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2013 Oklahoma Research Day

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10. Forensic Science

University of Central Oklahoma

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Abstracts from the 2013 Oklahoma Research Day

Held at the University of Central Oklahoma

05. Mathematics and Science

10. Forensic Science

05.10.01 Forensic Analysis of Cigarette Ash: Brand Determination Through Trace-metal Analysis

Anja Groth, Cris Lewis, James Barnes, Thomas Jourdan,

University of Central Oklahoma

Although cigarette ash is frequently encountered at crime scenes, it has largely been ignored in a forensic context. Few efforts have been made to utilize the information present in the form of trace-metal concentrations even though these could indicate the brand the ash originated from which could potentially help place suspects at crime scenes or assess how many people may have been present at a scene. This study aims to investigate the possibility of applying the distinction of cigarette brands based on the trace-metal concentrations in their ash in a forensic context. The most common American brands and the same brands purchased in different countries will be examined along with foreign brands. Cigarettes will be “smoked” using a variable-pressure peristaltic pump which allows for various smoking parameters reflecting the range of human smoking habits to be mimicked. Samples will be digested in a nitric-acid-based microwave digestion system and will then be analyzed using inductively coupled-plasma mass spectrometry (ICP/MS). The resulting database of trace-metal concentrations will be analyzed statistically using principal component analysis (PCA) to detect intrinsic differences between brands. A partial least squares-discriminant analysis (PLS-DA) will then be used to create a discriminant model capable of determining from which brand an ash sample may have originated.

05.10.02 Bluetooth and Spyware Hacking of Android Smart Phones: A Forensic Assessment Using FTK

Marci Brokish,

University of Central Oklahoma

This research will help in determining proper protocols and procedures to use in the forensic examination of an Android smart phone that has been compromised by a hacking exploit. This study will examine the artifacts left on an Android phone and determine whether these artifacts can provide clues to the phone's compromise. An Android phone is defined as a 'smart phone.' A smart phone is a cellular phone that has the computing power of a personal computer. Therefore, an Android smart phone is susceptible to the same security issues as a laptop or desktop computer. This research will provide digital forensics examiners protocols and procedures for locating artifacts on the phone that may be useful in an investigation. There are several different ways to hack a smart phone and this study will focus on Bluetooth hacking and hacking through the use of purchased spy software. This study will research hacking capabilities using six different programs. Each program will be installed on an HP Pavilion dv4 laptop. The separate programs will then be used to attempt to hack into an Android smart phone in order to test exactly how vulnerable the phone is to a hacking exploit. Once the phone has been compromised, proper digital forensic protocols will be used to image the phone and then examine the device to locate possible evidentiary artifacts left on the phone by the attack. Once all the data has been collected, compiled, and analyzed a report will be produced.

05.10.03 Relocation of Remains: Scavenger Scatter Patterns in North Central Oklahoma, Preliminary Findings.

Kama King, R. Christopher O'Brien,

University of Central Oklahoma

Human remains are often left exposed to the elements for a variety of reasons, which complicates the recovery of those remains. The proper identification of remains is highly dependent on the quantity and quality of remains recovered. When remains are left exposed many skeletal elements can be moved away from the deposition site through several processes. Scavenging is one of the most active of these processes. Scavenging leads to the separation of skeletal elements and the scattering of these elements. This makes recovering remains more difficult. It was hypothesized that scavenger behavior would be patterned and predictable, and that the observation of this behavior would lead to the identification of predictable patterns which will aid in the recovery of remains in the area. The activities of scavengers at placed domestic pig carcasses were monitored with still and video imaging equipment. Radio transmitters were implanted in long bones of these carcasses for tracking. The movement, both direction and distance, of the bones was tracked over time. The study has revealed that skeletal elements are moved large distances in a relatively short period of time. The skeletal elements of the pig carcasses were removed completely from the site within ten days. This indicates a very short time frame for the successful recovery of remains after deposition in an area with active scavengers. These are preliminary findings. The study will be repeated in at least three more seasons.

05.10.04 The Forensic Value of Processed Human Hair Extensions

Caitlin Porterfield,

University of Central Oklahoma

Human hair extensions are a nine billion dollar per year industry. Statistics indicate that over sixty percent of women have at some point invested in hair extensions. It is surprising, considering the growth of this industry, human hair extensions have never been investigated for their evidentiary value in a forensic case. A human hair extension recovered from a crime scene would likely be identified as a shed telogen human hair and processed as such. Extraction of mtDNA from the extension would place the hair donor, not the suspect, at the scene. Although it is not likely that mtDNA sequencing would result in the identification of the donor, the evidence would misdirect an investigation and result in a misuse of time and resources. In this study, processed human hair extensions will be evaluated genetically, microscopically, and chemically for their probative value in forensic casework. Current extraction techniques and detection technologies will be used to recover, quantify, amplify, and sequence mtDNA from the human hair extensions. In addition, this study will seek to differentiate between a processed human hair extension and a real human head hair based on physical, optical, and chemical attributes. Microscopy will be used to compare hair morphology. Chemical analysis using organic extraction and split injection gas-chromatography mass-spectrometry will also be conducted to detect processing chemicals used in the manufacturing of the extensions.

05.10.05 The Melanin Storm; How Melanin is Linked to Competitive Behavior, Murderous Activity, Genetic and Electrical Processes.

John Sparacio,

Northeastern State University

What is melanin? Where is melanin found in the human body and nature, and how does it affect humans physiologically and psychologically (behavior). This presentation will impart how limited quantities of melanin in human organisms acts subtly leading to a range of emotional states such as ruthlessness, arrogance, mercilessness, ultra competitiveness. The research will show how melanin reacts in certain human organisms and how these organisms respond within their environment both cultural and socioeconomic. It will show how behavior in low melanized human organisms cannot be contained or changed based on their genetic coding. This presentation will confer the science of melanin and how it relates to electromagnetic energy and frequencies linking melanin and light waves to extreme neural responses, and how the slightest deviation of this molecule can cause colossal changes in the organism. By continuing this study it is the researchers hope to expand and expound on these findings creating an awareness of the many uses and effects that melanin can have in our daily lives by contributing to such areas of scholarship as physics, chemistry, human biology, environmental biology, psychology, aerospace, optics, mathematics.

05.10.06 A reduction in the stochastic effects of low-copy number DNA amplification through the use of duplex-specific nuclease

Nicole Sambol,

University of Central Oklahoma

A study will be done to determine if the stochastic effects of amplification of low-copy number DNA could be alleviated using duplex-specific nuclease. DNA of a known concentration will be amplified using the AmpFISTR Identifiler PCR Amplification Kit protocol, and the results will be analyzed with the ABI 3130 Genetic Analyzer to obtain control profiles. The DNA samples will then be diluted to concentrations of less than 100 pg. Amplification will be performed using the AmpFISTR Identifiler PCR Amplification kit. PCR will be stopped after 10 cycles and the diluted samples will be treated with duplex-specific nuclease to obtain allelic normalization. PCR will then be resumed for the remaining 18 cycles according to the Identifiler protocol. Separation will be done using capillary electrophoresis on the Applied Biosystems 3130 Genetic Analyzer. The profiles produced for the diluted DNA samples will be compared to the non-diluted samples.

05.10.07 Deterioration of Various Cartridge Case Compositions in Selective Environments

Amanda Bevers,

University of Central Oklahoma

Examiners in the field of firearm and toolmark analysis compare characteristics on bullets or cartridge cases to determine if a specific firearm was used. Examiners can encounter ammunition components that have been exposed to or damaged by various environments when left behind, which can obscure or obstruct those characteristics needed to conduct an analysis. The proposed study seeks to classify the levels of deterioration on cartridge cases in select environments. In addition, we seek an appropriate restorative technique that may be effective in restoring characteristics necessary to draw conclusions. Fired cartridge cases were placed in six environments and collected every 31 days. The cartridge cases were cleaned with water using a sonication instrument when needed, and analyzed using a comparison microscope. A sample size of 9 cartridges per collection interval will be chosen based on composition and analyzed using a scanning electron microscope to evaluate elements present due to corrosion over time. Should the author find suitable characteristics for comparison, conclusions of identification or unsuitable will be drawn. All comparisons will be conducted using known samples that originated from one of 2 selected pistols (9mm Beretta and 9mm Hi Point). Should the author reach a conclusion of unsuitable, the cartridge case will then be cleaned using one of the three selected restorative techniques and analyzed again.

05.10.08 Retention and Disposition of Digital Evidence in the Federal Criminal Justice System

John Mabry, Marci Brokish,

University of Central Oklahoma

On any given day, law enforcement agencies across the United States are busy investigating crimes and seizing digital evidence in the form of computers, tablets, cellphones and data storage devices. In fact there is hardly a crime committed today that does not have some form of digital evidence associated with it. Given the enormous storage capacity of today's devices, cyber detectives face monumental challenges in finding that digital "needle in a haystack" - that image or file which may be key to solving the case or gaining a conviction. While much attention has been given to the process of gathering and evaluating such evidence, little has been devoted to law enforcement's responsibility in eventually returning non-criminal data and hardware to victims, innocent third-parties, and even defendants themselves or their families. The purpose of this legal research is to identify the most common retention and disposition issues facing federal law enforcement agencies and, based on current law, identify key areas for improvement, and the legal consequences of mismanagement. The need for such research is evident in light of the increasing number of civil claims, suits and adverse court rulings against police for improper retention and/or disposition of evidence and hardware that is not relevant to crimes under investigation or no longer needed.

05.10.09 The State of SANE Trainings in Oklahoma

Ngan Nguyen,

University of Central Oklahoma

For a crime scene investigator, the crime scene is usually comprised of lifeless evidence. However, to the Sexual Assault Nurse Examiner (SANE), the crime scene is the body of the living victim who has feelings and emotions. Therefore, not all the rules that are used by crime scene investigators are applicable. As taught, safety and emergency care are more importance than collecting and preserving evidence. Similarly, providing proper treatment and care to the victims is more significant than collecting and maintaining the evidence. The nurses are the best candidates to approach such crime scenes because they were taught the medical skills that enable them to evaluate and assess the bruises, scars, bite marks, etc. on the victim's body. For that reason, SANE is an important program, especially to those who are victims to sexual assault. Unfortunately, there are only 3 participating hospitals in the Oklahoma City Metro Area---Midwest Regional, Integris Baptist and Integris Southwest Medical Centers. Each hospital is on-call as a SANE hospital on a monthly basis. Currently, there aren't enough nurses or funding for SANE to improve. For that reason, the purpose of this research (semi-structured interview) is to educate the forensic professionals about the SANE program in Oklahoma. By learning more about SANE, they can be more precise in understanding the needs of SANE. From there, they can help SANE in becoming a more effective program in Oklahoma.