26
11:20 AM	CHARLOTTE LE FEVRE Comparing Leucocrystal Violet, Amido Black, and Acid Yellow to enhance bloody fingerprints	27
11:30 AM	ISABELLA GROSSI A comparison of liquid latex and tape for removing debris to improve fingerprint quality	28
11:40 AM	YOANNA MUSTELIER Assessing the efficacy of Thermoprint™ for the development of latent fingerprints on thermal paper	29
11:50 AM	AMY DYLEWSKA Examining the effectiveness of using UV irradiation to decontaminate Cyanoacrylate Fuming Chambers	30

THE 23RD ANNUAL FORENSIC SCIENCE DAY

STUDENT INTERNSHIP PRESENTATIONS

12:00 - LUNCH BREAK

1:30 PM THE BLIND DUCK PUB
UTM Student Centre

1:30 PM STUDENT INTERNSHIP PRESENTATIONS RESUME

AFTERNOON SESSION CHAIR: VANESSA ROSSI

Department of Anthropology, University of Toronto Mississauga

1:30 PM	ALLANA BRAGA Comparing crime scene examiner recruitment models	32
1:40 PM	JIA QI (JACKIE) HAN Evaluating the effectiveness of the standard field sobriety test at the legal limit	33
1:50 PM	SI YING (SANDY) WANG Evaluating the predictive value of the standard field sobriety test for alcohol impairment	34
2:00 PM	NICHOLAS LOWE An analysis of drugs and demographic variables in relation to fatal motor vehicle collisions in Ontario	35
2:10 PM	MICHELLE XINGYU WU Assessing the efficiency of forensic paint examination	36
2:20 PM	SHIU HEI (SHARON) TAO Toward the development of differential extraction of human sperm cells on digital microfluidics (DMF)	37
2:30 PM	MARVIMAR CASTROVERDE Trends in the superimposition of genuine signatures	38

THE 23RD ANNUAL FORENSIC SCIENCE DAY

STUDENT INTERNSHIP PRESENTATIONS

2:40 - **COFFEE BREAK**

2:55 PM

Room KN108, Kaneff Building/Innovation Complex

(next door to the Second Cup Cafe)

2:55 PM	BEN FENG Demographic factors and their effects on public perception of jury processes in Ontario	40
3:05 PM	PAIGE HOLMES "Psychopath" as a label in courtrooms	41
3:15 PM	DANIELLE MITREVSKI Ethnicity and sexual offences: An exploratory study	42
3:25 PM	ANIQA RASHID Influence of early traumatic experiences amongst a sample of incarcerated males on sexual offending against children	43
3:35 PM	MERUBA SIVASELVACHANDRAN The effectiveness of the WRPS Prolific Offender Program	44
3:45 PM	SONYA MCLAREN The frequency and utility of urine drug screening in a forensic population	45

3:55 PM **CLOSING REMARKS**

TRACY ROGERS | FSC481Y Instructor

Forensic Science Program, University of Toronto Mississauga

FSC INTERNSHIP CLASS OF 2019

Student Internship Group Photo

RECEPTION

Immediately following at The Blind Duck, until 5:00PM

(Cash bar)

FORENSIC SCIENCE AT THE UNIVERSITY OF TORONTO MISSISSAUGA

Each year, the Forensic Science Program attracts some of the brightest students from across Canada and worldwide to take part in our unique education experience. The program admits roughly 130 students per year out of the hundreds who apply, and students transfer to this campus from all across the country. Over the last few years, we have had many students from British Columbia, Alberta, Saskatchewan, Quebec, Nova Scotia, and Newfoundland. From within Ontario, we have students from as far away as Thunder Bay, Windsor, and Ottawa.

Students obtain an Honours BSc Degree in Forensic Science by choosing to complete one of our four Specialist Programs: Forensic Anthropology, Forensic Biology, Forensic Chemistry or Forensic Psychology. Alternatively, students can choose to complete a Forensic Science Major in conjunction with a second major from one of the following disciplines: Anthropology, Biology, Chemistry, or Psychology. In addition to the above programs, we have also just recently introduced a new Minor Program in Forensic Science. The Minor Program can be taken in combination with any specialist or major program, including those from the Social Sciences and Humanities. This Minor program complements degrees in criminology, sociology, geography, political science, and any other field that intersects with the legal system.

Students in our program learn forensic theory as well as at least one applied skill set through lectures and labs. Today, we are celebrating the hard work and success of our Specialist degree students.



INTERNSHIP IN FORENSIC SCIENCE AND THE IMPORTANCE OF MENTORS

FSC481 is the fourth year internship course required for all graduates of the Forensic Science Specialist Program at the University of Toronto Mississauga. In addition to spending at least 200 hours at a forensic agency participating in on-the-job training or job shadowing; assisting with routine tasks; and collaborating with a professional forensic specialist on an original research project; students also attend classes on professional practice and research skills. Experiential learning combined with a first class science degree is the keystone of the UTM Forensic Science Program. Successful internships benefit the student, the mentor, and the agency through an exchange of ideas, learning opportunities, and resources dedicated to addressing a research problem or question of interest to the forensic agency and its employees. Forensic Science Day is the culmination of these partnerships.

In addition to class assignments designed to develop professional skills (a mock job interview, writing a cover letter and resume, practice presentations, critical assessment of colleague's research, and a mock trial), students also learn research skills such as obtaining ethics permission for research and writing a detailed research proposal. The research results are submitted in the form of a manuscript suitable for publication, written to the specifications of the Journal of Forensic Sciences. After final grading and editing by the course instructor, we anticipate that, with the mentors' approval (and given co-authorship), at least half of the research projects presented today will be accepted for publication in a peer-reviewed journal. We also ask that all students provide a PDF of their corrected paper to the FSC program to keep on file for future reference so that their data and conclusions can be made available to others in the forensic sciences.

It is our pleasure today to thank the mentors and to praise the initiative and efforts of these very bright students.

OPENING REMARKS

8:30 - 8:35 AM

DR. TRACY ROGERS

Director, Forensic Science Program
Department of Anthropology

FSC481Y5 Course Instructor

Forensic Science Program
University of Toronto Mississauga

8:35 - 8:45 AM

WELCOMING STATEMENT

PROFESSOR MICHAEL LETTIERI

Vice-Dean, Academic Experience
University of Toronto Mississauga



UNIVERSITY OF
TORONTO
MISSISSAUGA

**FORENSIC SCIENCE
PROGRAM**

MORNING SESSION PRESENTATIONS

8:45 AM

SESSION CHAIR:

VANESSA ROSSI, MSc.

Department of Anthropology
University of Toronto

Teaching Assistant
FSC481Y5 Internship in Forensic Science



UNIVERSITY OF
TORONTO
MISSISSAUGA

**FORENSIC SCIENCE
PROGRAM**

TABITHA PALMER

The impact of aqueous environment of Lake Simcoe on rates of decomposition

ABSTRACT

Purpose: The purpose of this research is to examine how the rate of decomposition at Lake Simcoe is influenced by environmental factors, using pig carcasses as proxies for human remains. This research is significant because it will aid in death investigations for cases involving missing persons or recovered remains at Lake Simcoe. **Background:** Past research suggests that underwater submersion slows decomposition, and that microenvironmental differences can drastically influence the physical processes that alter an organism after death. **Methodology:** Two pig carcasses were submerged at different times and depths in Lake Simcoe: the first at 20 feet in March, and the second at 80 feet in May. Decomposition was scored biweekly using the Aquatic Decomposition Scoring System (ADS). The scores were generated by assessing the head, trunk and limbs separately, then combining the scores to create a total. The temperatures of all days following submergence were summed to create the variable of accumulated degree days (ADD), allowing for comparison between the two pigs deposited in different seasons. **Results:** A Spearman's Rho correlation test indicated that temperature has a strong positive correlation with time passed ($r=0.99$). Warmer temperatures are correlated slightly higher with increasing TADS achieving a correlation coefficient of 1 in the Summer season and 0.98 in Spring. **Conclusion:** Water temperature, specifically warmer temperatures, is the main factor influencing the rate of decomposition in Lake Simcoe. York Regional Police will use this data to predict the condition of human remains during a search or retrieval, or assist in determining the post-mortem interval of recovered human remains.

Keywords: forensic science, forensic anthropology, aquatic decomposition, decomposition, taphonomy

Supervisor: Doug Penner, Detective Constable, York Regional Police Marine Unit

CAITLIN PENNY

The decompositional effects of long-term submersion in Lake Simcoe

ABSTRACT

Purpose: The purpose of this research is to: (1) test the precision of the decompositional scoring system presented by Heaton et al. (2010) by testing interobserver error rates, and (2) test whether the Heaton et al. (2010) formula for determining the postmortem submersion interval can be used for Lake Simcoe. The significance of this research is to aid investigators in the identification of recovered bodies from Lake Simcoe. **Background:** Heaton et al. (2010) developed a formula to estimate the postmortem submersion interval on humans in UK waterways based on accumulated degree days (ADD) and total aquatic decomposition scores (TADS). This research is a continuation of a study begun in 2018, wherein two pigs acting as human proxies were submerged in Lake Simcoe at depths of 20 and 80 feet. **Methodology:** The decompositional scores based on video footage of the submerged pigs from two researchers were used to test the precision of the Heaton et al. (2010) scoring method. For Pig 1(20 ft), 12 TADS were used and for Pig 2(80 ft), 5 TADS were used. **Results:** All calculations for Pig 1 using Heaton et al. (2010)'s formula were within the 95% confidence interval, while Pig 2's were not. **Conclusion:** Based on the interobserver error rates of two researchers, the Heaton et al. (2010) scoring system is precise; however, the small sample size restricts the significance of these results. Additionally, the results show that Heaton et al. (2010)'s formula cannot be applied to accurately estimate the PMSI of bodies recovered from a depth below 20 feet in Lake Simcoe.

Keywords: forensic science, forensic anthropology, forensic taphonomy, accumulated degree days, decompositional scoring, Lake Simcoe, postmortem submersion interval

Supervisor: Doug Penner, Detective Constable, York Regional Police Marine Unit

ABSTRACT

Purpose: The purpose of this research was to study wear effects of water velocity on chop marks on bone. This was done by placing bone samples in water moving at different velocities in order to determine how chop marks change over time, and how accurate artificial settings are in replicating natural settings. The research was significant as previous research on wear effects of water on bone mostly occurred in artificial settings. **Background:** Chop marks on bone are created by heavy tools with cutting edges. Individuals can be dismembered with instruments creating chop marks and can be disposed of in aquatic environments. When bone is exposed to flowing water, the differential movement between bone and sediment in water creates abrasions. Abrasions can be described as ablation, cracking, pitting, and displacement. **Methodology:** 10 sections of pig femora with chop marks were submerged in a natural setting at the Mullet Creek and in an artificial setting with 3 differing water velocities. Samples were removed from each setting after 120 hours of submersion, 1 week, and weekly until 10 weeks. The GE-5 digital microscope with S-Eye software was used to observe the presence of abrasion according to established criteria by Thompson et al. (2011). **Results:** Significant abrasions were not seen in the natural or artificial settings. **Conclusion:** Abrasions were undetectable on samples suggesting that either the digital microscope cannot detect abrasions or there were no abrasions on the bone surfaces. As other researchers were able to detect abrasions on bone after 120 hours of submersion with a scanning electron microscope (SEM), it is possible that abrasions are only visible with powerful equipment at higher magnifications.

Keywords: forensic science, forensic anthropology, abrasion, aquatic environment, digital microscope, taphonomy, wear

Supervisor: Eugene Liscio, P.Eng ai2-3D Forensics

ISABELLA POWER

The effects of diagenesis on the Ca/P ratio in adult human bone

ABSTRACT

Purpose: The purpose of this research is to determine how long it takes for diagenesis to affect the calcium-to-phosphorus (Ca/P) ratio present in human bone. This was done by burying sections of bone for different periods of time and comparing the Ca/P ratio present before and after burial. This research is significant because it will help determine the usefulness of a Ca/P age estimation method for buried bodies. **Background:** The normal ratio of Ca/P found in bone is 1.67, but this ratio decreases with age due to a loss of calcium. Diagenesis, which is the process of change to bone's structure and components after final deposition, affects the Ca/P ratio in bone eventually but how long before this begins is unknown. **Methodology:** 20 medallions (bone sections) were used, with 4 each from 5 post-menopausal females. Individuals with osteoporosis were excluded. 3 of the sections per individual were buried and placed into temporal groups of: 6 weeks, 12 weeks, and 1 year. The sections in the 6 week and 12 week groups were excavated and examined in this study, while the 1 year group was left buried for future research. Elemental analysis of samples using a scanning electron microscope energy-dispersive x-ray (SEM/EDX) was performed, with the non-buried section being the "before burial" control, and the 6 and 12 week sections being the "after burial" samples. **Results:** Paired t-test results show no statistically significant difference in the Ca/P ratio after 6 weeks ($p=0.1573$) or 12 weeks ($p=0.1124$). **Conclusion:** The results of this study indicate that diagenesis did not affect the Ca/P ratio for these time periods however further research is still needed to determine when diagenesis begins to significantly alter the Ca/P ratio.

Keywords: forensic science, forensic anthropology, bone composition, diagenesis, elemental analysis

Supervisor: Melissa Bernard, MSc Anthropology Graduate Student, University of Toronto Mississauga

ABSTRACT

Background: Ancestry refers to the biogeographical origin of a human, and is assessed by forensic anthropologists in order to identify skeletonized remains. To date, Oschinsky's (1964) study is the most comprehensive assessment of Northern Canadian indigenous (NCI) ancestry, however standards have changed, thus the establishment of an updated cranial ancestry protocol is necessary in regards to the admissibility of evidence. **Purpose:** The purpose of this research is to update and standardize the existing protocols for the cranial assessment of NCI ancestry. An updated protocol for NCI ancestry is necessary to assist with the identification of unknown human remains, and is significant as there is a lack of research regarding NCI ancestry using accepted methodologies. **Methodology:** A sample population of 60 complete, adult crania of NCI ancestry were assessed, with an intraobserver test of $n=6$. The assessment of each cranium included a blind morphological sex assessment using Williams & Rogers' revised table, a morphological ancestry assessment using 36 traits from Rhine, and a metric ancestry assessment using 38 measurements used by FORDISC and Oschinsky. **Results:** Both metric and morphological methodologies used were capable of distinguishing NCI from European-White ancestries. Resulting from metric assessment, a discriminant function was generated using NCI and European-White populations. **Conclusion:** Further research using other Canadian Indigenous populations must be conducted to refine the assessment of NCI ancestry in order to assist Indigenous populations with the reclamation of unidentified Indigenous remains.

Keywords: forensic science, forensic anthropology, Canadian Indigenous ancestry, cranial ancestry, craniometric ancestry

Supervisor: Dr. Janet Young, Curator of Physical Anthropology, Canadian Museum of History

JENNA BLACK

Transgender death investigations in Ontario

ABSTRACT

Purpose: The purpose of this research is to inquire into the death investigations of transgender individuals in Ontario by examining records from the Hamilton Regional Forensic Pathology Unit (HRFPU). This examination serves to determine the ease of finding trans people in death data as well as to identify inconsistencies in recording name(s) and sex. This research is significant because it informs data recording policies, in turn enabling future research and increasing respect for the trans community. **Background:** Transgender people have gender identities different from their birth sex and can be gender non-conforming, transition from male to female, or vice versa. Trans people have increased risks of mental health issues, murder, and suicide, however, trans identity is not systematically recorded in Canadian death data. **Methodology:** The HRFPU's autopsy database from 2010 – 2018 was searched for keywords (trans, gender, etc.) and for names in parentheses (indicative of name change). Of 8000+ cases, the search revealed three trans decedents from 2018. Staff recalled two others, and one was found by chance. Full files were read and data (name(s) recorded, sex classification, etc.) were recorded and analyzed. **Results:** The HRFPU has no protocol for recording trans identity in their database or case files. There is inconsistency with naming, pronoun use, and sex classification within and between cases and between institutions. **Conclusions:** The lack of trans visibility and standard protocols in autopsy records is problematic for conducting trans mortality research. Recommendations include an expanded "sex" category to include trans identities, a naming protocol, and awareness training for staff.

Keywords: forensic science, forensic pathology, transgender persons, gender identity, death, autopsy, Ontario

Supervisor: Dr. Linda Kocovski, Forensic Pathologist, Hamilton Regional Forensic Pathology Unit

Sudden natural deaths in Ontario: A retrospective autopsy analysis (2012-2016)

ABSTRACT

Introduction: This research was performed to determine the categories and distribution of sudden natural deaths (SNDs) in Ontario (ON) from January 2012 to December 2016. The information gathered from this study will be used to contribute to Community Forensic Medicine, which seeks to prevent health problems in the community by determining disease trends in the deceased.

Background: Research on the assessment of SNDs has routinely focused on the effect of cardiovascular deaths in young age groups (<40 years), overlooking other potential causes of SNDs. While studies have been presented to examine the effects of other causes on SNDs, no known reports have been published in ON. **Methodology:** 10,880 cases were collected from three databases: F-Path, Provincial Information Management System, and Coroner's Information System. Cases that were due to non-natural causes, had missing data, did not provide a certain cause of death (COD), or involved infant deaths were excluded from the study. SND was evaluated using Chi-Square and Logistic Regression analyses. These were performed to examine if age, sex, location, or year was associated with SND; if age and year were significant predictors of sex; and if age, sex, and year of death were significant predictors of different types of SND. **Results:** Chi-Square analysis revealed that in a random sample of 300 cases, age ($p = 0.038$), when examined as above or below 40-year age groups, and sex ($p = 0.006$) were significantly associated with SND. In the same sample, Logistic Regression indicated that age ($p = 0.006$, OR = 1.026) and sex ($p = 0.000$, OR = 1.715) significantly influenced the probability of CVS death. **Conclusion:** These results demonstrate that prevention strategies should be aimed towards males and older individuals (>40 years) that are at a greater risk of SND, particularly cardiovascular-related deaths.

Keywords: forensic science, forensic pathology, cause of death, community forensic medicine, epidemiology, Ontario, sudden natural death.

Supervisor: Dr. Jayantha Herath, Forensic Pathologist and Coroner, Ontario Forensic Pathology Service

OLIVIA GIACOBBO

The frequency of anemia in natural deaths within modern forensic populations

ABSTRACT

Purpose: The purpose of this research is to [1] evaluate the frequency of anemia within cases of documented natural deaths, and [2] determine if anemia is influenced by age, sex and comorbidities. This will be achieved by assessing the medical records of deceased individuals in the Hamilton region from 2016. This research will provide quantifiable data pertaining to the correlation of anemia in natural deaths. Understanding the frequency of anemia in natural death will make a positive contribution to forensic medicine and public health. **Background:** Anemia is a comorbidity that negatively impacts the ability of red blood cells (RBCs) to transport oxygen throughout the body. A range of conditions including (but not limited to) myocardial infarctions can be exacerbated in anemic individuals due to impaired functioning of the RBCs, potentially increasing risk of mortality. **Methodology:** The sample consists of 90 autopsy cases that contained a complete blood count (CBC). Data was transcribed from both the HRFPU autopsy database and the MediTech electronic record system. The frequency of anemia and its relationships to age, sex and comorbidities were evaluated with chi-square analysis. **Results:** 38.8% of the examined sample was determined to be anemic. No statistically significant associations between anemia and the tested variables were observed (Age - $X^2 = 2.0651$, d.f. = 1, $p = 0.15071$; Sex - $X^2 = 1.3641$, d.f. = 2, $p = 0.50559$; Comorbidities - $X^2 = 1.7532$, d.f. = 1, $p = 0.18547$). **Conclusion:** It does not appear that age, sex and comorbidities were influencing factors within the anemic individuals. A relatively high frequency but no association may be an effect of the small sample size. Future research should examine other non-natural causes of death to establish a baseline rate of anemia in the forensic population.

Keywords: forensic science, forensic pathology, anemia, comorbidities, manner of death, natural death

Supervisors: Dr. Jay Maxwell, Hamilton Regional Forensic Pathology Unit, and Lelia Watamaniuk, Ph.D. Candidate, McMaster University

SUKARMINA SINGH SHANKAR

The benefit of autopsies in suspected drug overdose cases as seen in Nova Scotia, Canada

ABSTRACT

Purpose: This research analyzes the impact of performing an autopsy on the accuracy of determining the cause of death (COD) as drug overdose. Initial investigative findings (putative COD) and post autopsy conclusions in drug related investigations at the Nova Scotia Medical Examiner Service (NSMES) are compared. This research will contribute to developing standards for autopsies in suspected drug overdose deaths (DOD). **Background:** Currently, one of the major issues in Canada regarding DOD is whether suspected DOD should undergo an autopsy. Variations in the conduct of “unnatural” death investigations across jurisdictions can misrepresent DOD statistics. Considering the current opioid crisis, accurate determination of DOD is important for public health policy formulation. **Methodology:** Information regarding all deaths investigated at NSMES between January 1, 2015 and December 31, 2016 was extracted from the Medical Examiner Assistant database. All cases that were either classified as “drug related” during the initial investigation or confirmed as DOD after autopsy were included for analysis. A total of 1,498 cases were analyzed. Putative and post autopsy COD decisions were compared for each case. **Results:** A Chi Square/McNemar test revealed a statistically significant difference between putative COD and post autopsy conclusions ($\chi^2=16.17$, d.f.=1, $p=0.00006$). This analysis shows that 52 cases would have been misreported if autopsies had not been performed to confirm COD. **Conclusion:** In suspected drug related deaths, determination of COD without an autopsy can misrepresent DOD statistics. Standardization and inclusion of an autopsy in DOD investigations is necessary for accurately reporting statistics and developing public health policy.

Keywords: forensic science, forensic pathology, autopsy, cause of death, drug overdose, opioid crisis

Supervisor: Dr. Matthew J. Bowes, Chief Medical Examiner, Nova Scotia Medical Examiner Service

10:15 - 10:30 AM



MORNING SESSION

COFFEE BREAK

Room KN108, Kaneff Building/ Innovation Complex

MIGUEL WALTERS

The accuracy and repeatability of reconstructing single bullet impacts

ABSTRACT

Purpose: The purpose of this research was to test the accuracy and repeatability of reconstructing the angle of single bullet impacts using the 2-D ellipse method. This was done by firing various caliber rounds into drywall panels positioned from 88 degrees until ricochet. The research will determine if the 2-D ellipse method is appropriate for use and will potentially provide a more accurate way of reconstructing a shooting scene. **Background:** The 2-D ellipse method is a program found in Cloud Compare (ELipser app), a 3-D point processing software, which calculates the angle of impact using a point and click tool. In shooting scene reconstructions, bullet impact examinations provide investigative details that can refute or support witness statements regarding the sequence of events or the position of the shooter.

Methodology: The sample consisted of 9mm, .22cal, .40cal and .45cal rounds fired into drywall panels. 5 rounds were fired for each angle of incidence and caliber type (n=220). 10 analysts processed the data utilizing the 2-D ellipse method in order to test the repeatability. According to the standards set by Michael Haag, trajectories should have an associated error of +/- 5 degrees.

Results: Bivariate statistical analysis revealed that .45cal was the most accurate caliber type (+0.98 degrees) with the least amount of inter-observer error (+1.78 degrees). The most precise ammunition type was the .40cal with an overall standard deviation of +2.17 degrees. **Conclusion:** The results show that the 2-D ellipse method can achieve highly accurate and precise results well within the acceptable range of error when calculating the angle of impact. It is recommended that the caliber type be taken into consideration since it can affect the accuracy of scene reconstructions.

Keywords: forensic science, forensic ballistics, accuracy, bullet trajectory analysis, caliber, cloud compare, 2-D ellipse method, precision

Supervisor: Eugene Liscio, P.Eng, ai2-3D Forensics

MEAGHAN CAMPBELL

Evaluating the virtual lead-in-method for common handguns

ABSTRACT

Background: When steel or other malleable materials are hit by bullets fired at $\sim 70^\circ$ to $\sim 10^\circ$, a lead-in-mark is created. A lead-in-mark is the ellipse that forms prior to a bullet entry hole, and can be used to determine the angle of impact, which in turn can estimate the location of a gun when fired. **Purpose:** The purpose of this research is to test the accuracy of the virtual lead-in-method when determining the angle of impact for vehicles shot by common handguns. If accurate, the virtual lead-in-method would provide ballistics experts with an alternative to the manual-lead-in method, preventing contamination at the impact site. **Methodology:** Four handguns – a 9mm, 22 caliber, 40 caliber and 45 caliber, were fired at steel panels from a gun mount 3 times at 9 known angles (90° to ricochet), for a total of 27 shots per handgun. Impact sites, which had a lead-in-mark greater than 3 mm were analyzed using the virtual lead-in-method. An Artec Spider scanner was used to scan the impact sites in order to create a 3D mesh in Artec Professional 12, which was then imported into Autodesk 3Ds Max where the angle of impact was determined using measurement tools. **Results:** The deviation from the known angle was different for each caliber. On average the difference ranged from ± 1.80 (9mm) to ± 11.52 (22 cal). **Conclusion:** The virtual lead-in-method shows promise as an alternative method to the manual lead-in-method for some calibers. It would be beneficial for future studies to use different types of ammunition for a single caliber to see if the deviation from the known angle is also influenced by the ammunition type.

Keywords: forensic science, forensic ballistics, crime scene reconstruction, angle of impact, Artec Spider Scanner, lead-in-mark, 3D reconstruction

Supervisor: Eugene Liscio, P.Eng, ai2-3D Forensics

JESSE GARCIA

Evaluating the effect of solution age on luminol-based blood detectors

ABSTRACT

Background: Luminol is a sensitive blood reagent used to locate traces of blood. Research suggests that cyclodextrins can enhance luminol's performance.

Purpose: This study examined the effect of solution age on the performance of Bluestar® Forensic, Grodsky's luminol, and Grodsky's luminol with urea & 2-hydroxypropyl- β -cyclodextrin (luminol+) to gain insight into their effective shelf-lives and potential impact on DNA extraction. The efficiency of blood detection and collection at crime scenes could be improved by selecting the solution that is the most effective and least destructive. **Methodology:** The intensity and duration of luminescence of each solution was examined at seven 1-hour intervals using sheep's blood of 1:1000 dilution deposited on white cotton fabric, for a total of 315 bloodstains. For each stain, a long exposure photograph was taken with a DSLR camera and the duration was recorded. The intensity was measured through the average pixel brightness of the image using Adobe Photoshop CC 2019. DNA from 9 treated human bloodstains of 1:10 dilution was extracted using the QIAamp® DNA Investigator kit and quantitated using the Qubit® dsDNA HS Assay kit for comparison. **Results:** Tukey's pairwise test showed that Bluestar decreased in intensity significantly faster than luminol ($p=0.0052061$) and luminol+ ($p=0.0004785$). Luminol+'s intensity remained stable with solution age. Also, ANOVA showed that treatment did not have a significant effect on the change in duration. A Kruskal-wallis rank sum test indicated that the quantities of DNA extracted from the treatments were not statistically different however the overall mean quantity of DNA extracted was less than the positive control. **Conclusion:** Grodsky's luminol performed the best with age, thus this study supports its continued use for blood detection. Investigators should be aware of how much is applied at crime scenes as these reagents dilute and potentially degrade DNA.

Keywords: forensic science, forensic identification, blood detection, Bluestar® Forensic, β -cyclodextrin, chemiluminescence, luminol, urea

Supervisors: Clayton Asano, Detective Constable, Peel Regional Police; Robert Hofstetter, Detective, Peel Regional Police; Michelle Pflug, Detective, Peel Regional Police.

ABSTRACT

Background: Infrared (IR) photography enhances the contrast of bloodstains on dark substrates that are not as visible to the naked eye. **Purpose:** The purpose of this research is to examine the capabilities of IR photography in visualizing diluted bloodstains. **Methodology:** Sheep's blood (v_b) was diluted with 3 different solvents (v_s ; water, gasoline, and bleach) of 5 different concentrations (v_b/v_s). The solutions ($n = 75$) were deposited on 100% black cotton fabric and photographed with both standard and IR cameras at different time intervals (t): 0, 4, and 24 hours after deposition. Quantitative analysis was completed by measuring the mean gray value of the bloodstains in IR images using Image J. **Results:** Linear regression showed that as the amount of water increased, the contrast level of the bloodstains significantly decreased ($p = 1.85e-11$, $8.66e-6$, and $1.69e-5$ at $t = 0$, 4, and 24 respectively). The contrast level also decreased as the concentration of gasoline increased, however, this difference was not statistically significant. Increasing the amount of bleach exponentially decayed the contrast level ($p = 1.64e-8$, $2.63e-10$, and $3.21e-8$ at $t = 0$, 4, and 24 respectively). **Conclusion:** The study demonstrated that IR photography is capable of visualizing diluted bloodstains despite the change in blood concentrations. Since the type of solvent is one of the factors affecting the visibility of bloodstains in IR photography, it is encouraged to replicate the experiment with different substrates. It is also encouraged to investigate the effects of diluted bloodstains in various bloodstain patterns rather than a single droplet, which was utilized in this study.

Keywords: forensic science, infrared photography, bloodstains, forensic photography

Supervisor: Detective Constable Matthew Yee, York Regional Police Forensic Identification Unit

ANTHONY LUISOTTO

Visualizing bloody fingerprints on dark surfaces using infrared photography

ABSTRACT

Purpose: The purpose of this research is to test the effectiveness of infrared photography on visualizing bloody fingerprints on dark surfaces by comparing it to the blood enhancing chemical fluorescent techniques, hungarian red and acid yellow 7. This research is significant in that IR photography is non-destructive and could provide an alternative, time efficient method for documenting bloody fingerprints. **Background:** Blood on a dark surface can be difficult to see especially in low quantities. The IR camera utilizes the different absorption and reflection properties of blood and surfaces to create contrast in an image, documenting a fingerprint's detail. **Methodology:** 270 fingerprints in total were placed using sheep's blood in a depletion series of 15 fingerprints on black ceramic tile, black plastic garbage bag, and hard black plastic. IR photography, hungarian red, and acid yellow 7 were each used to visualize two depletion series on each surface. Fingerprints were edited in Adobe Photoshop CC and scored using the Bandey scale. **Results:** Logistic regression indicated that surface type ($p=.007$) and method of visualization ($p=.000$) were significant factors influencing whether a fingerprint was identifiable. The quantity of blood as indicated by the depletion number was not a significant factor, although greater fingerprint detail was seen at later depletions using chemical fluorescent techniques. **Conclusions:** Optimal equipment and methods used for visualization varied widely depending on the surface type. While IR is non-destructive and time efficient, its ability to produce identifiable fingerprints is limited.

Keywords: forensic science, forensic identification, blood, fingerprints, infrared photography, luminescence

Supervisors: Thomas Greer, Detective Constable, Toronto Police Forensic Identification Service. Jaclyn Slaney, Laboratory Technician, Toronto Police Forensic Identification Service. Cameron Power, Laboratory Technician, Toronto Police Forensic Identification Service.

CHARLOTTE LE FEVRE

Comparing Leucocrystal Violet, Amido Black, and Acid Yellow to enhance bloody fingerprints

ABSTRACT

Background: Latent fingerprints are those that cannot be seen by the naked eye, compared to patent fingerprints which can be seen naturally. Chemicals can be used to enhance fingerprints in order to augment the amount of visible detail, thereby increasing the likelihood of identification. **Purpose:** This study was conducted to determine the optimal method for enhancing bloody fingerprints using leucocrystal violet (LCV), amido black (AB), and acid yellow (AY) in order to inform best practices for the Sûreté du Québec (QPP). **Methodology:** The sample size of this study was 300 fingerprints, which were deposited on black garbage bags, aluminum foil, duct tape, and white garbage bags. Before enhancement, the fingerprints were aged for 1, 7, 14, 21, or 28 days. The fingerprints were graded using the Bandey scale; scores over 3 were considered a pass and scores under 3 were considered a failure. **Results:** Based on an odds ratio analysis, the optimal chemical method depends on the substrate. For aluminum foil, AY performed significantly better than AB ($p=0.019$) and LCV ($p=0.041$). For duct tape, AB performed significantly better than AY ($p=0.047$). LCV had a greater chance of success of enhancing fingerprints on garbage bags (OR=0.167 for black) (OR=0.637 for white). **Conclusion:** The QPP can continue to use amido black, however, it is recommended that other chemicals be considered for substrates other than duct tape while taking into account the cost and availability of materials. This research shows that there is not one singular solution for bloody fingerprint enhancement, and that options for different substrates should be reviewed.

Keywords: forensic science, forensic identification, acid yellow, amido black, bloody fingerprints, chemical development, leucocrystal violet

Supervisor: Alexandre Beaudoin, Criminalistic Service Chief, Sûreté du Québec (Quebec Provincial Police)

ISABELLA GROSSI

A comparison of liquid latex and tape for removing debris to improve fingerprint quality

ABSTRACT

Purpose: The purpose of this research is to compare the use of liquid latex to tape for the removal of surface debris from glass, prior to powdering and lifting fingerprints. If liquid latex is successful, this research can provide an alternative method for fingerprint recovery on surfaces that are dirty prior to fingerprint deposition. **Background:** Liquid latex is a sticky, fast-drying, and elastic substance that can adhere to and remove surface debris. This research is a continuation of Ho's (2019) research, which utilized liquid latex for fingerprint recovery from the exterior of vehicles. **Methodology:** A total of 130 fingerprints were deposited by the author to maintain continuity and control of variables such as sex, age, and health. Glass windowpanes collected debris indoors and outdoors, for approximately 2, 4, and 6 weeks. Tape and liquid latex were used to remove surface debris independently in different trials. Additionally, there is a control trial, and a trial where fingerprints were recovered without surface debris removal. Black granular powder, fingerprint tape, and liquid latex were utilized for the recovery of fingerprints. The Bandey Scale was used for fingerprint scoring. **Results:** Liquid latex is 100% unsuccessful in this research. Chi Square test results indicate that no removal of surface debris is the more successful method for fingerprint recovery ($p=0.045$) compared to utilizing tape to remove surface debris. Odd's ratio results indicate that 2-week debris accumulation increases the odds of fingerprint recovery from dirty surfaces by 9 times ($\text{Exp}(B)=9.013$, $p=0.009$). **Conclusion:** Liquid latex cannot be used to assist in fingerprint recovery when fingerprints are deposited on top of accumulated debris.

Keywords: forensic science, forensic identification, fingerprints, glass, liquid latex, tape lifting

Supervisors: Thomas Greer, Detective Constable, Toronto Police Forensic Identification Service. Jaclyn Slaney, Laboratory Technician, Toronto Police Forensic Identification Service. Cameron Power, Laboratory Technician, Toronto Police Forensic Identification Service.

YOANNA MUSTELIER

Assessing the efficacy of Thermoprint™ for the development of latent fingerprints on thermal paper

ABSTRACT

Background: Fingerprint development on thermal paper is challenging due to the issue of over-developing the thermal side, which results in a darkening of colour that reduces the visibility of potential fingerprints. Various methods have been proposed to mediate this issue, including HCl fuming. Thermoprint™ has been designed to maximize fingerprint development and prevent over-development using heated acid and internal ventilation. **Purpose:** This research aims to assess the quality of fingerprint development on thermal paper by comparing Thermoprint™ to traditional HCl fuming done in a glass container. This research addresses the issue of thermal paper over-development, and also seeks to validate or refute a recent finding regarding the inconsistency and unreliability of HCl fuming. **Methodology:** A total of 144 fingerprints deposited by a female and a male donor were developed using Thermoprint™ and a glass aquarium. The fingerprints were subject to 3 different acid exposure times (10, 15, and 20 minutes), and aged for 0 days, 1 week, and 2 weeks. Fingerprint quality was scored using the Bandey scale. **Results:** Binary logistic regression showed that development of a successful fingerprint was significantly associated with the sex of the fingerprint donor ($p=0.000281$). Male fingerprints were 3.78 times more likely to develop compared to female fingerprints. There was also no significant difference in the quality of fingerprints developed in either fuming chamber. **Conclusion:** These results suggest that the success of HCl fuming is contingent on the nature of the fingerprint deposited, therefore HCl fuming may not be a reliable method for casework.

Keywords: forensic science, forensic identification, hydrochloric acid fuming, latent fingerprints, thermal paper, Thermoprint™

Supervisor: Rob Rigole, Forensic Identification Training Officer, Ontario Police College

AMY DYLEWSKA

Examining the effectiveness of using UV irradiation to decontaminate Cyanoacrylate Fuming Chambers

ABSTRACT

Background: Cross-contamination of DNA can occur in Cyanoacrylate (CA) chambers between cycles and within cycles when multiple objects are fumed for fingerprinting. The current protocol is to swab for DNA prior to fuming, though there are cases where swabbing after fuming is necessary. Certain chambers have an optional UV light for secondary disinfection; however no previous research has been done on its efficacy. **Purpose:** The purpose of this research is to determine if short-wave UV light can be used to decontaminate a CA fuming chamber. This research is significant since the integrity of evidence items will be maintained if contamination can be eliminated by UV cleaning. **Methodology:** Four surfaces of a Cyanosafe™ chamber (left and right side, base and back) with existing DNA were exposed to two portable 254 nm UV lamps (Fisher Scientific: UVS-26P). The surfaces were swabbed in various areas for DNA after 60, 90 and 120 minutes of exposure, for a total sample size of 36 swabs. The DNA extraction and quantification was done using the QIAamp DNA Investigator Kit and the Qubit™ dsDNA HS Assay Kit. **Results:** The results varied across each surface as a scatter plot of the data did not reveal any specific trend. DNA was still detected on all surfaces except the back wall after 120 minutes of UV irradiation, however this could be an artifact of the method of swabbing. The mean amount of DNA detected was similar for each time interval. **Conclusion:** The portable short-wave UV lights were not effective in decontaminating the surfaces of the CA chamber. Future studies should explore using UV lights with a higher wattage and with greater coverage over the larger surfaces of the chamber.

Keywords: forensic science, forensic identification, cyanoacrylate fuming chamber, decontamination, forensic testing, preventing cross-contamination, UV irradiation.

Supervisor: Rob Rigole, Forensic Identification Training Officer, Ontario Police College

12:00 - 1:30 PM



LUNCH BREAK

THE BLIND DUCK

UTM Student Centre

ALLANA BRAGA

Comparing crime scene examiner recruitment models within Durham, Halton and York police services

ABSTRACT

Purpose: This research examines which Scenes of Crime Officer (SOCO) model is most efficient, in terms of productivity and training costs. It will form the basis of policy decision for Durham Regional Police, and will be a useful resource for other agencies considering the costs and benefits of different SOCO models. **Background:** The two main SOCO models currently being utilized by police services in Ontario are [1] a front-line model: employs sworn officers, assigned to their respective policing units who respond to SOCO calls in addition to their regular duties. [2] a regional model: employs sworn officers, assigned to a centralized forensic unit who are directly supervised by forensic identification officers and attend SOCO calls exclusively. **Methodology:** Computer automated dispatch data from 2017 was examined for Durham and York Regional Police. Response times for SOCO calls, the number of evidence submissions, and the turnover rate for officers were compared between services. **Results:** YRP (Regional model) has 16 SOCO, who made 10,202 AFIS Submissions in 2017, which is equivalent to 637.6 submissions per SOCO. Durham (Front line model) made 314 AFIS submissions by 71 SOCO officers, which is equivalent to 4.4 submissions per SOCO. The clearance rate for crimes against property was 41.5% for York and only 25.86% for Durham, despite the fact that Durham has over four times more SOCO officers. **Conclusion:** The results indicate that a regional model is most effective as it ensures that SOCO calls are attended to more expeditiously, achieve improved productivity and save on training costs. This research benefits police services by ensuring the community is served effectively and efficiently through the commitment of qualified personnel, and overall improved police work.

Keywords: forensic science, forensic identification, crime scene investigation, efficiency, model, performance, scenes of crime officers

Supervisor: Drew Groves, Detective Constable and Trudy Bennett, Detective Constable, Durham Regional Police Services

JIA QI (JACKIE) HAN

Evaluating the effectiveness of the standard field sobriety test at the legal limit

ABSTRACT

Purpose: This research seeks to assess the validity of the Standard Field Sobriety Test (SFST) to detect impairment by alcohol. SFST performance scores and blood alcohol concentrations (BAC) were assessed to determine if there is a correlation between the two at the federal legal limit (80mg/100mL). This research could be used to aid court testimony, as there is limited peer reviewed research to support the SFST's effectiveness. **Background:** The SFST is administered to assess if individuals are too impaired to drive by testing their ability to divide attention and their physiological reactions to alcohol. A score 38/18 on the SFST considers an individual impaired and provides grounds for an arrest. **Methodology:** 144 healthy subjects (n=46 controls; n=98 intoxicated) performed the SFST. Intoxicated individuals were volunteers of legal drinking age (>19 years old) who attended training sessions and were evaluated by trained instructors after being provided alcohol by the OPC. BAC was collected before SFST tests using the Intoxylizer 8000C. The SFST scores and associated BAC for each individual was used to determine the theoretical threshold for impairment detection. **Results:** Logistic regression results show that the threshold of detection of the SFST is at 97mg/100mL. Also, an average individual is 4.7 times more likely to fail the SFST if they are above the legal limit compared to individuals with a BAC range of 50-80mg/100mL. **Conclusion:** The SFST is able to assess impairment although above the legal limit. It is recommended that changes be made to how SFST performance is evaluated such that impairment can be better assessed at the legal limit.

Keywords: Forensic science, forensic toxicology, alcohol, blood alcohol concentration, drug impaired driving, Standard Field Sobriety Test

Supervisors: Dr. Vivienne Luk, Assistant Professor, Teaching Stream, University of Toronto Mississauga and Laura Gorczynski, Chief Instructor, Ontario Police College

SI YING (SANDY) WANG

Evaluating the predictive value of the standard field sobriety test for alcohol impairment

ABSTRACT

Background: The Standard Field Sobriety Test (SFST), designed to screen for impairment, is composed of three sub-tests: 1) horizontal gaze nystagmus (HGN), 2) walk and turn (WAT), and 3) one leg stand (OLS). **Purpose:** This study aims to evaluate the capability of individual components of the SFST in predicting alcohol impairment by comparing SFST component scores and indicators with blood alcohol concentrations (BAC). This is significant as extensive research on nystagmus and alcohol is available, but there is limited research on the other components. Therefore this study hopes to fill these gaps and aid in the development of future impairment tests. **Methodology:** Trained instructors tested 144 healthy subjects (n=46 controls; n=98 intoxicated) for alcohol impairment using the SFST. The subject's BAC was assessed using the Intoxylizer 8000C prior to SFST testing. To further determine the utility of each indicator used in each test, logistic regression and Fisher's exact test were used to compare subjects with BAC > 80mg% (n=73) to controls (n=46). **Results:** A multiple linear regression model was able to account for 73% of the variance in the SFST data ($R^2 = 0.733$), demonstrating its ability to screen for alcohol impairment, with HGN ($\beta = 0.667$) being the greatest predictor followed by WAT ($\beta = 0.191$) and OLS ($\beta = 0.127$). Good predictors ($p < 0.0003125$) include: lack of smooth pursuit, sustained nystagmus at 45°, nystagmus prior to 45°, stopping in WAT, stepping off line, missing heel-to-toe, raising arms (WAT), wrong step number, putting foot down, raising arms (OLS), swaying. **Conclusion:** The current components of the SFST model are effective, but may benefit from a new scoring system which better reflects the weight of each subtest at predicting impairment.

Keywords: forensic science, forensic chemistry, alcohol impairment, impaired driving, SFST

Supervisors: Dr. Vivienne Luk, Assistant Professor, Teaching Stream, University of Toronto Mississauga and Laura Gorczynski, Chief Instructor, Ontario Police College

NICHOLAS LOWE

An analysis of drugs and demographic variables in relation to fatal motor vehicle collisions in Ontario

ABSTRACT

Background: Impairing drugs are present in over half of fatal motor vehicle collision (FMVC) cases in Ontario, which demonstrates the extent of their involvement in FMVCs. Associations between drug prevalence and demographic variables are lacking in literature, and the variables that have been studied are either outdated or non-Canadian. **Purpose:** The purpose of this study was to examine the association between drug prevalence and demographic variables in cases FMVCs in Ontario (2017). This was accomplished by analyzing toxicology reports in order to better understand the scope of current drug use in FMVCs, and how it varies demographically. This is important as it may influence future driving and drug related laws.

Methodology: 385 driver FMVC cases from Ontario in 2017 were included in this study regardless of toxicological findings. Data was collected from the Laboratory Information Management System at the Centre of Forensic Sciences in Ontario. Demographic data regarding the sex and age of the driver, season, collision region, vehicle type, and the number of vehicles involved were collected. **Results:** A chi square test revealed statistically significant differences in sex ($\chi^2=4.4296$, d.f.=1, $p=0.01766$) and the number of vehicles involved ($\chi^2=13.905$, d.f.=1, $p<0.001$) in FMVCs where drugs were present.

Conclusion: These results signify that impairing drugs are present in FMVCs with a higher prevalence in males and single FMVCs. Future driving impairment laws and education centres should focus on this vulnerable group in order to minimize the incidence of these types of collisions.

Keywords: forensic science, forensic toxicology, demographics, drugs, fatal motor vehicle collisions, Ontario.

Supervisors: Dr. Nathalie Desrosiers, Forensic Toxicologist, Centre of Forensic Sciences and Brent Cahill, Assistant Section Head, Toxicology Section, Centre of Forensic Sciences

MICHELLE XINGYU WU

Assessing the Efficiency of Forensic Paint Examination

ABSTRACT

Purpose: This research aimed to improve the examination efficiency of the current Centre of Forensic Sciences (CFS) paint comparison protocol by reducing the number of tests required in order to minimize cost, time, and resources. **Background:** Similar to other types of forensic testing, paint examinations compare known samples of paint against questioned samples. "Eliminated" excludes two samples from sharing an origin. "Not Eliminated" means that the samples cannot be excluded from sharing a common source. The current CFS protocol is to test using stereomicroscopy, FTIR, PGC-MS, SEM-EDX, high power comparison microscopy, and XRD until a difference is found. **Methodology:** Case data from 190 evidence items for 131 files spanning 2016-2018 were collected. The number of items "eliminated" and "not eliminated" by each combination of up to six techniques were examined. **Results:** Stereomicroscopy resulted in 100% of eliminations that used one technique. When utilizing two techniques, the combination of stereomicroscopy and FTIR resulted in 97.1% of eliminations. Together, the use of one or two techniques resulted in 96.7% of eliminations. Most non-eliminations were determined after using four to five techniques (55.1%) for all types of paint. **Conclusion:** The use of stereomicroscopy and FTIR together led to the most eliminations. It is recommended that FTIR and stereomicroscopy used in combination are sufficient for paint comparison. The results support the basis that additional testing to achieve the same conclusion is unnecessary, especially when other contextual factors and confirmatory results are present.

Keywords: forensic science, forensic chemistry, analytical techniques, ASTM, paint examination, protocol efficiency

Supervisor: Dalia Bagby, Quality Assurance and Technical Manager; Aleks Stryjnik, Section Head, Chemistry Section, Centre of Forensic Sciences

SHUI HEI (SHARON) TAO

Toward the development of differential extraction of human sperm cells on digital microfluidics (DMF)

ABSTRACT

Purpose: The purpose of this research was to explore and evaluate digital microfluidics (DMF) as a new platform for Differential Extraction (DE) of human sperm cells. This was done by evaluating the isolation efficiency and DNA extraction efficiency of human sperm cells on DMF devices (on-chip) versus in centrifuge tubes (off-chip). This was the first study to perform DE on a DMF device, which is a cheaper and more efficient alternative to the current protocol.

Background: Differential Extraction is used to generate the Y-STR profile of the perpetrator in sexual assault cases. DMF is a platform for manipulating discrete liquid droplets by electrostatic force, which is suitable for carrying out automated reactions in small volumes. **Methodology:** The sperm cells (SC) were purchased from ReproMed while the vaginal epithelial cells (VEC) were donated by the Centre of Forensic Science. For sperm cell isolation, samples with SC:VEC ratio of 2:1 and 1:2 ($n=1$) were prepared and tested. Sperm cells were separated by passing the cell mixture through Whatman Filter Paper Grade 4 on-chip and were quantified by microscopic cell counting. For DNA extraction, sperm cell solutions at 5 concentrations, ranging from $5 \pm 4 \times 10^4$ to $1.6 \pm 0.4 \times 10^6$ SC/mL ($n=3$), were prepared and DNA extraction was done by using DNA IQ™ kit on-chip and off-chip. The amount of DNA extracted was quantified by qPCR, and the on-chip and off-chip extraction efficiency calculated were evaluated by paired t-test. **Results:** The on-chip isolation efficiency for 2:1 and 1:2 SC:VEC solution are $40 \pm 10\%$ and $7 \pm 10\%$ respectively. The overall DNA extraction efficiency is $2 \pm 2\%$ (on-chip) and $6 \pm 7\%$ (off-chip), which are not significantly different. **Conclusion:** DMF platform was capable of conducting differential extraction for various sperm cell concentrations and has the potential to be a useful tool for forensic DNA analyses.

Keywords: forensic science, forensic biology, differential extraction, digital microfluidics, DNA extraction

Supervisor: Stephen Ho, PhD Candidate and Professor Aaron Wheeler, University of Toronto

MARVIMAR CASTROVERDE

Trends in the superimposition of genuine signatures

ABSTRACT

Purpose: The purpose of this research is to determine the amount of superimposition that occurs in genuine signatures, and to assess any potential trends in how they superimpose by examining signatures with varying styles, lengths, and complexity. These findings can validate or refute the discipline's current premise that naturally written signatures will never superimpose.

Background: A lack of natural variation within a signature is an indication of tracing. The traced signature often deviates slightly from the original signature. The question of what is "too similar" surfaces, and the lack of studies can leave testifiers with no supporting facts to rely on.

Methodology: The sample includes signatures from 20 individuals obtained from signed 1995 timesheets from the Centre of Forensic Sciences. 40-52 signatures from each individual were superimposed using white and transparent papers. A similarity index for the individual was calculated while also examining the length, style, and complexity of each signature. Length was measured using a ruler. Style and complexity were assessed using standards from past literature.

Results: No complete superimpositions were observed. The linear regression test indicates that superimposition is not affected by length ($r^2=0.0072$, $p=0.72$). The two-sided two sample t-tests show that signatures with higher complexity ($x=0.0057$) have less superimposition than those with medium complexity ($x=0.015$, $p=0.19$). Also, text-based signatures ($x=0.016$) have greater superimposition than stylized signatures ($x=0.0058$, $p=0.15$).

Conclusion: In conclusion, the length, style, and complexity do not significantly affect the amount of superimposition that occurs in genuine signatures. However, the study reveals instances where genuine signatures can be mistaken as tracings if only superimposition is examined, highlighting the importance of using additional observations to produce reliable conclusions.

Keywords: forensic science, forensic document examination, genuine signatures, handwriting, similarity index, superimposition, tracing.

Supervisor: Jackie Osmond, Forensic Document Examiner, Centre of Forensic Sciences

2:40 - 2:55 PM



AFTERNOON SESSION

COFFEE BREAK

Room KN108, Kaneff Building/ Innovation Complex

BEN FENG

Demographic factors and their effects on public perception of jury processes in Ontario

ABSTRACT

Purpose: The purpose of this research is to establish whether the public perception of jury duty in Ontario is consistent throughout the demographic areas of age, gender, ethnicity, and socioeconomic status (SES). This research is significant because biasing effects occurring in any of these demographic variables may result in an increased chance of a wrongful conviction.

Background: Age was addressed due to possible biasing effects on conviction rates and attitudes towards jury service, as previous research has shown a bias in older age groups. Gender may also affect conviction rates, and previous research has identified females as being under-represented in the jury population. Over-representation of specific ethnicities resulting in an increased conviction rate has also been noted. Socioeconomic Status may cause issues in jury representation, verdict outcomes, and absenteeism due to Ontario's low jury pay.

Methodology: The final sample size for this study was 179 individuals, with the inclusionary parameter being permanent resident status for Ontario. Data collection was performed through a survey distributed through various platforms including email in order to collect demographic information and opinions. Chi-Squared tests were performed to determine if results were statistically significant.

Results: This study found that interest in jury duty decreased with age, non-binary genders, and with mid/high SES. Non-binary genders and minority groups (e.g. African, East Asian) were less likely to be willing to participate in jury duty. Non-binary genders and lower SES were also more likely to be monetarily influenced. SES affected sense of fair pay, with lower SES individuals finding it less fair. Working aged individuals found jury pay to be less fair.

Conclusion: The results of this research show that the public perception of jury duty in Ontario is not consistent across the above variables, and as such each of the variables may bias jury opinion. Further research on this topic should explore the use of a larger sample size as well as variables not covered in this paper (e.g. political views, religion) for a more nuanced understanding.

Keywords: forensic science, forensic psychology, jury duty, public perception, demographic influences, Ontario.

Supervisor: Bhavan K. Sodhi, Claire Horsnell, The Innocence Project at Osgoode Hall.

PAIGE HOLMES

“Psychopath” as a label in courtrooms

ABSTRACT

Background: Psychopathy is a personality-based psychological condition that can include traits such as callousness, guiltlessness, dishonesty, superficial charm, egocentricity, and poor impulse control. Research has suggested that a psychopathy label, which is often introduced by Crown prosecutors, can result in negative bias toward a defendant. **Purpose:** This study aimed to investigate the effect of the diagnostic label “psychopath” on juror guilt ratings and sentencing recommendations, by comparing these variables across various labelling scenarios in order to determine if this label had a biasing effect on jurors. This research is significant because should this label lead to bias, its prejudicial value will outweigh its probative value when used in court. **Methodology:** Participants (n=83) were exposed to one of three versions of an online survey; a control survey containing only facts from a mock criminal case, a survey which included character evidence that labelled the defendant as a psychopath, or a survey which included the same character evidence save for the psychopath label. Participants were required to provide a verdict of “guilty” or “not guilty” and an appropriate sentencing recommendation (in months) for the defendant. **Results:** A simple logistic regression test showed no significant difference in guilt verdicts across the three conditions ($p=0.837$). A one-way between-groups ANOVA showed no significant difference between sentencing recommendations across the three conditions ($p=0.542$). **Conclusions:** Although not all jurors were immune to negative bias in this study, these results indicate that a label of “psychopath” may not result in bias in all cases.

Keywords: forensic science, forensic psychology, bias, courtroom testimony, guilt ratings, psychopathy, “psychopath” label

Supervisor: Dr. Rasmus Rosenberg Larsen, University of Toronto Mississauga

DANIELLE MITREVSKI

Ethnicity and sexual offences: An exploratory study

ABSTRACT

Background: Toronto, Ontario is one of the most ethnically diverse cities in the world, with 20.6% of people being foreign-born in 2011. This makes it an optimal location to conduct preliminary research examining the existence of a potential relationship between ethnicity and sexual offending. **Purpose:** This study's purpose is to compare variables related to sexual offending for European (White) and ethnic minority male sexual offenders to determine if ethnicity plays a role in sexual offences. Types of offences and responsivity to treatment can differ between individuals from different ethnic or cultural groups, yet there is a lack of individualized treatment approaches for minority offenders. **Methodology:** Archival analyses were conducted on data collected from adult male offenders referred by parole or probation to the Sexual Behaviours Clinic (SBC) at the Centre for Addiction and Mental Health (CAMH) in Toronto, ON between 2008-2012. The total sample was comprised of 358 adult male sexual offenders. Individuals who did not report their ethnicity ($n = 252$; 70%) were excluded, leaving a final sample size of 106. White and non-White offenders were compared along key variables related to sexual offending. **Results:** Chi square analyses demonstrated significant associations between ethnicity and offence type ($p = 0.004$), victims being unrelated to offenders ($p = .046$), and preference for male victims ($p = 0.032$). **Conclusion:** The results suggest that White and non-White male sexual offenders differ in many important respects. Tailoring treatment programs to meet the needs of offenders from different ethnic groups may aid in increasing responsivity and reducing recidivism in the sexual offender population.

Keywords: forensic science, forensic psychology, ethnicity, recidivism, sexual offender, treatment

Supervisors: Dr. Smita Vir Tyagi, Forensic and Clinical Psychologist, Centre for Addiction and Mental Health

ANIQA RASHID

Influence of early traumatic experiences amongst a sample of incarcerated males on sexual offending against children

ABSTRACT

Background: While most research examines differences in childhood adversity between sex offenders (SOs) and non-sex offenders (NSOs), limited research examines differences in levels of CA amongst adult-targeting sex offenders (ATSO) and child-targeting sex offenders (CTSOs). **Purpose:** The purpose of this research was to determine whether childhood adversity (CA) and trauma are factors leading to the sexual targeting of children. Scores from the Adverse Childhood Experiences (ACE) questionnaire and Personality Assessment Inventory (PAI) were used to examine this. This research is significant because it aims to understand why particular offenders target certain age groups, which may allow for more focused treatment to prevent urges and reduce recidivism. **Methodology:** A total sample of 441 included incarcerated offenders that were NSOs, ATSOs and CTOSs. To determine sexual deviance, a penile plethysmograph (PPG) test was used. Variables examined included ACE scores, PAI scores, index offence, and PPG results. **Results:** A t-test indicated that trauma levels did not differ between NSOs and SOs. For ACE scores, a t-test showed that NSOs had more adversity on average compared to SOs in all categories except for sexual abuse ($p = 0.00$). There were no differences between diagnosed hebephiles and pedophiles. However, a t-test revealed that there was significantly more adversity among ATSOs than CTOSs, ($p=0.01$). **Conclusion:** Interestingly, NSOs and ATSOs scored similarly on the ACE, and such scores were higher than those of CTOSs. This suggests that NSOs and ATSOs experience similar adversity in childhood, and that there may be something other than childhood adversity that is contributing to the offences of CTOSs.

Keywords: forensic science, forensic psychology, childhood adversity, sexual offending, trauma

Supervisor: Dr. Christopher Koegl (PhD), Research Director, Ontario Correctional Institute

MERUBA SIVASELVACHANDRAN

The effectiveness of the WRPS Prolific Offender Program

ABSTRACT

Purpose: The purpose of this research is to evaluate the impact of the Prolific Offender Program (POP) at the Waterloo Regional Police Services (WRPS) by comparing pre-program and post-program statistics in order to determine if the program is achieving its goal in reducing the recidivism rate of this population. This research will be used to inform the future directions of the program and add to the literature on POPs. **Background:** Prolific offenders are individuals who frequently reoffend. Recently POPs have been implemented in an effort to focus police resources on this small population who may be committing a disproportionately large volume of crimes. Studies have illustrated a wide variety of techniques for management and evaluation of POPs however there is no consensus as to the best model of POP. **Methodology:** 16-18 prolific offenders from the current POP tracking list, who had been a part of the program for at least 20 months, were included in this study. Their records were accessed through the WRPS' NICHE database, where police document all of the individuals' interaction with the justice system. Negative police interactions, time in custody (TinC), and crime severity were calculated for the period of 20 months prior to the program and following its implementation. **Results:** A Wilcoxin-Ranked Sum Test indicated that negative police interactions significantly decreased after the implementation of the POP ($p=0.017$). TinC and crime severity had no statistically significant differences between the pre- and post-program periods. **Conclusion:** As there is a significant decrease in negative police interactions, there are now fewer instances where police need to respond to calls dealing with these individuals. This would allow for them to focus their resources on other calls and away from these repeat offenders. The effects of the POP should continue to be monitored as a reduction of CSI and TinC may be seen if investigated over a longer period of time.

Keywords: forensic science, forensic psychology, offender management, prolific offenders

Supervisor: Constable Ernest Friesen, Waterloo Region Police Services

SONYA MCLAREN

The frequency and utility of urine drug screening in a forensic population

ABSTRACT

Background: It is important to monitor substance use in a clinical-forensic population as it is highly comorbid with other psychiatric disorders, and can intensify psychiatric symptoms. The main use of UDS in this population is to deter substance use however there is limited evidence for its efficacy.

Purpose: The purpose of this research was to examine the clinical utility of urine drug screening (UDS) at CAMH by identifying its frequency from patient charts. This was done to provide a basis for current practices for risk management purposes. This research is significant as it will provide data to support best practices of UDS for clinical utility and risk management.

Methodology: The sample included 237 forensic patients. Patient charts were reviewed and demographic variables were coded. If there were one or more positive UDS, variables pertaining to each positive test were also coded.

Results: For the number of tests administered, ANOVAs revealed a significant difference for diagnostic groups ($F(3,233)=10.81, p=0.00$), and risk level ($F(2,170)=6.94, p=0.00$). The most frequently observed clinical response to a positive and tampered test was "no change/response". **Conclusion:** The clinical utility of UDS was not supported by these results as there was no evidence of a deterrent effect. The increase in the frequency of UDS for higher risk patients is rational since these patients are at higher risks for relapse and/or deterioration following substance use. However, a lack of response to a positive test may be problematic if patients are not held accountable or if further support to deter substance use is not undertaken.

Keywords: forensic science, forensic psychology, clinical utility, risk management, urine drug screening

Supervisor: Dr. Stephanie Penney, Clinician Scientist, Forensic Division, the Centre for Addiction and Mental Health (CAMH)

CLOSING REMARKS

3:50 PM

DR. TRACY ROGERS

Director, Forensic Science Program
Department of Anthropology

FSC481Y5 Course Instructor

Forensic Science Program

RECEPTION IMMEDIATELY FOLLOWING AT

THE BLIND DUCK

UTM Student Centre

Until 5:00 PM

Cash bar



UNIVERSITY OF
TORONTO
MISSISSAUGA

**FORENSIC SCIENCE
PROGRAM**

CONGRATULATIONS FORENSIC SCIENCE INTERNSHIP CLASS OF 2019



Jenna Black

Allana Braga

Meaghan Campbell

Marvimar Castroverde

Amy Dylewska

Ben Feng

Jesse Garcia

Olivia Giacobbo

Isabella Grossi

Jia Qi (Jackie) Han

Paige Holmes

Jong In Kim

Charlotte Le Fevre

Tessa Lehmann

Jihwa Lim

Olivia Liu

Nicholas Lowe

Anthrony Luisotto

Sonya McLaren

Danielle Mitrevski

Yoanna Mustelier

Tabitha Palmer

Caitlin Penny

Isabella Power

Aniqa Rashid

Sukarmina Singh Shankar

Meruba Sivasehachandran

Shiu Hei (Sharon) Tao

Miguel Walters

Si Ying (Sandy) Wang

Michelle Xingyu Wu

SPECIAL THANKS TO THIS YEAR'S PARTICIPATING MENTORS

CLAYTON ASANO

Detective Constable, Peel Regional Police

DALIA BAGBY

Quality Assurance and Technical Manager, Centre of Forensic Sciences

ALEXANDRE BEAUDOIN

Criminalistic Service Chief, Sûreté du Québec (Quebec Provincial Police)

TRUDY BENNETT

Detective Constable, Durham Regional Police Services

MELISSA BERNARD

MSc Anthropology Graduate Student, University of Toronto Mississauga

MATTHEW J. BOWES

Chief Medical Examiner, Nova Scotia Medical Examiner Service

BRENT CAHILL

Assistant Section Head, Toxicology Section, Centre of Forensic Sciences

NATHALIE DESROSIERS

Forensic Toxicologist, Centre of Forensic Sciences

ERNEST FRIESEN

Constable, Waterloo Region Police Service

LAURA GORCZYNSKI

Chief Instructor of Senior Courses, Ontario Police College

THOMAS GREER

Detective Constable, Toronto Police Forensic Identification Service

DREW GROVES

Detective Constable, Durham Regional Police Services

JAYANTHA HERATH

Forensic Pathologist and Coroner, Ontario Forensic Pathology Service

STEPHEN HO

PhD Candidate, University of Toronto

ROBERT HOFSTETTER

Detective, Peel Regional Police

CLAIRE HORSNELL

The Innocence Project, Osgoode Hall

LINDA KOCOVSKI

Forensic Pathologist, Hamilton Regional Forensic Pathology Unit

CHRISTOPHER KOEGL

Research Director at Ontario Correctional Institute

RASMUS ROSENBERG LARSEN

University of Toronto Mississauga

EUGENE LISCIO

ai2-3D Forensics

VIVIANNE LUK

Assistant Professor, Teaching Stream, University of Toronto Mississauga

JAY MAXWELL

Hamilton Regional Forensic Pathology Unit

JACKIE OSMOND

Forensic Document Examiner, Centre of Forensic Sciences

DOUG PENNER

Detective Constable, York Regional Police Marine Unit

STEPHANIE PENNEY

Clinician Scientist, Forensic Division, the Centre for Addiction and Mental Health (CAMH)

MICHELLE PFLUG

Detective, Peel Regional Police

CAMERON POWER

Laboratory Technician, Toronto Police Forensic Identification Service

ROB RIGOLE

Forensic Identification Training Officer, Ontario Police College

JACLYN SLANEY

Laboratory Technician, Toronto Police Forensic Identification Service

BHAVAN K. SODHI

The Innocence Project, Osgoode Hall

ALEKS STRYJNIK

Section Head, Centre of Forensic Sciences Chemistry Section

SMITA VIR TYAGI

Forensic and Clinical Psychologist, Centre for Addiction and Mental Health

LELIA WATAMANIUK

Ph.D. Candidate, McMaster University

AARON WHEELER

Professor, University of Toronto

MATTHEW YEE

Detective Constable, York Regional Police Forensic Identification Unit

JANET YOUNG

Curator of Physical Anthropology, Canadian Museum of History

FORENSIC SCIENCE PROGRAM

STAFF

TERESA CABRAL

Forensic Science Program Administrator
Academic Advisor & Internship Coordinator

MURRAY CLAYTON

Forensic Science Program Officer & Outreach Coordinator

AGATA GAPINSKA

Forensic Science Lab Manager & Technician

JOANNA SZURMAK

Forensic Science Librarian

JOANNE KAO

Forensic Science Business Officer

FACULTY

MARC DRYER

Associate Professor, Teaching Stream
Biomedical Communications, Department of Biology

WADE KNAAP

Lecturer, Forensic Ident Specialist, Forensic Science Program
Detective Constable (Retired) Toronto Police Service

ULRICH KRULL

Vice-President & Principal, UTM
Professor, Department of Chemistry and Physical Science
UTM and AstraZeneca Chair in Biotechnology

VIVIANNE LUK

Assistant Professor, Teaching Stream, Forensic Chemistry

NICOLE NOVROSKI

Assistant Professor, Forensic Biology

TRACY ROGERS

Director, Forensic Science Program
Associate Professor, Department of Anthropology

FORENSIC SCIENCE PROGRAM

DAX URBSZAT

Senior Lecturer, Department of Psychology

ALISON WEIR

Senior Lecturer, Department of Mathematics & Computational Science

VISITING PROFESSOR

RASMUS ROSENBERG LARSEN

Visiting Assistant Professor, Forensic Psychology & Philosophy

SESSIONAL LECTURERS

HELEN GURYN

FSC406H5 - Introduction To 3D Crime Scene Mapping And Reconstruction

LINDA KOCOVSKI

FSC401H5 - Forensic Pathology

CAITLIN PAKOSH, LLB

FSC360H5 - Evidence, Law and Forensic Science in Canada

JESSICA PIEKNY

FSC303H5 - Techniques of Crime Scene Investigation

ASHLEY SMITH

FSC316H5 - Forensic Anatomy

LELIA WATAMANIUK

FSC316H5 - Forensic Anatomy, FSC401H5 - Forensic Pathology

ADJUNCT PROFESSORS

EUGENE LISCIO, P.ENG

FSC406H5 - Introduction To 3D Crime Scene Mapping And Reconstruction

KAREN WOODALL, BSc, PhD

FSC271H5 - Ethics and Professionalism in Forensic Science

PROFESSOR EMERITI

W. RAYMOND CUMMINS

2018-2019 TEACHING ASSISTANTS

ELYSSA BADER, MSc., PhD Student, FSC271

ERNEST PRACK, MSc., PhD Student, FSC311

STEPHEN HO, MSc., PhD Student, FSC311

VANESSA ROSSI, MSc. FSC360, FSC481

ALEXANDRA SALY, MSc., PhD Student, FSC239

JENNA SCHALL, MSc. Student, FSC100, FSC239

SHELBY SCOTT, MSc., PhD Student, FSC100 (Head TA)

KATHRYN CAMPEAU, PhD Student, FSC239

PATRICK BOZEK, MSc., PhD Student, FSC406

EMMA TYTANECK, MSc., FSC239

CELINE MOYEN, MSc. Student, FSC303

TORI BEREZOWSKI, MSc., FSC300

MELISSA BERNARD, MSc. Student, FSC302, FSC407

GRACE GREGORY-ALCOCK, MSc. Student, FSC302

ELISABETH GUERRIER-RICHER, MSc. Student, FSC300, FSC100

FORENSIC SCIENCE PROGRAM CONTACTS

DR. TRACY ROGERS

Director, Forensic Science Program
Department of Anthropology

Terrence Donnelly Health Sciences Complex, Room 400
University of Toronto Mississauga

905-828-5449 | tracy.rogers@utoronto.ca

TERESA CABRAL

Forensic Science Program Administrator
Academic Advisor & Internship Coordinator

Terrence Donnelly Health Sciences Complex, Room 402
University of Toronto Mississauga

905-569-4423 | teresa.cabral@utoronto.ca

MURRAY CLAYTON

Forensic Science Program Officer & Outreach Coordinator

North Establishment, Room 5204
University of Toronto Mississauga

416-705-5876 | murray.clayton@utoronto.ca



UNIVERSITY OF
TORONTO
MISSISSAUGA

**FORENSIC SCIENCE
PROGRAM**

NOTES



UNIVERSITY OF
TORONTO
MISSISSAUGA

FORENSIC SCIENCE PROGRAM

NOTES



UNIVERSITY OF
TORONTO
MISSISSAUGA

FORENSIC SCIENCE PROGRAM