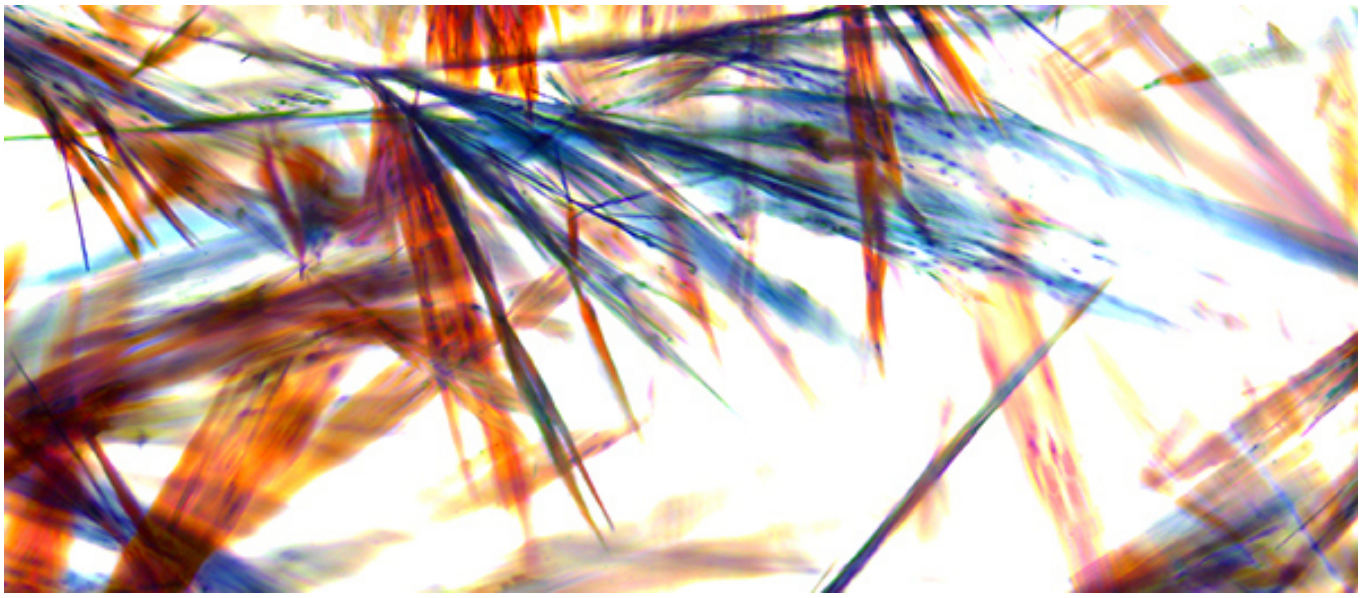
9th Annual

FORENSIC SCIENCE RESEARCH DAY



Friday April 21st, 2017

- Regent Theatre -

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

FORENSIC SCIENCE

UOIT Forensic Science Research Day 2017

Program Schedule

8:15 a.m.	Registration	Regent Theatre Atrium
	Refreshments	Upper Mezzanine
8:55 a.m.	Welcome	Dr. Cecilia Hageman, *Assistant Professor & Undergraduate Program Director*
9:00 a.m.	Keynote Address	Monica Sloan
9:20 a.m.	Session I	Chair: Mr. David Robertson, *Adjunct Professor*
10:15 a.m.	Break	Upper Mezzanine
10:45 a.m.	Session II	Chair: Dr. Michael Corbett, *Adjunct Professor*
12:30 p.m.	Closing Remarks	Dr. Cecilia Hageman, *Assistant Professor & Undergraduate Program Director*
12:35 p.m.	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 UOIT 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

Learning Outcomes

A degree is awarded to students who have reliably demonstrated the ability to:

- Apply an in depth knowledge and critical understanding of chemistry, biology, physics, and mathematics to identify, evaluate, analyze and interpret information and hypotheses relevant to forensic science
- Utilize independent learning and analytical skills to solve problems specific to forensic science and broader issues outside the discipline
- Formulate and conduct research or equivalent advanced scholarship in forensic science or a related discipline
- Critically evaluate and describe the principles, concepts, theories and assumptions that form the foundation of forensic science
- Communicate accurately and effectively in written and oral form with members of academia, government and industry, as well as the general public on matters related to the legal applications of science
- Recognize the limitations of the current state of knowledge in forensic science and appreciate the need to adapt to new and emerging technologies in the field
- Pursue further scholarly pursuits, employment, and community involvement to advance the knowledge base in forensic science and contribute towards the economic and societal growth of the community

Forensic Science Program Accreditation

The innovative Forensic Science program at the UOIT has received the prestigious accreditation of the American Academy of Forensic Sciences' Forensic Education Programs Accreditation Commission (FEPAC). It is the second such program in Canada granted this distinction by the Colorado Springs, Colorado-based organization.

Keynote speaker – Monica Sloan

Monica Sloan is one of the longest serving Forensic Scientists in Ontario. A graduate of Queen's University, she was hired at the Centre of Forensic Sciences (CFS) in the Spring of 1991 as part of the Biology Section.

Since then, Monica has been witness to and involved in many of the changes and advancements in forensic science from the sweeping changes brought to forensic biology by DNA technologies to the effect of improved quality assurance on all forensic disciplines.

She has assisted a countless number of investigations in her role as a forensic scientist. Monica has testified on more than 100 occasions in criminal courts across Ontario as well as before the Supreme Court of Bermuda.

Monica has been an active member of the Canadian Society of Forensic Science for 24 years. As Chair of the Biology Section in 1998, she helped to draft the standards now used by the Standards Council of Canada when accrediting forensic laboratories in Canada. Recently, she was the Chief Organizer of the 2010 CSFS scientific conference and the President-Elect for the 2016 conference. Over the course of the last year as President, Monica has overseen the rejuvenation of the CSFS website and logo.

Schedule

8:55 **Welcome**: Dr. Cecilia Hageman

9:00 **Keynote address:** Monica Sloan

Session I Directed Studies & Mock Crime Scene Practicum Students
Chair: Mr. David Robertson

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.

The focus of 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.

9:20 **Nicole Santos**

Canadian Society of Forensic Science Careers Booklet

9:25 **Mary Walker**

Forensic Science in Canada: An Overview

9:30 **Christopher Adair**

Health Effects Associated with the use of Less-Lethal CEDs

9:35 **Benjamin Wong**

The Implications of DNA Evidence in Wrongful Convictions

9:40 **Janel Pangilinan**

Human Chimeras and Their Effects on Forensic Investigations and Relatedness Testing

9:45 **Nicole Crawford**

The Challenges of an Underwater Crime Scene

9:50 **Savannah Serrao**

A Review of the Understanding of DNA Evidence by the Legal System

9:55 **Sarah Sime**

A Comparison of Extraction Techniques for Ignitable Liquid Residues from Fire Debris

10:00 **Madeleine Lord, Kamesha Persaud, Brandon Chen**

Mock Crime Scene Practicum Course

10:15 **Refreshment Break, Mezzanine**

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 **Chantelle Forbes**

Direct and Indirect DNA Transfer in a Mock Crime Scenario

11:00 **Taryn Glazier**

Recovery of Trace DNA from Nitrile Gloves

11:15 **Julie Ly**

Electrophysiological Response of *Phormia regina (Diptera: Calliphoridae) to Sus scrofa* Cadaveric Volatile Organic Compounds

11:30 **Michele Pickles**

The Creation of a Searchable Electronic Natural and Synthetic Fibre Database

11:45 **Felicia Rodrigues**

Validation of Grimley Kinship Calculator

12:00 **Raven Schuett**

Introducing Probabilistic Genotyping into a Forensic Science Undergraduate Program

12:15 **Brandon Ypma**

Investigation of Document Alteration and Gunshot Residue Detection Using Reflective Ultraviolet and Infrared Photography Techniques

12:30 **Closing Remarks:** Dr. Cecilia Hageman

Refreshments and Networking Session

Canadian Society of Forensic Science Careers Booklet

Nicole Santos[1]; Kimberly Nugent, MSc[1]

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Synopsis

The careers booklet prepared for the Canadian Society of Forensic Science (CSFS) provides an overview of forensic science professions in Canada. This document is an updated version of a similar one published in 2007 by Dr. Gail Anderson, which reviewed both careers and discipline-specific information. This updated version specifically addresses career opportunities (a separate document focuses on the structure of forensic science in Canada). The document is structured to provide the novice reader an overview of the different disciplines in forensic science, by way of a topic description. Educational requirements for employment and career opportunities are also highlighted. The intended audience are students as well as those with a general interest in forensic science and would like to learn more. This document will be reviewed for accuracy by the forensic science community and published as part of the newly redeveloped 'Student Zone' on the CSFS website.

Forensic Science in Canada: An Overview

Mary Walker[1]; Kimberly Nugent, MSc[1]

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Synopsis

This document was prepared for the Canadian Society of Forensic Science (CSFS) to provide an overview of forensic science in Canada. This document is an updated version of a similar one published in 2007 by Dr. Gail Anderson, which reviewed both careers and discipline-specific information. This updated version specifically addresses the structure of forensic science across the country (a separate document focused on forensic-related professions). This resource serves to highlight the organizations themselves and the synergies among them. These include, law enforcement, government and private laboratories, death investigation specialists, as well as forensic science research. The historic context is discussed as well as the impact and role an organization plays within Canada. The intended audience are students as well as those with a general interest in forensic science. This document will be reviewed for accuracy by the forensic science community and published as part of the newly redeveloped 'Student Zone' on the CSFS website.

Health Effects Associated with the use of Less-Lethal CEDs

Christopher Adair[1]; Nelson Lafrenière, PhD[1]

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Synopsis

Conducted Electrical Devices (CEDs) are widely used by various law enforcement agencies, security companies, and the military around the world. CEDs have been deployed an estimated 3 million times – with 250,000 deployments taking place on an annual basis. Whether or not CEDs should be used by law enforcement agencies as a means of less-lethal force is a highly debated and controversial topic for review. The main goal or purpose of the directed studies paper is to examine the potential health effects associated with the use of such a device within the field. The paper explores the following concepts: (1) how a CED works to incapacitate a subject, (2) the health effects associated with the use of these devices, and (3) an in-depth review involving the sudden death of Robert Dziekanski at the Vancouver International Airport.

From this research, it was discovered that the X26 device can incapacitate an individual by acting on both the muscles and nerves within the body; resulting in the diminished voluntary control of movements. In addition, several secondary injuries can result from the uncontrolled collapse or fall of an assailant to the ground after CED capture. Finally, there were several mitigating factors involved in the sudden death of Robert Dziekanski and that there was no exact link between his death and CED deployment by RCMP. Concepts and evidentiary items within the paper illustrate potential health effects associated with CED use, which in turn can help develop more enhanced technologies as a means of increasing safety for both law enforcement personnel and citizens within a community.

The Implications of DNA Evidence in Wrongful Convictions

Benjamin Wong[1]; Nelson Lafrenière, PhD[1]

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Synopsis

Deoxyribonucleic acid (DNA) is the genetic blueprint for living beings and has unique properties that can be used to discriminate between individuals. Its use in identifying and excluding suspects in criminal investigations has made it a powerful piece of evidence. As such, DNA has become the gold standards of forensic evidence in the criminal justice system. The continual advancement of DNA analysis has made post-conviction DNA testing possible, thus leading to the exoneration of many wrongfully convicted individuals. However, these advancements have also increased the risk of DNA being used to cause wrongful convictions. When DNA evidence is improperly analyzed, interpreted, or understood it can cause miscarriages of justice. DNA is a double-edged sword that has the potential to either hinder or help people in the criminal justice system depending on how it is used. There are organizations in the United States and Canada that use DNA analysis to exonerate wrongfully convicted people, such as the Innocence Project and Innocence Canada. These organizations have identified a number of causes contributing to wrongful convictions, include eyewitness misidentification, jailhouse informant testimony, false confessions, police tunnel vision, and misapplication of forensic science. As well, they work with the criminal justice system to determine the cause of wrongful convictions and establish reforms to prevent miscarriages of justice from happening in the future.

Human Chimeras and their Effects on Forensic Investigations and Relatedness Testing: A Literature Review

Janel B. Pangilinan[1]; Nelson Lafrenière, PhD[1]

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Synopsis

This paper discusses how DNA from human chimeras can impact the interpretations made by forensic scientists during an investigation. A chimera is an organism that has more than one set of DNA and there are three categories of chimeras that will be discussed: artificial, transplacental, and tetragametic (Kaye, 2012). The main issue with chimeric DNA is if a forensic scientist is unaware that he or she is analyzing chimeric DNA, the wrong assumptions can be made leading to a misinterpretation of DNA profiles. These misinterpretations can impede an investigation or mislead investigators when trying to find suspects. In a relatedness testing capacity, the same misinterpretations can lead to scientists believing that two people are not related when they actually are. This paper also briefly touches on current technology that can detect chimerism in humans and how this technology may open doors to ways to more easily detect human chimeras during a forensic investigation, rather than just being helpful in a medical capacity.

The Challenges of an Underwater Crime Scene

Nicole Crawford[1]; Nelson Lafrenière, PhD[1]

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Synopsis

As water technologies and recreational toys have developed, the use of waterways for recreational pleasure have increased. This influx of activity on or near the water invariably increases the chances of accidents, drownings, as well as the occurrence of criminal activities. In response to this, police agencies must be aware of the proper processing procedures and the large numbers of challenges that arise when dealing with an underwater crime scene. The goal of this project was to create a procedural guide for officers to ensure that they are aware of the specific underwater procedures required to conduct a successful investigation. If standardized practices are not used, evidence may be lost and criminals may not be convicted. Overall, the key aspects related to the water crime scene can be broken down into (1) first responding officers, (2) dry land investigators, (3) specialized team composition, (4) initial arrival at the scene, (5) preliminary documentation and evaluation of the scene, (6) processing the scene, and (7) evidence examination. Each aspect has a specific procedure and information to follow which was evaluated in this review.

A Review of the Understanding of DNA Evidence by the Legal System

Savannah Serrao[1]; Nelson Lafrenière, PhD[1]

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Synopsis

DNA evidence is highly probative and it is increasingly being introduced as evidence in various courtroom procedures. This review evaluated the understanding of DNA evidence by active members of the justice system, which are largely non-scientists. The various areas of misunderstandings were highlighted and explored, from the time when the DNA report is first handed to a lawyer to the point when a verdict is reached by the judiciary.

The main findings were that the conclusions of DNA reports were often misinterpreted due to the complex scientific terminology, and a failure to communicate the significance of statistics. Due to time and resource constraints, many lawyers often do not have adequate pre-trial consultation available to them, which hinders their ability to understand the reports they are provided and therefore, their performance in court. Judges assigned the gatekeeping role often have minimal resources available to inquire about the analysis and interpretation of DNA evidence. Yet, these resources are more than what the jury usually received to handle the complexity of the material provided in court. The inadequate presentation methods and the threat of mistakenly associating statistical evidence with guilt or innocence are just a few of the issues that were discovered. Due to the capability of these issues causing miscarriages of justice, more research is required to assess how these misunderstandings are caused and how they can be dealt with. The overarching recommendation was to address this effort with the collaboration of the scientific and legal communities.

A Comparison of Extraction Techniques for Ignitable Liquid Residues from Fire Debris

Sarah Sime[1]; Nelson Lafrenière, PhD[1]

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Synopsis

Ignitable liquid residues (ILRs) are important to a fire investigation for two main reasons: (1) they often act as fuels for fires, and (2) their presence may indicate a fire was intentionally set. These ILRs are primarily composed of hydrocarbon chains and can be extracted from left over debris after a fire. There are several techniques used for their extraction, including: solvent extraction, passive adsorbent materials, and passive or heated headspace extraction.

Passive headspace entails placing an adsorbent material (i.e. activated carbon strips), into a sample container overnight where the hydrocarbons adsorb to the carbon. The carbon strip is then washed with an organic solvent and the resulting extract is analyzed using gas chromatography mass spectrometry (GC-MS). This technique, however, suffers from the displacement of oxides and smaller hydrocarbons, meaning the final chromatograms are slightly skewed. As such, coupling this with zeolites (i.e. small beads with pores of various sizes), would allow for the extraction of oxides and smaller hydrocarbons while the carbon strip would extract the larger and heavier compounds. This would provide the best overview of what was present in the sample and during the fire.

The most widely accepted approach to the extraction of ILRs from fire debris is to use a combination of all three techniques. This combined technique is efficient at adsorbing hydrocarbons of various sizes, requires minimal human interaction (minimizing error), and provides good overall representation of the hydrocarbons present in the sample.

The Mock Crime Scene Practicum

Brandon Chen[1], Madeleine Lord[1]; Kamesha Persaud[1]; Kimberly Nugent, MSc[1]; Stacey Sainte-Marie, MSc[1], Det. David Robertson[1]

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Synopsis

Education is at its most efficient when theoretical learning is reinforced by practical application. The Mock Crime Scene Practicum capstone experience allows students to apply the cumulative value of their education to the investigation of a simulated crime scene in a controlled environment. Three students, acting as scenes of crimes officers, worked independently of one another over the course of 6 weeks. Each student conducted the investigation in 3 stages: (1) scene examination, (2) laboratory examination, and (3) testifying as the expert witness.

In the earliest stage, the students worked through the initial examination, the documentation, and the collection of evidence of 5 sub scenes, both inside and outside of the UOIT Crime Scene House. The next stage took place in the UOIT Forensic Laboratory, and consisted of the examination of all the evidence collected in stage 1. This investigation culminated in the participation of a mock trial for the final stage, wherein students were qualified as experts and underwent rigorous examination in chief and cross-examination.

Direct and Indirect DNA Transfer in a Mock Crime Scenario

Chantelle Forbes[1]; Stacey Sainte-Marie, MSc[1]; Cecilia Hageman, PhD, LL.B, LL.M[1]

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Abstract

Forensic DNA techniques have become very sensitive, meaning that smaller and smaller amounts of DNA can be detected. With a consideration of the super-sensitivity of modern forensic DNA analysis, lawyers in criminal trials have proposed an innocent and indirect DNA transfer hypothesis when, for example, their client's DNA profile is found at a crime scene.

This goal of this study was to better understand some of the limits of the transfer and persistence of DNA by recreating the situation in the Arnott & Hageman (2016) study. In this study, the supervisor's DNA was found on a firearm that her thesis student assembled when the supervisor never handled, or was even in the vicinity of, the firearm. A crime scenario was organized where two males (Mr. X and Mr. Y) planned an assassination plot and hired an assassin (Ms. A) to perform the act by "stabbing" the person of interest. Two male participants had a one-minute conversion over a table, followed by Mr. Y pulling out an envelope onto the table then handing it to the Ms. A. Ms. A as the assassin then grasped a knife one hour or 24 hours following the conversation experiment. Two additional experiments were performed where Mr. X simulated coughing and sneezing, or his saliva was spread out onto the table prior to the conversation. In all recreated scenarios, DNA was not detected on the knife for all three experiments. This study suggested that DNA transfer depends on many variables and the situation in the Arnott & Hageman (2016) study appeared to be a relatively rare event.

Recovery of Trace DNA from Nitrile Gloves

Taryn Glazier[1]; Stacey Sainte-Marie, MSc[1], Kimberly Nugent, MSc[1]

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Abstract

As DNA analysis instruments become more sensitive, DNA contamination from background levels in the environment is becoming an increasing concern. The goal of this study was to determine if trace amounts of DNA could be recovered from nitrile gloves before evidence examination. Investigator-mediated and background DNA contamination scenarios were analyzed in the University of Ontario Institute of Technology's undergraduate Forensic Science Teaching laboratory. Four types of DNA contamination were evaluated: (1) contamination from the manufacturer (by random sampling of gloves from closed boxes), (2) contamination from the scientist via removal of glove from box, (3) contamination from the scientist during experimental set-up, and (4) contamination by passive deposition of DNA in the environment. Overall, 57 samples were Chelex® extracted and quantified using an ABI 7500 Real-Time PCR. DNA was not detected in any of the 57 samples. This result indicates that nitrile gloves are an efficient type of glove to use during evidence examination to prevent DNA contamination.

Electrophysiological Response of *Phormia regina (Diptera: Calliphoridae)* to *Sus scrofa* Cadaveric Volatile Organic Compounds

Julie Ly[1]; Hélène LeBlanc, PhD[1]

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Abstract

During the process of decomposition, volatile organic compounds (VOCs) evolve from carcasses and are generally characteristic of the stage of decomposition. This has further implications entomologically as insects such as blowflies (*Diptera: Calliphoridae*), are reliant on these chemical signals to determine the suitability of the carcass as a host or potential food source. Blowflies are typically the first family of Dipteran flies to colonize a carcass soon after its death; hence, their role as primary colonizers has been exploited for the purposes of forensic investigations to help determine the minimum post-mortem interval (PMImin). The aim of this study was to identify specific VOCs from cadaveric pigs that caused an electrophysiological response in *Phormia regina* through analysis by GC-MS coupled electroantennography (EAG). VOCs were collected from two adult pigs (*Sus scrofa*) during the early stages of decomposition: fresh, bloat and active decay. The VOCs were introduced to female virgin *P. regina* fly preparations and electrophysiologically-active compounds were determined by analyzing the resulting electroantennogram for depolarizations and matching these depolarizations with the corresponding GC-MS chromatogram/mass spectrum. Five compounds that evolved during the fresh, bloat and active decay stages were determined to be EAG-active: toluene, 3-hexen-2-one, dimethyl disulphide (DMDS), dimethyl trisulphide (DMTS), and phenol. Hence, knowing the compounds that cause physiological responses in these flies early in decomposition is a useful investigative tool for determining a more precise post-mortem interval.

The Creation of a Searchable Electronic Natural and Synthetic Fibre Database

Michele Pickles[1]; Kimberly Nugent, MSc[1]; Stacey Sainte-Marie, MSc[1]

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Abstract

Forensic microscopy is important in examining and identifying a fibre's origin. It is one of the crucial steps in investigating the possible mode of transfer of a fibre from a victim, suspect or crime scene. An efficient way to identify the fibre is to reference a known database containing characteristics of shape, texture, diameter, and optical properties. A polarizing microscope is a commonly used instrument as it allows you to quickly obtain all the necessary morphological and optical properties needed for examinations. A searchable database of natural and synthetic fibres was created using Microsoft Access for the University of Ontario Institute of Technology's undergraduate Forensic Science laboratory. A forensic fibre database will allow for easy identification of fibres for forensic scientists of all levels because the characteristics would be readily available for reference. The database will be used as a teaching tool for students as they learn how to identify, compare and exclude fibre evidence collected from mock crime scenes.

Validation of Grimley Kinship Calculator

Felicia Rodrigues[1]; Cecilia Hageman, PhD, LL.B, LL.M [1]; Valerie Blackmore, MSc[2]

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Abstract

Forensic kinship analysis is performed to assess the degree of relatedness between individuals in a legal context. This project has been carried out to perform validation studies on in-house software, named Grimley Kinship Calculator, created by the Wyndham Forensics Group, prior to its use in casework. The software was created to assist case scientists in performing reliable kinship calculations more quickly and efficiently while reducing human error. The software underwent seven validation steps, which included allele frequency database verification, likelihood ratio formula verification, entering test cases and verifying the output against a manual likelihood ratio calculation, entering fictitious cases and verifying the output against a manual likelihood ratio calculation, as well as ensuring the 'Clear' and 'Print' buttons functioned correctly. A few anomalies were encountered during the entering of test cases with respect to retrieval of the proper likelihood formula or allele frequency; however, these anomalies can be fixed by the programmer. The software performs very reliably, is user friendly and will be ready to use in forensic casework once the anomalies encountered have been addressed.

Introducing Probabilistic Genotyping into a Forensic Science Undergraduate Program

Raven Schuett[1]; Cecilia Hageman, PhD, LL.B, LL.M[1]

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Abstract

Probabilistic genotyping is a new approach used by forensic DNA analysts to analyze, interpret and calculate statistics for complex STR profiles. Probabilistic genotyping software has been developed to compute statistical weights for sets of genotypes in complex mixture profiles. Mixture profiles arise when two or more contributors are present in an evidentiary sample. Interpreting electropherograms produced from mixture profiles becomes problematic when contributors in the sample share alleles leading to allele stacking, the number of contributors in the sample is increased, if the DNA is degraded or if the electropherogram contains artifacts.

Forty DNA mixture samples were created using ten DNA donors. The samples contained a range of two to five contributors in a variety of ratios. DNA amplification was performed using the PowerPlex® 16 HS system. The amplified DNA products were separated using an ABI Prism® 3100-Avant Genetic Analyzer and analyzed with GeneMapper® ID v3.2 software. From the manual interpretation of the mixture electropherograms, 62.5% of the samples under estimated the actual number of contributors based on the number of allele peaks. An under estimation to the number of contributors resulted from allele sharing and allele or locus drop out. Underestimating the number of contributors could become problematic when having to input a number of contributors into STRmix™.

Investigation of Document Alteration and Gunshot Residue Detection Using Reflective Ultraviolet and Infrared Photography Techniques

Brandon Ypma[1]; Andrew Groves Det/Cst[2]

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Abstract

Ultraviolet and infrared reflective photography were evaluated for their potential use in (a) the visualization of obliterated text, and (b) the visualization of gunshot residue (GSR).

For the visualization of obliterated text, nine different writing methods and nine different obliteration techniques on common paper types were examined. Analysis of these obliterations found that visual observations of the documents and obliterated text provided a greater number of positive visualizations than either UV or IR reflective photography. Between UV and IR reflective photography however, it was noted that IR reflective photography was able to visualize the obliterated text more frequently than UV, despite the fact that IR reflective photography was only able to positively identify ballpoint ink in two instances (those being the IR reflective photography of ZEBRA Zgrip ballpoint pen ink prior to obliteration on printer paper and cheque paper using the 695nm IR filter) any of the samples. Overall, Bic gel pen ink as well as correction fluid and correction tape proved to be the most resilient obliteration methods, however when observed from behind the underlying text below both correction fluid and correction tape was legible.

For the visualization of GSR, five fabric types, three separate firearms, and three shooting distances were examined. The analysis of GSR patterns resulted in the development of three general trends. First, IR reflective photography proved to have a greater ability to visualize GSR patterns than either light photography or UV photography. Second, GSR patterns had a tendency to be visualized more readily on cotton and polyester fabric than nylon and denim fabric. Finally, as the shooting distance increased, the number of GSR patterns observed decreased.

Congratulations Class of 2017!

Christopher Adair

Bandar Almarwani

Brandon Chen

Nicole Crawford

Chantelle Forbes

Taryn Glazier

Madeleine Lord

Julie Ly

Janel Pangilinan

Kamesha Persaud

Michele Pickles

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