11th Annual

FORENSIC SCIENCE RESEARCH DAY

Tuesday April 16th, 2019

- Regent Theatre -

OntarioTech UNIVERSITY

Ontario Tech Forensic Science Research Day 2019

Program Schedule

8:30 a.m.	Registration	Regent Theatre Atrium
	Refreshments	Upper Mezzanine
9:00 a.m.	Opening Remarks	Dr. Cecilia Hageman, *Associate Teaching Professor*
9:15 a.m.	Session I	Chair: David Robertson, *Adjunct Professor*
10:25 a.m.	Break	Upper Mezzanine
10:45 a.m.	Session II	Chair: Dr. Michael Corbett, *Adjunct Professor*
12:15 p.m.	Closing Remarks	Dr. Hélène LeBlanc, *Associate Professor*
	Refreshments	Upper Mezzanine

The research conducted by our fourth-year students would not have been possible without the support and mentorship of our supervisors and mentors!

Thank you.

Mission Statement

The Forensic Science program at Ontario Tech University strives to create an interdisciplinary learning environment dedicated to education, research, and contribution to the forensic community.

The Forensic Science program endeavours to:

- Advance the highest quality of knowledge, skills and abilities through excellence in teaching and a technologically-enhanced learning environment;
- Foster inquiry, critical thinking and scholarship in innovative research by providing access to state-of-the-art facilities and supervision by internationally recognized faculty and professional experts;
- Actively collaborate with industry to produce outstanding graduates who are consistently sought and highly valued by professional partners and employers;
- Command next-generation leaders demonstrating integrity, ethical behaviour, and professional conduct in the field of forensic science;
- Contribute to society through community participation, leadership and outreach initiatives, with the goal of inspiring youth

Forensic Science Program Accreditation

We are pleased to announce that our program was successful in obtaining re-Accreditation in February 2019. It is the second such program in Canada granted this distinction by the American Academy of Forensic Sciences' Forensic Education Programs Accreditation Commission (FEPAC).

Have you Heard? We are now Ontario Tech University!

Since its founding in 2002, the university has quickly established itself as one of Canada's newest publicly funded research universities; it has enjoyed many successes and is well-positioned for the future. We have a great story to tell. Unfortunately, the university has struggled with developing a definitive identity. A unified brand platform will strengthen our ability to significantly enhance our image and reputation going forward.

Our new brand is:

- **Simple, unique and identifiable:** stands out in a crowded academic landscape.
- **Technology-focused:** consistent with our mandate, communicate our positioning as an innovative and leading-edge technology-focused institution.
- **Modern and relevant:** approachable, untraditional and confident.
- **Flexible:** useable across multiple applications that range in scale and touchpoints.

[N.B- We're not changing the university's formal name through this brand initiative; we're changing the way we refer to the university so that it is clear and consistent.]

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Schedule

9:00 **Opening Remarks: Dr. Cecilia Hageman**

Session I **Mock Crime Scene Practicum Students**
Directed Studies
Lord Ridgeback Mass Disaster Simulation

Chair: David Robertson

The focus of the Lord Ridgeback Exercise and the Mock Crime Scene Practicum is to *apply practical skills* to process a complex crime scene. This is accomplished by simulating all the associated events a person may encounter from crime scene to court. This includes extensive documentation of the scene, collection and identification of evidence, creation of detailed logs and forensic reports, and finally testifying as an expert witness in a mock court setting. Students selecting this capstone experience are expected to individually prepare a written report and collaborate on an oral presentation.

The focus of a Directed Studies Project is to *identify* gaps in the research literature. This is achieved by conducting a thorough literature review on a particular subject. Ultimately, the goal is to review the current state of the chosen field, leaving no stone unturned and putting current research into the broader context of forensic science. Students selecting this capstone experience have the opportunity to investigate more diverse subject matter where conducting original research may be difficult. Students are expected to prepare a written document and a 3-minute oral presentation.

9:15 **Niveth Chandrakumar, Kevin Christian, Blythe Elliott, Brigitte Hadley, Mykayla Jackson, Andrew Motayne, Josh Munro, Ranusha Ravindranathan, Mallory Rocco, Bradley Semenick, Elkin Valencia Riascos, Leah Vincent**

Mock Crime Scene Practicum Course

9:40 **Oscar Tran**

The Effects of Temperature, Body mass, and Trauma on the Rate and Pattern of Human Decomposition on Post-mortem Interval Estimations

9:45 **Priya Singh**

A Review of Cell Line Authentication: Techniques, Applications, and Legal Implications

9:50 **Lori Goggan**

Drug Recognition Experts in Canada

9:55 **Theebica Vasantharajan**

The investigation of the effect of type of substrate, manner of contact and background DNA on the transfer of DNA

10:00 **Claudia Chu, Natalie Cooper, Robert Gattie, Sarah Huxter, Emily Lanos, Zenia Leung, Emilie Menegotti, Tiffany Sinclair**

Lord Ridgeback Mass Disaster Simulation Exercise

Session II Thesis Research Students
Chair: Dr. Michael Corbett

The focus of a thesis project is to *fill the gaps* in the research literature. This is achieved by reviewing previous studies, designing an experiment and conducting original examinations. Ultimately, the goal is to contribute novel research to a relevant field of forensic science or broader natural science. Students work closely with either internal or external supervisors who mentor them throughout the course of their work. Students selecting this capstone experience are expected to prepare a written thesis and oral presentation.

10:45 **Katelyn Allen**

A Review and Categorization of Centre of Forensic Sciences Fire Debris Cases

10:57 **Melanny Barrios Pedroza**

Transfer of DNA from Polyester and Cotton Fabrics to a Metal Surface

11:09 **Gabrielle Caron**

Assessing the use of expert DNA evidence on transfer and persistence by non-scientist justice system participants in Ontario criminal courts

11:21 **Ivy Haw**

A Retrospective Analysis of Domestic Homicides in Ontario (2012-2017)

11:33 **Kayla Treflik**

Natural Product Derivatization Toward Pest Control Efforts

11:45 **Julia Ivancic**

The Behavioural Response of Gravid Female Phormia regina (Diptera: Calliphoridae) to Specific Volatile Organic Compounds Released During Decomposition

11:57 **Kaitlyn Lemay**

Genetic Structures of the Ontario Population- Improving Allelic Databases

12:09 **Kelsey Moore**

Dynamics of Bloodstain Pattern Analysis: An Investigation of Center of Mass and Dual-Phase Projectile Motion

12:21 **Closing Remarks: Dr. Hélène LeBlanc**

Refreshments and Networking Session

The Mock Crime Scene Practicum Course

Niveth Chandrakumar[1], Kevin Christian[1], Blythe Elliott[1], Brigitte Hadley[1], Mykayla Jackson[1], Andrew Motayne[1], Joshua Munro[1], Ranusha Ravindranathan[1], Mallory Rocco[1], Bradley Semenick[1], Elkin Valencia[1], Leah Vincent[1], Stephanie Kolodij MSc[1], Kimberly Nugent, MSc[1], David Robertson[1]

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The Mock Crime Scene Practicum was a 12 week course that provided students the opportunity to apply their acquired crime scene and laboratory knowledge to a practical scenario. Students participated in all aspects of a simulated major crime scene, an alleged bank robbery, working independently and in small teams of three, reporting to a Case Officer throughout the entirety of the investigation.

The scene examination took place at the Ontario Tech University Crime Scene House, and further analysis was conducted at the undergraduate teaching laboratory. Students maintained a paperless documentation record using both CrimePad and OneNote software. These platforms allowed real-time data entry and collaboration among team members to record the scene, track evidence and maintain information logs. Identifiable evidence varied and included; fire debris, fingerprints, body fluid collection, and weapons. Laboratory analysis included recovery of writing indentations, fingerprint enhancement and examination, footwear and ink comparisons. The investigation was culminated with a police report summarizing the actions, findings, and conclusions, followed by a case review with the Case Manager, David Robertson.

Throughout the duration of the capstone project, students honed the necessary skills required to be effective at a crime scene. Development of an individual's judgment, critical thinking, deductive reasoning skills, and teamwork, transpired through engagement with their team to solve challenges presented to them.

The Effects of Temperature, Body mass, and Trauma on the Rate and Pattern of Human Decomposition on Post-mortem Interval Estimations

Oscar Tran[1]

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Time since death, also known as post-mortem interval (PMI), can aid in the re-creation and timeline development of occurred events, falsify or support an alibi or eye witness testimony, and can include or exclude potential suspects in criminal investigations. Generally, using principles of forensic entomology, total body score, and/or mathematical formulas, a reliable and accurate estimation of PMI can be obtained.

However, there are many factors which can affect the reliability and accuracy of these PMI estimations. Specifically, temperature, body mass, and trauma have high variability and can either increase or decrease PMI by up to days, weeks, or months, and can hinder the use of such techniques. What's more, many PMI estimation techniques rely heavily on one specific factor, failing to account for the multitude of variables which can affect human decomposition and ultimately influence PMI estimations.

It is virtually impossible to isolate one specific factor and assess its effects among many others involved in decomposition. However, by taking a more holistic approach when considering the factors which affect decomposition rate and pattern into current and future research, there can be an increase in the reliability and accuracy for PMI estimation.

A Review of Cell Line Authentication: Techniques, Applications, and Legal Implications

Priya Singh[1]

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Immortalized cell lines have been very important in the scientific community as model systems to help understand diseases at the cellular level. These cell lines are termed 'immortal' because of mutations that prevent regular cell death, allowing the cells to proliferate indefinitely. Cell lines have assisted in testing toxicity of drugs, understand diseases better, create vaccines and much more.

The first 'immortal' cell line originated from a cervical cancer biopsy of a woman named Henrietta Lacks – these are known as HeLa cells. HeLa cells have been used in many laboratories, leading to many scientific breakthroughs such as vaccinations for polio and the human papillomavirus (HPV). As the initial biopsy was taken from Lacks without her consent, many ethical questions were raised. The common rule was eventually established – these are regulations to protect the rights of patients and donors whose cells are used in scientific research. In addition, the Canadian Tri-Council Policy Statement was created with core principles to respect people, concern for welfare and justice.

While cell lines are crucial to scientific research, problems may occur with cell line misidentification and cell line contamination – to solve these problems, scientists have made use of techniques to authenticate cell lines. Contamination of cell lines include cross-contamination with HeLa cells, mycoplasma bacteria and other contaminants. The International Cell Line Authentication Committee (ICLAC) has established standards for cell line authentication, and a list of misidentified cell lines, for researchers who wish to publish work that include cell lines for researchers. Additionally, cell banks such as the American Type Collection Culture (ATCC) have begun to follow the guidelines and protocols set by ICLAC.

The preferred technique for cell line authentication is Short Tandem Repeat (STR) analysis, a reliable method to identify the source of the cell line and ensure there are no contaminants present. However, other methods can be used, such as Single Nucleotide Polymorphisms (SNPs) analysis, deoxyribonucleic acid (DNA) barcoding, and karyotyping.

Drug Recognition Experts in Canada

Lori Goggan[1]

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The development of the Drug Evaluation and Classification Program in the 1970's by the Los Angeles Police Department set the basis for distinguishing drivers impaired by drugs other than alcohol. This is a growing concern for Canadians, as alcohol impaired driving statistics decrease, drug-impaired incidents are on the rise and are much more complex to detect at the roadside. Most current screening methods are focused on detection of alcohol impairment; without the knowledge to detect signs and symptoms of the various drugs used in society, drug impairment may go undetected. The program was incorporated into the Canadian law enforcement in efforts to prevent crashes, injuries, and deaths caused by drug-impaired driving. Trained police officers, known as Drug Recognition Experts (DREs) have undergone extensive training to obtain the knowledge and skills necessary to determine if a motorist is impaired by a drug and if so, what drug(s)? This is accomplished using a twelve-step evaluation where the DRE can assess the level of impairment a suspect is experiencing while examining one's vital signs, and conducting divided attention and psychomotor tests.

Several evaluation studies have identified that DREs, using their expertise and the twelve-step evaluation, are equipped to be able to distinguish an individual as impaired by a drug compared to a non-impaired driver and detect the category of drug(s) causing such impairment with a high accuracy rate. Toxicology reports of a suspect's sample, such as a blood or urine analysis, can confirm or dispute the findings of the evaluator.

Looking ahead, the Government of Canada has supported the DRE program and has allotted funding specifically for training officers to become qualified DREs. This will further support creating public awareness, the acceptance of DRE evaluations in court, and overall promoting a more safe driving environment for society.

The investigation of the effect of type of substrate, manner of contact and background DNA on the transfer of DNA

Theebica Vasantharajan [1]

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At crime scenes and on evidence, trace DNA, DNA that can't attributed to an identifiable body fluid, might be present, which may have great weight in forensic investigations. The role of a forensic scientist might be to speak to the possibilities of the activities that may have produced the trace DNA. To reliably answer these questions, scientists look to peer-reviewed research articles and reviews that investigate the factors that affect the deposition and persistence of DNA. In this review, the effect of type of substrate, the manner of contact and background DNA have been examined.

Different transferring and receiving substrates can have significant effects on DNA transfer. In general, less DNA will be transferred from a porous substrate e.g. cotton than from a non-porous substrate e.g. plastic. However, more DNA is transferred to a porous receiving substrate regardless of the type of transferring substrate. Applying a force between transferring and receiving substrates may increase the amount of DNA deposited from the first to second substrate. This manner of contact may result in the detection of more alleles compared to placing the substrates together with no pressure or light pressure. The presence of background DNA, DNA present on the surface prior to the deposition of the targeted DNA, may also affect transfer of DNA. This factor is dependent on the combination of biological material and type of substrate.

This review only examines three of the multitude of factors that impact the transfer of DNA; further research must be done, and is now a significant area of research interest, to assist scientists in their evaluation of the likelihood of crime scene activity scenarios.

Lord Ridgeback Mass Disaster Simulation Exercise

Hiu Ching Chu[1], Natalie Cooper[1], Robert Gattie[1], Sarah Huxter[1], Zenia Leung[1], Emily Lanos[1], Emilie Menegotti[1], Tiffany Sinclair[1], David Robertson[1], Stephanie Kolodij, MSc[1], Kimberly Nugent, MSc[1]

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Project Lord Ridgeback was a joint exercise between Ontario Tech University and Durham College. This multi-disciplinary experiential learning activity brought together students from a wide range of disciplines including; nursing, paramedics, 911 communications, law enforcement, journalism, fire and social services. All students worked with subject-matter experts to respond and work through the 2-day mock disaster as they would in real-life.

The simulation took place in the UB Cafeteria on day 1 and in the undergraduate teaching laboratory on day 2. The Forensic science group entered the scene once it was cleared by first responders. Students worked in teams focusing on 3D scanning, explosive residue identification and analysis, and victim identification. FARO® SCENE and OneNote technology were used to document the scene for the preservation of information. A 3D model and fly-through video of the crime scene were produced. For the determination of origin and cause of the explosion, a combination of presumptive and confirmatory tests were performed, including; Griess test, spot tests, spectroscopy, and chromatogram comparisons. Finally, various victim identification methods were employed to identify five unknown decedents, including odontology, fingerprinting analysis, serial number restoration, cranial measurements, and DNA analysis.

The challenges presented throughout the project allowed students to enhance their skills in critical thinking and strengthen their ability to communicate and work effectively as a team.

A Review and Categorization of Centre of Forensic Sciences Fire Debris Cases

Katelyn Allen[1], Dalia Bagby, MSc.[2]

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When an arson is committed in Ontario, evidence samples are collected and submitted to the Centre of Forensic Sciences (CFS) for ignitable liquids (IL) testing. Techniques routinely employed by the CFS for such samples include headspace sampling, followed by gas chromatography-mass spectrometry (GC-MS). The resulting chromatograms are then forwarded to the reporting scientist to be interpreted.

The first part of this study reviewed cases submitted between January 2016 and September 2018, and was performed to determine data trends. Previous case reviews by have been completed by other laboratories, however temporal and regional variabilities exist. In this review, fabric and clothing were found to be the most common type of evidence submitted for IL testing, and the majority of evidence was packaged in glass Mason jars (67.2%). The most commonly identified IL was gasoline (28.0%), however no IL was identified in the majority of samples (63.5%). The most common type of offense for which fire debris were submitted to the CFS was arson property, and the Office of the Fire Marshal was involved in the majority of submissions.

The second part of the study was a categorization of cases based on the level of difficulty of interpretation of analytical results. This was done in attempt to assess the impact on casework if technologists were to interpret cases of a certain level of difficulty. Cases were categorized into three levels of difficulty, with 45% of cases being simple, 49% of cases being moderately difficult, and 6% categorized as difficult. These findings suggest that shared interpretation responsibility could significantly change workflow. In the future, a cost-benefit analysis should be performed to determine the efficiency of converting to such a system.

Transfer of DNA from Polyester and Cotton Fabrics to a Metal Surface

Melanny Barrios[1], Cecilia Hageman PhD, LL.B, LL.M.[1]

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Recent advances in forensic DNA analysis have led to the development and use of very sensitive techniques. This increase in sensitivity has allowed for trace amounts of DNA to be analyzed for the creation of DNA profiles. However, controversy has arisen from these advancements in the community of forensic scientists and legal professionals. One of the key areas of controversy and continuing research include the conditions that affect the indirect transfer of trace amounts of DNA.

There have been criminal cases where transfer activities have been posited as explanations for the presence of, for example, a suspect's DNA at a scene. Some experimental research has been performed to address the effects of porous and non-porous surface type on both the transferability and persistence of DNA. However, more research is needed to explore the effects of a non-porous material as a receiving surface of DNA from porous surfaces.

The purpose of this research was to identify if DNA from porous fabrics such as cotton and polyester can be transferred onto a gun-like surface. Known amounts of DNA were deposited on to 100% cotton and 100% polyester fabrics, and steel pipes were used as a gun proxy. Two experiments were performed exploring the potential transfer of DNA through pressure and friction activities. DNA from swabs collected from each experiment was quantified and subjected to STR analysis if DNA was detected. In this experiment, little to no DNA was transferred from textiles to a non-porous surface through either pressure or friction. In future work, the effects of textured metal, DNA concentrations, moisture, and DNA transferability of various people should be explored. This research merely scratches the surface of understanding the transferability of DNA from porous surfaces on to non-porous and opens the door to new possible areas of exploration.

Assessing the use of expert DNA evidence on transfer and persistence by non-scientist justice system participants in Ontario criminal courts

Gabrielle Caron [1], Cecilia Hageman, PhD, LL.B, LL.M.[1]

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Forensic DNA technology has been used in Canadian criminals courts for over 30 years. During trials, forensic biologists are admitted as expert witnesses to explain the significance of DNA evidence to non-scientist participants (i.e., lawyers, judges, and juries). However, experts are not present for the entirety of the court proceedings. In their absence, it is crucial that non-scientist participants maintain the integrity of DNA evidence. With the advances in sensitivity and discrimination of DNA analysis, DNA evidence is becoming more and more challenging to explain and interpret, especially when considering transfer and persistence issues.

The purpose of this research project was to assess the use of DNA evidence by non-scientist justice system participants to detect their strengths and weaknesses. To do so, transcripts of seven Ontario criminal cases were analyzed to compare what forensic biologist experts were saying about DNA transfer and persistence and what lawyers and judges were reflecting. In most cases, the court's questions required addressing possible DNA transfer scenarios. When experts refrained from commenting due to a lack of empirical knowledge, lawyers seemed prompted to do so themselves. This resulted in many instances of unsubstantiated claims put forward to the judge or jury. In terms of accuracy of reflections, both lawyers and judges showed strength in body fluid identification statements and weaknesses in negative results. These incorrect reflections seemed to stem from a lack of understanding of the meaning of DNA absence. Moreover, the increased sensitivity and discrimination of DNA analysis now reveals DNA findings that are often irrelevant to the case. However, these findings can be the source of long lines of questioning, creating an inefficiency in the expert's testimony. Overall, this exploratory research project points to potential issues in the use of DNA evidence by lawyers and judges in Ontario criminal courts and provides suggestions for the direction of future research.

A Retrospective Analysis of Domestic Homicides in Ontario (2012-2017)

Ivy Haw [1], Jayantha Herath MD, DLM, MD-Forensic, FRCPC-AP & FP [2]

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Domestic violence may be difficult to spot, but there are warning signs. Domestic violence may escalate and physical, emotional and mental abuse may become worse and worse resulting in death. With the policy changes and the major recommendations from inquests intended to help prevent domestic violence-related deaths, the number of domestic homicide cases in Ontario should be exhibiting a downward trend. Current research only covers domestic homicide cases before 2013, more modern research into trends indicate potential factors that policy makers need to address. The purpose of this research was to observe the overall trends in domestic homicide cases in Ontario from 2012 to 2017. Relationships that are considered include the number of male and female victims of domestic homicide, the victims ages and causes of death, the prevalence of domestic homicide-suicide, the sex of the victim and the sex of the perpetrator is also compared along with their relationship to each other. The primary victim of domestic homicide is a female in her 40's, with a male perpetrator that was a current or former intimate partner. The data obtained from this research indicates that domestic homicides are on a downward trend.

Natural Product Derivatization Toward Pest Control Efforts

Kayla Treflik [1], Yuri Bolshan, PhD.[1]

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Biting pest fly families such as Muscidae and Tabanidae negatively impact the agricultural industry by spreading diseases, causing physical discomfort to livestock and lead to economic loss, particularly with cattle and sheep. Ongoing pest control efforts are expensive and not always effective. Forensic Science program at Ontario Tech University has refined a procedure, which has identified a natural volatile compound that elicits an appreciable behavioural response in pest fly species, as well as blowflies of the Calliphoridae family. Therefore, this product may prove useful not only in pest control, but also in the determination of postmortem interval using forensic entomology techniques.

The compound identified is not commercially available and therefore had to be synthesized in the Organic Chemistry Lab at Ontario Tech University. Synthetic efforts toward its preparation have proven difficult due to its low boiling point and volatility. This study investigates the preparation of a less volatile derivative of this natural product, which maintains physiological activity in pest fly and blowfly species. This joint effort between forensic entomology and organic chemistry provides a feasible model for the exploration of naturally derived baits for pest fly species, in an effort to reduce their negative impact on the health of livestock, as well as introduce possible applications in legal investigations.

The Behavioural Response of Gravid Female *Phormia regina* (Diptera: Calliphoridae) to Specific Volatile Organic Compounds Released During Decomposition

Julia Ivancic [1], Hélène N. LeBlanc, MSc, PhD, M-ABFE.[1]

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The arrival of gravid, or egg-carrying, female blowflies to decomposing remains provide a useful aid in the determination of the post-mortem interval for forensic investigations. Volatile compounds released during the fresh, bloat and active stages of decomposition, such as dimethyl disulfide (DMDS), dimethyl trisulfide (DMTS), and toluene, are perceived by gravid female blowflies, through olfactory receptors in their antennae, as an indication of a suitable source for the deposition of eggs. Assuming the immediate deposition of blowfly eggs on remains, the determination of the post-mortem interval, or time since death, can be estimated through the application of blowfly development data and colonization patterns.

Improved understanding of the precise behaviour-modifying volatiles that attract blowflies to decomposing remains have been previously identified through the use of coupled gas-chromatography mass-spectroscopy electroantennography (GC-MS-EAG). While this technique identifies volatile compounds that transmit a message along the insect's central nervous system, the blowfly's interpretation of these compounds must then be observed through behavioural testing to determine the nature of the physiological response. The use of a choice system to observe blowfly response in the presence of decomposition volatile compounds provide an environment to observe attractive behaviour, distinguished by flight towards the stimulus, and repulsive behaviour, distinguished by flight away from the stimulus.

This research focused on the design and construction of a dual-choice hybrid Y-Tube Flight Tunnel to observe and record the behaviour of gravid female *Phormia regina* to previously confirmed active compounds including: DMTS, DMDS, and toluene, along with two newly synthesized compounds, KT0117 and KT0156 against an acetone negative control. The behavioural response between the treatment compounds and negative control were statistically analyzed to determine whether attractive or repulsive behaviour was exhibited during each experiment. Results showed that the synthesized compound, KT0117, was a strong attractant for *Phormia regina*. Such results are important and can aid in the improvement of post-mortem interval estimations.

Genetic Structures of the Ontario Population- Improving Allelic Databases

Kaitlyn Lemay [1], Cecilia Hageman, PhD, LL.B, LL.M[1]

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A forensic DNA profile is comprised of allelic data from numerous genetic locations. When two DNA profiles match, either they came from the same source, or a coincidental match occurred. In order to address the coincidental match hypothesis, a statistical analysis is performed to determine the probability of randomly choosing an unrelated individual who could also have the same profile. In order to do this, a DNA database, containing allele frequencies, is required.

The current Ontario autosomal DNA database has not been updated to include allele frequencies data of loci analyzed in new "megaplex" forensic DNA kits. In addition, Ontario does not have a Y-STR DNA database for male-specific haplotypes and there are no Canadian representatives within the international Y-STR haplotype database (YHRD). The purpose of this research was three-fold: to gather biological reference samples in order to update the current Ontario autosomal STR DNA database, to begin an Ontario Y-STR database and to add Canadian sample profile data to the existing international Y-STR database. The research results will aid in understanding the genetic structure of the Ontario population and will also allow forensic scientists to calculate more discriminating random match probabilities.

There were two parts to this research: sample collection and Y-STR analysis of the collected male samples. Mega-plex STR analysis of all samples is expected to occur at a later date. A total of 341 volunteer samples were collected between June 2018 and December 2018. Of these, 89 male samples were successfully profiled and interpreted. Only one duplicate haplotype was observed, with the remainder of the haplotypes being singletons. This research met the goal of effectively sampling for the autosomal DNA database in Ontario by collecting over 300 samples from five different ethnicities and also through beginning an Ontario Y-STR database with a total of 89 Ontario males being profiled this far that can also be added to the international Y-STR database.

Dynamics of Bloodstain Pattern Analysis: An Investigation of Center of Mass and Dual-Phase Projectile Motion

Kelsey Moore[1], Franco Gaspari, MSc, PhD.[1]

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Many blood stain pattern analysis (BPA) methods used today, such as the *stringing method*, rely on straight line geometric reconstruction. This method models the flight of blood droplets as a straight line, which has been shown to cause imperfect predictions in determining the area of origin of a bloodletting event.

The goal of this study was to apply the theory of center of mass to BPA to determine the maximum distance from impact that straight line geometric reconstruction can be considered reliable. Furthermore, this research aimed to model blood droplet dynamics by developing a mathematical model that incorporated the effects of gravity and air resistance that act on a blood droplet in flight. A modified mouse trap was used to create blood stain impact patterns at varying distances away from an impact source. These impact patterns were analyzed with ImageJ to determine the center of mass of the blood stain pattern, number of blood stains, percent area that the blood stain pattern encompassed, and individual area of each blood stain. This study showed that the center of mass of a blood stain pattern follows a linear regression from distances 20 cm to 50 cm from the impact source, indicating that straight line geometric reconstruction can be used up until 50 cm. The dual-phase mathematical model of projectile motion developed demonstrates that a time of order dependency is responsible for the drag force affecting the trajectory of the blood droplet. This study shows that further exploration of the application of center of mass to BPA is warranted. The theoretical dual-phase projectile motion equation developed should be applied to experimental results in future studies to model its accuracy.

Congratulations Class of 2019!

Katelyn Allen
Melanny Barrios Pedroza
Gabrielle Caron
Niveth Chandrakumar
Kevin Christian
Claudia Chu
Natalie Cooper
Blythe Elliott
Robert Gattie
Lori Goggan
Brigitte Hadley
Ivy Haw
Sarah Huxter
Mykayla Jackson
Julia Ivancic
Emily Lanos
Kaitlyn Lemay
Zenia Leung
Emilie Menegotti
Kelsey Moore
Andrew Motayne
Josh Munro
Ranusha Ravindranathan
Mallory Rocco
Bradley Semenick
Tiffany Sinclair
Priya Singh
Oscar Tran
Kayla Treflik
Elkin Valencia Riascos
Theebica Vasantharajan
Leah Vincent

Canadian Society of Forensic Science Conference 2020

Save the Date

The week of May 11th, 2020, will have scientists, academics, students, police and lawyers from across Canada gather at the Ontario Tech University in Oshawa to participate in the Annual General Meeting and Conference of the Canadian Society of Forensic Science. This conference will provide participants with opportunities for training workshops, panel discussions, the presentation of cutting edge forensic science research results and networking with Canada's leading forensic science professionals. The faculty and students of Ontario Tech University's Forensic Science Program are looking forward to hosting our forensic science colleagues and students at this Conference next year!