Second Annual IFRI Forensic Science Symposium

International Forensic Research Institute

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Second Annual IFRI Forensic Science Symposium

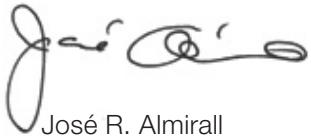
International Forensic Research Institute

March 13 - 14, 2013

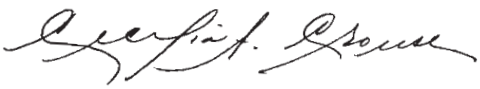
It is with great pleasure that we welcome you to FIU for the Second Annual IFRI Forensic Science Symposium. This meeting is a continuation of a series of ad-hoc forensic science meetings previously held in South Florida (Nova Southeastern University, Miami-Dade Police, Broward Sheriff, etc.). This year, the IFRI advisory board decided to expand on the very successful symposium held in March 2012 by again bringing together the talented practicing scientists and researchers in the South Florida area to showcase advances in the rapidly evolving fields within the forensic sciences. The more than 200 practicing scientists and more than 100 faculty and students at FIU and other institutions combine to provide a forum for information exchange that is mutually beneficial to both the researchers and the practicing scientists. The aims of this symposium are to provide continuing education opportunities for forensic scientists with presentations of recent research findings and new technologies, to provide the faculty and students a mechanism to showcase their research and together coordinate responses to challenges in forensic casework. The symposium will be offered over two days with five workshops, a keynote presentation, 25 oral presentations and 28 poster presentations.

This symposium would not have been possible without the generous support of our collaborators: Miami-Dade Police Department, Broward Sheriff's Office, Palm Beach County Sheriff's Office, and their leadership as well as the corporate sponsors: Agilent, Life Technologies, Bruker, LGC Forensics, Qiagen, IonSense and Eppendorf. We are also grateful to the other forensic laboratories throughout Florida for their participation and to the faculty and staff at FIU's International Forensic Research Institute for assistance with the coordination of this event.

Sincerely,



José R. Almirall
Director, International Forensic Research Institute
Co-Chair, Second Annual IFRI Forensic Science Symposium



Cecelia A. Crouse
Crime Laboratory Director, Palm Beach County Sheriff's Office
Co-Chair, Second Annual IFRI Forensic Science Symposium

Program

Wednesday, March 13

Applications of the Sciences in the Forensic Sciences (SIPA 125)
Stephanie Stoiloff

1:00 – 2:00 p.m.	Registration
2:00 – 2:10 p.m.	Welcome and opening remarks
2:10 – 2:40 p.m.	Tool mark examinations in the Lindbergh kidnapping case, John M. Mancini
2:40 – 3:00 p.m.	Go with the flow: Palm Beach County Sheriff's Office early user evaluation of the RapidHITTM 200, Karin Crenshaw
3:00 – 3:30 p.m.	Research study for the reliability of the ACE-V process; accuracy, precision, reproducibility and repeatability in latent fingerprint examinations, Igor Pacheco and Brian Cerchiai (Miami-Dade Police Department)
3:30 – 4:00 p.m.	Application of LA-ICP-MS for the elemental profiling of glass, ink, paper and chemical taggants, Tatiana Trejos and José R. Almirall
4:00 – 5:00 p.m.	Keynote speaker: Kevin C. McElfresh – Advanced genome technology and forensics, looking forward through the lens of 25 years of casework
5:00 – 5:15 p.m.	Special tribute to Bud Stuver, former supervisor of Miami-Dade Police Department biology section
5:15 – 7:00 P.M.	**RECEPTION AND POSTER SESSION**

Thursday, March 14

Session 1 – Breakout: Veterinary Forensic Science and Firearms (SIPA 103)
Chairperson: Jessica Brown

8:30 – 9:00 a.m.	Veterinary forensic sciences, J. H. Byrd
9:00 – 9:25 a.m.	Animal cruelty crime scenes: The role of the forensic veterinarian, Rachel Touroo
9:25 – 9:45 a.m.	Application of forensic principles to the protection of fish and wildlife resources and other cases involving examination of animal-related evidence, Hector Cruz-Lopez and Kristen Hoss
9:45 – 10:10 a.m.	Illegal slaughter of horses in Miami-Dade and Broward counties, DeEtta Mills
10:10 – 10:30 A.M.	**BREAK**
10:30 – 11:05 a.m.	Possible sources for false positives when conducting the Modified Griess Test for the detection of gunshot residues, Phase IV., Jorge Bello and Christopher Barr
11:05 – 11:30 a.m.	An empirical study to improve the scientific foundation of forensic firearm and tool mark identification utilizing consecutively manufactured Glock EBIS barrels with the same EBIS pattern, Gabriel A. Hernandez
11:30 – 12:00 p.m.	Evidentiary value continued research of swabbing the front sight on handguns for DNA analysis, Sara Cole, Earl Gordon, Victor Morillo and Cara Lopez
12:00 – 1:00 P.M.	**LUNCH**

Session 2 – Breakout: Drug Analysis/Toxicology (SIPA 100)
Chairperson: Luis E. Arroyo-Mora

8:30 – 8:55 a.m.	A study of blood alcohol stability in forensic antemortem blood samples, Dustin Tate Yeatman, Xiaoqin Shan, Nicholas B. Tiscione and Ilene Alford
8:55 – 9:20 a.m.	Quantitation of Ethanol and identification of other volatiles by headspace gas chromatography with simultaneous flame ionization and mass spectrometric detection, Nicholas B. Tiscione, Ilene Alford, Dustin Tate Yeatman, Xiaoqin Shan (Palm Beach County Sheriff's Office) Joe Kahl (Miami-Dade Medical Examiner Department)

9:20 – 9:45 a.m.	Fast detection of peroxide explosives using Planar Solid Phase Microextraction (PSPME) coupled to Ion Mobility Spectrometers (IMS), Wen Fan, Mimy Young and José R. Almirall
9:45 – 10:10 a.m.	Submerged remains: a study on the scent of death, Iris Caraballo and Kenneth G. Furton
10:10 – 10:30 A.M.	**BREAK**
10:30 – 11:00 a.m.	Rapid screening of 725 drugs and metabolites in 7.5 minutes with GC/MS TOX analyzer, Fred Feyerherm (Agilent Technologies)
11:00 – 11:30 a.m.	Cross-reactivity of cathinone derivatives and other designer drugs in commercial immunoassays, Madeleine J. Swortwood and Anthony P. DeCaprio
11:30 – 12:00 p.m.	Broad-based screening of bath salts, synthetic cannabinoids, and other designer drugs by LC-QQQ-MS and LC-QTOF-MS, Anthony P. DeCaprio, Ana-Michelle Broomes, Joshua Z. Seither, Madeleine J. Swortwood, and Luis E. Arroyo-Mora
12:00 – 1:00 P.M.	**LUNCH**

Session 3 – Breakout: DNA Analysis and Forensic Laboratory Management (SIPA 125)
Chairperson: Cecelia Crouse

8:30 – 8:55 a.m.	ParaDNA®: The technology, Randy Nagy, Mark Dearden, Paul Rendell, Simon Wells, Stephen Blackman
8:55 – 9:20 a.m.	Obtaining genotype out of low-copy number DNA, Pero Dimsoski, Julian Mendel, Bruce McCord and DeEtta Mills
9:20 – 9:45 a.m.	DNA methylation markers as a powerful technique to discriminate body fluids present in crime scenes, Joana Antunes, Tania Madi, Kuppareddi Balamurugan, Robin Bombardi, George Duncan and Bruce McCord
9:45 – 10:10 a.m.	Cutting out the middle (wo)man: implementing a direct outsourcing strategy for DNA cases, Celynda Sowards
10:10 – 10:30 A.M.	**BREAK**
10:30 – 11:00 a.m.	Divide and conquer: a novel approach to tackling a growing DNA backlog and increasing turnaround times, Angela Spessard
11:00 – 11:30 a.m.	The ABC's of forensic certification, Angie Vassalotti
11:30 – 12:00 p.m.	Spatial autocorrelation of soil biota profiles with soil type can be used for soil provenance, Natalie Damaso, Maria Mendoza and DeEtta Mills
12:00 – 1:00 P.M.	**LUNCH**

Workshops

1:00 – 3:00 p.m.	SIPA 100 – Big & small; inside & out; long & short sample analyses for forensic sciences using vibrational spectroscopy techniques by Agilent Technologies
	SIPA 103 – 6-dye evolution: prepare your lab for the future of CE fragment analysis by Life Technologies
3:00 – 5:00 p.m.	OE 107 – Designer drug screening using DART and GC-QQQ by Florida International University, Agilent Technologies (GC-MS) and IonSense (DART-MS)
	SIPA 100 – ParaDNA® workshop by LGC Forensics
	SIPA 103 – Improving differential workflow efficiency workshop by Qiagen

Poster Abstracts

1. Comparative detection of biowarfare agent surrogate DNA signature sequences via qPCR in defined backgrounds and clinical samples

Jonathan Segal, Florida International University

Real-time quantitative polymerase chain reaction (real-time qPCR) assays are a popular and effective option to detect biowarfare agents. Although real-time assays exist to detect both B. anthracis and Y. pestis, such assays are rarely validated in relevant clinical samples. In this study, SYBR-green real-time qPCR assays have been designed using chromosomal signature sequences to specifically detect biowarfare agent surrogates B. thuringiensis and S. marcescens. Currently, the efficiencies of both assays are being tested in a variety of conditions: pure-culture bioagent DNA, bioagent DNA spiked into constructed DNA mixtures (closely related and common lung species), and bioagent DNA spiked into DNA extracted from five clinical bronchoalveolar lavage (BAL) lung samples of unknown composition. Comparison of PCR amplification profiles and other assay parameters between conditions could provide some insight to the importance of background composition on single species detection, particularly at low DNA concentrations. This study is particularly poignant because of the inclusion of clinical samples from the lung, the main organ-of-entry of both B. anthracis and Y. pestis.

2. Evaluation and Comparison of Planar Solid Phase Microextraction (PSPME) with Other Substrates for Headspace Sampling of Cocaine and MDMA Coupled to Ion Mobility Spectrometry

Mimy Young, Wen Fan and José R. Almirall, International Forensic Research Institute

A novel planar solid phase microextraction (PSPME) sorbent-coated disk has been developed for the sampling and preconcentration of volatile chemical markers typically detected in illicit drugs and coupled to ion mobility spectrometry systems. The novel extraction phase offers a 10,000X increase in surface area and significantly increased phase volume capacity for fast sampling and preconcentration of analytes in comparison to fiber-based solid phase microextraction (SPME). While PSPME-IMS has been previously coupled to ion mobility spectrometry (IMS) for the identification of volatile chemical compounds found in illicit drugs (methyl benzoate for cocaine and piperonal for MDMA), we report for the first time, the extraction and retention capabilities of PSPME in comparison to other sampling substrates such as the commercially used Teflon coated swabs and uncoated glass filters. Static extractions using PSPME resulted in significant improvements in the extraction efficiency as well as retention capability for the volatile compounds associated with Cocaine and MDMA from static and dynamic extractions.

3. New Mite Species Described in Human Death Investigation: Implications for Forensic Entomology and Decomposition Ecology

Charity G. Owings, Meaghan L. Pimsler, Barry M. O'Connor, Aaron M. Tarone, Jeffery K. Tomberlin, University of Florida

The partially mummified remains of an elderly gentleman were discovered in his bed in April 2011 during a routine wellness check. Immature flies of the species Synthesiomyia nudiseta Wulp (Diptera: Muscidae) had pupated in a large mass of tangled hair of the decedent, instead of dispersing from the remains and forming cocoons of saliva and detritus. During processing for forensic entomological analysis, a previously unnoticed mite population was discovered. These mites constitute a new species within the genus Myianoetus (Asitgmata: Histiostomatidae), and represent the first recorded mite associated with this species of cosmopolitan fly. A description of the Myianoetus species as well as a discussion of the reciprocal implications in forensic entomology, acarology, and decomposition ecology will be presented.

4. Comparison of Scanning Electron Microscope and 3D Digital Imaging Microscope for Forensic Applications

Melissa Zwilling, José R. Almirall, International Forensic Research Institute

The ability to analyze trace evidence is essential in forensic examinations. The physical characteristics of small fragments of evidence are often determined via scanning electron microscopy (SEM), which can have magnification from 50x-50,000x. SEMs have been used to examine line crossings on paper documents, paper fibers, paint and coatings, gunshot residue, and laser ablation craters in glass, amongst others. While effective, this technique does have some drawbacks. All samples must be maintained in a vacuum, and technical expertise is required for operation. In addition, determination of three-dimensional features such as volume and morphology is a tedious process on SEM, sometimes requiring hours for analysis of a single sample. Recent progress in digital microscopy has improved resolution such that forensic evidence can be examined with detail comparable to that of SEM, but without the need for a vacuum using light microscopy instead of an electron beam raster. In addition, the digital optical method is such that 3D features of common forensic samples can be determined, such as depth of bullet striations. Additional benefits include the short time required to operate the instrument, which is a matter of seconds to minutes, and operation of the instrument requires minimal training and maintenance. Here, the three-dimensional morphologies of several samples of forensic interest are examined, such as bullet striations, tool marks, and fibers, showing the benefit of 3D resolution with the advantages of ease, cost and speed.

5. Separation and Identification of Synthetic Cathinones using GC/MS, GC/MS/MS and ESI-IMS-MS

Seongshin Gwak, Luis E. Arroyo-Mora and José R. Almirall, International Forensic Research Institute

Cathinone is the main component of the khat plant which produces a stimulating effect similar to amphetamines. In this study, 6 synthetic cathinones, recently scheduled as Schedule I controlled substances in Florida as of July 2012, 4-methylmethcathinone (4-MMC), 3-fluoromethcathinone (3-FMC), 4-methylethcathinone (4-MEC), 4-methoxymethcathinone (methedrone), 3,4-methylenedioxymethcathinon (methylone) and 3,4-methylenedioxypyrovalerone (MDPV), were analyzed using a commercially available electrospray ionization-ion mobility spectrometer-mass spectrometer (ESI-IMS-MS), a gas chromatograph-mass spectrometer (GC/MS) using electron ionization (EI) and a GC/MS/MS Triple Quadrupole (QQQ) with both EI and chemical ionization (CI) modes. One of the advantages of using the softer CI and ESI ionization sources is the creation of molecular ions of the easily fragmented compounds and, in the case of ESI, the ability to analyze nonvolatile compounds and ionize compounds in the liquid phase. We report a fast and selective method that can be used to unambiguously identify this important class of drugs using ESI-IMS-MS and the performance was compared to both GC/MS and GC/MS/MS.

6. Comparison of mitochondrial DNA analysis of wild and domestic horses

Evelyn Perez and DeEtta Mills, International Forensic Research Institute

Mitochondrial DNA (mtDNA) analysis is useful to examine population maternal lineages and biogeographic ancestry within species. However, there are some limitations in its forensics use. The objective was to determine mtDNA lineages in wild horses and compare to modern domestic breeds using haplotypes identified. Forensic analysis was also performed on a recent case involving a slaughtered horse. DNA was extracted using Qiagen QIAamp DNA micro kit from equine mane hair, quantified and sequenced using the ABI BigDye® Terminator v3.1 Kit and equine D-loop primers. Among 152 randomly sampled horses, 30 different haplotypes were identified and corresponded to publish mtDNA haplogroups A-G. The data showed higher mtDNA haplotype diversity in wild horses when compared to domestic breeds. Equine casework was supported by mtDNA sequencing using hair samples in an attempt to generate a reference sample for the slain horse. STR profiles were unable to be generated, but mtDNA sequences were obtained.

7. Comparison of Two Novel Polymers using Capillary Electrophoresis for Bioseparations of Complex DNA Mixtures

Natalie Damaso and DeEtta Mills, International Forensic Research Institute

Objective: A critical need exists to develop a method that can rapidly analyze community profiles not only by length, but also based on inherent sequence polymorphisms without the need for metagenomic sequencing, that is costly, or by community profiling via amplicon length sequence heterogeneity, which grossly underestimates the community diversity. Method: The commercial polymer, POP-4, and a novel polymer, F-108, will be compared using capillary electrophoresis (CE) to discover the best matrix for separating and detecting the obscured sequence diversity within length-based amplicons of microbial populations. Significance: Utilization of novel polymers, that can provide 2-D mixture profiles based on length and sequence differences, will have a great impact on the forensic community by assisting in the detection and identification of harmful pathogens and biothreat agents that are critical to homeland security.

8. Identification of five base coat color markers in Wild Mustangs through non-invasive sampling and the SNaPshot Method.

Lauren A. Martin and DeEtta Mills, International Forensic Research Institute

A method using coat color and Single Nucleotide Polymorphisms (SNPs) for the Extension (E), Agouti (A), Cream Dilution (C), Overo (O), and Sabino 1 (sb1) loci was used to link phenotype descriptors from DNA extracted from equine hair samples. Methods: Equine DNA was collected from hair, amplified by PCR, treated using ABI's SNaPshot kit and analyzed by GeneMapper 4.0. PCR protocol and primers were from previous research by [Katoi, et. al, 2009]. Results: Based on the results of the five specific loci, the analyses represent a basic phenotypic profile for each equine sample. Significance: Utilizing the SNP color markers at the five loci can provide a genetic link to coat color phenotype and help describe unknown equine contributors when non-invasive sampling techniques are used (e.g., hair rubbed off on a tree). Increasing the number of loci queried can also increase the individualization and help in herd census and conservation management.

9. New Drug Trends: Introduction To Synthetic Cathinones Aka "Bath Salts"

Sayuri Umpierrez and Oliver S. Spicer, Jr., Miami-Dade Police Department Forensic Services Bureau

The use of new psychoactive synthetic substances as recreational drugs has raised concern over the last years. In an attempt to avoid legal prosecution, new designer drugs have been marketed as bath salts when they in fact contain synthetic chemicals that mimic the pharmacological effects of commonly abused controlled substances like cocaine, LSD, ecstasy and amphetamines. Both the law enforcement community and health care professionals indicate that synthetic stimulants are growing in popularity. Due to their potential threat to public safety, many of these drugs are currently illegal in the United States. The Miami-Dade Police Department is tasked with the challenge of identifying these emerging substances when submitted for analysis by various law enforcement agencies in Miami-Dade County. The analysis of the most prevalent "bath salts" submitted to the lab will be discussed. Common methods of qualitative analysis include GC-MS and FTIR, and Raman Spectroscopy will be evaluated as an alternative tool for the analysis of synthetic cathinones.

10. Forensic support of investigations involving illegal poaching of the American alligator (Alligator mississippiensis Daudin)

Kristen Hoss and Hector Cruz-Lopez, Florida Fish and Wildlife Conservation Commission

The American Alligator (Alligator mississippiensis), a member of the order Crocodilia, is a common target of illegal hunting activities throughout its range. Illegal "take" methods can readily be identified utilizing conventional and wildlife forensic analysis. In addition to physical examination, we apply biochemical systematic and DNA analysis techniques to identify and cross-match physical and biological items of evidence as part of the crime scene reconstruction process. The poster presentation outlines the background, methodology, data analysis, and study cases illustrating the application of forensic principles to the formulation of charges, prosecution, and conviction of suspects in cases involving violation of the Florida Wildlife Code as it pertains to alligators.

11. Assessment of spatial heterogeneity in soil samples using laser-based elemental analysis techniques for forensic applications

Sarah C. Jantzi, José R. Almirall, International Forensic Research Institute

Laser-based elemental analysis can be used in forensic analysis by comparing the elements present and their relative amounts in the questioned sample with that of a set of known samples to determine whether two samples originated from the same source, or to determine provenance. A laser-induced breakdown spectroscopy (LIBS) method was developed for elemental analysis using calibration curves and certified standard reference materials as controls. The resulting accuracy, precision and sensitivity are reported, and are sufficient for discrimination between samples originating from different locations. The heterogeneity within sites, sub-plots and samples was characterized using surface samples taken throughout Miami-Dade County, FL in each of six different USDA-defined soil type regions. Using Principal Components Analysis (PCA) of the multi-element data, groupings were observed for most sites with some overlap between the sites. Heterogeneity was found to be site-specific; with some sites exhibiting a large spread, while others split into tight groups.

12. Differential Extraction of Equine Epithelial Cells from Fecal Matter Using Pressure Cycling Technology and IPCRp

Melissa Villarreal, Pero Dimsoski, and DeEtta Mills, International Forensic Research Institute

Non-invasive sampling from fecal matter can aid in conservation and management of America's wild horses or in forensics, when a reference sample is needed for a missing animal. Selective DNA extraction by differentially lysing equine gut epithelial cells over bacterial DNA is possible using pressure cycling technology (PCT). The Isolation of PCR products (IPCRp) made it possible to obtain a complete DNA profile. Methods: For extraction, the Qiagen DNA Stool Mini Kit, with an added PCT step prior to clean up, was used. For IPCRp, the biotin-incorporated primers were used to amplify, and then eliminate unincorporated primers, dramatically reducing background noise. Results: When incorporating PCT and IPCRp methods, partial equine DNA profiles from fecal matter were obtained in 10 of 27 samples while full profiles were obtained in 17 of 27 samples. PCT along with IPCRp improved the likelihood of obtaining a full equine DNA profile from fecal samples.

13. Case Report of a Fatality Involving a New Designer Drug 5-APDB

Tiffanie L. Hargraves and Julia M. Pearson, Hillsborough County Medical Examiner Department

Benzofuran derivatives were originally synthesized to assess the structure-activity relationships and the pharmacological properties produced from changes in ring substitutions of 3,4-methylenedioxyamphetamine (MDA) and 3,4-methylenedioxymethamphetamine (MDMA) (1). The benzofuran derivatives 5- and 6-(2-Aminopropyl) benzofuran (5- and 6-APB) and 5- and 6-(2-aminopropyl)-2,3-dihydrobenzofuran (5- and 6-APDB) have become available as designer drugs. These drugs are designed to avoid legal prosecution as substitutes for ecstasy and are commonly sold on the Internet and in head shops. However, these designer drugs have caused confusion within both Internet drug chat rooms and the forensic community because some were abbreviating 5- and 6-APDB as 5- and 6-APB (2, 3). There is little known about these synthetic designer drugs and their potential toxicity. In this case report, we present a fatality involving 5-APDB and provide analytical data for all four benzofuran derivatives in order to assist other toxicologists with the identification of these designer drugs in casework.

14. ParaDNA®: Advance Knowledge to the Investigator

*Beatrice Kallifatidis[1], *Julian Mendel[1], Nick Dawnay[2], Randy Nagy[2], DeEtta Mills[1] (*equal contribution)
[1]International Forensic Research Institute [2]LGC Forensics

ParaDNA® indicates whether samples collected at the crime scene contain human DNA and which of these are most likely to deliver investigative leads. It only takes 75 minutes to screen up to four samples and acquire this vital advance knowledge using fluorescent HyBeacons™ technology. The results indicate whether human DNA is present in sufficient quantity to generate a conventional STR profile upon submission to the laboratory. In addition, the sex of the sample donor is determined. ParaDNA does not supplant existing STR analysis, but augments the process and could save significant time and cost by effectively directing the investigative process. Using an innovative sample collector, minimal training is required to enable investigators to collect, assemble and analyse DNA. This poster presents the validation data that indicates the potential utility of the system in the United States, by screening several touch, saliva and blood mock evidence samples.

15. Effect of organic modifiers on separation of fluorescently labeled phenethylamines in capillary electrophoresis.

Britt E. Turnquest, Bruce R. McCord, International Forensic Research Institute

In electrophoresis, electric potential is applied at the ends of a capillary filled with an electrolytic solution resulting in the generation of an electric field causing the movement of the electrolyte and any analytes present. Due to this analytes are separated based on their mass-to-charge ratios. A highly sensitive and specific detection method for this kind of separation is laser-induced fluorescence. For this study, five commonly encountered drugs and precursors (used in illicit preparations) were investigated: amphetamine, methamphetamine, norephedrine, ephedrine and methylenedioxyamphetamine (MDMA). Analytes were coupled to the fluorescent molecule, 5-DTAF. Given their small size and structural similarities the phenethylamines investigated all have similar pKa values and migration rates making coelution common. To improve the separation between the individual drugs assessed, modifiers were added to alter the electro-osmotic flow and the velocity of the bulk solution thus varying the migration rates of the analytes through their interactions with them. These modifiers included various Î²-cyclodextrins and organic solvents.

16. Comprehensive Confirmatory Analysis of Multiple Improvised Explosives

Kelley Peters, Bruce R. McCord, International Forensic Research Institute

In recent years there has been a dramatic increase in the use of improvised explosive devices (IEDs) due to better controls placed on explosives. Commonly used materials for explosive preparation include oxidizers such as chlorates, perchlorates, and nitrates as well as peroxides. Unfortunately there is no single procedure capable of quickly identifying the wide range of chemical fillers present in these devices. It is the goal of this study to develop a more comprehensive procedure for the detection of IEDs. In this study we are examining the combination of electrochemical detection coupled with ESI/TOF MS to detect these materials. The procedure uses 18-crown-6 ethers in order to detect the ion pairs of ammonium nitrate, urea nitrate, potassium chlorate, and ammonium perchlorate while simultaneously being able to detect organic peroxides and nitrates. Overall, this technique allows for multiple IEDs to be differentiated using one comprehensive method, LC-EC-ESI-TOFMS.

17. Application of GC-QqQ for Forensic Application of Oil Spills

Kefei Wang, Louis Maljers, Bruker Daltonics

The wide use of petroleum and its products inevitably leads to their spills into the environment, causing the health and ecological risks that of public concerns. The source identification of oil spills has received considerable attention. Petroleum biomarkers are hydrocarbons molecules derived from the formerly living organisms and of critical importance in forensic fingerprinting of the oil spills. The analytical methodologies for these biomarkers are

mostly based on GC-MS. In this study, we illustrate the use of GC triple quadrupole mass spectrometer (GC-QQQ) with extracts of the weathered oils. The GC-QQQ operated in the multiple reaction monitoring (MRM) mode has shown to have advantageous for some of the biomarkers over the traditional GC-MS operated in full scan or SIM mode due to the selectivity of the GC-QQQ.

18. The Development of Field Calibrants fir Detection Canines

Katylynn Beltz, Michelle Cerreta and Kenneth G. Furton, International Forensic Research Institute

Biological detectors such as canines are valuable tools used for the rapid identification of illicit materials because they can be trained to reliably detect a wide variety of odors. However, increased scrutiny over the reliability of detection canines is currently being evaluated in the legal system as there are no formal regulations regarding detection canine maintenance and training. This study deals directly with the steps taken for the validation of surrogate continuation aids and a Universal Detector Calibrant (UDC). The development of a UDC allows for the determination of the reliability of the biological and instrumental detectors on a daily basis. By training the canine to alert to the UDC before each working day the handler can record if the biological detector is working at suitable standards. Standardization of detection canine training aids will ensure the optimal number of illicit material odors detectable in the most reliable manner.

19. Comprehensive Screening and Quantitation of Designer Drugs by LC-QQQ-MS/MS Analysis

Ana-Michelle J. Broomes, Luis E. Arroyo-Mora, Anthony P. DeCaprio, International Forensic Research Institute

A comprehensive mass spectrometric analytical method for the separation and identification of 23 recently schedule designer drugs by the DEA and 12 compounds from the Japan controlled substance list is presented. A triggered multiple reaction monitoring method (tMRM), with up to 10 ion transitions are incorporated into a customized database to allow identification via a score match. The chromatographic separation of the target analytes was achieved by using a Zorbax Eclipse Plus C18 column, 2.1 x 100mm, 1.8 µm using a methanol water gradient mobile phase. This allows separation of all DEA and Japan drug entities in less than 16 minutes for each schedule group. Acceptable linearity (r2>0.99) and excellent detection limits in the low parts per billion range were obtained for the majority of the investigated analytes. This method will ultimately be expanded to include several hundred designer drug analytes in a single analytical run.

20. Development of a High Resolution MS/MS Spectral Library and a Compound Database for the Identification of Designer Drugs by LC-QTOF-MS.

Joshua Z. Seither, Luis E. Arroyo-Mora, Anthony P. DeCaprio, International Forensic Research Institute

With the recent rise in popularity and use of designer drugs, a need is created within the forensic science community to be able to comprehensively screen for designer drugs. The LC-QTOF-MS has been suggested to be a useful tool for screening designer drugs. A high resolution MS/MS designer drug spectral library was created with a LC-QTOF-MS. The high resolution spectral library contained 263 designer drug standards from different classes such as cathinones, piperazines, phenethylamines, tryptamines and synthetic cannabinoids. In addition to the spectral library a compound database was created in order to enhance the screening potential. This compound database has chemical information for 500 additional designer drug compounds that can be used to help aid in the identification of designer drugs in a full mass scan. The combination of a high resolution MS/MS library and a compound database could be a very useful tool for the identification of designer drugs.

21. Immunomagnetic capturing (IMC) procedure for separation of the sperm fraction out of mixed (vaginal epithelial and sperm cells) samples.

Pero Dimsoski, Vanessa Martinez, and Bruce R. McCord, International Forensic Research Institute

A male genotype was separated from mixed samples using IMC procedure where vaginal epithelial cells were removed from mocked mixed sample by targeting them with antibodies specific for the epithelial cells. The antibodies, attached to tetrameric complexes integrating magnetic nano-particles (EasySep kit, Stemcell Technologies), were separated magnetically. The sperm fraction was washed out of the tube and the DNA was extracted either by ethanol precipitation with addition of pressure cycling step (Pressure Barocylcer NEP2320, Pressure Biosciences Inc.) or by DNA Investigator kit used with EZ1 robot (Qiagen). PowerPlex 16 kit (Promega) amplified the DNA which was genotyped on AB310 Genetic Analyzer and a male genotype was obtained.

22. AP endonuclease 1 sustains the fidelity of DNA polymerase β during repair of an abasic lesion in the context of a T/G mismatch

Jing Zhou, Florida International University

The cytosines of multiple CpGs located in gene promoters and encoding regions can be methylated at their 5-position to result in a specific pattern of DNA methylation (5-mC). CpG clusters have been identified as the hotspots of oxidative DNA damage and mutagenesis. DNA base excision repair (BER) can remove the damage on CpGs, thereby sustaining normal DNA methylation pattern. BER can also mediate active DNA demethylation, where a 5-mC is converted into a thymine introducing a T/G mismatch adjacent to a guanine that can be damaged by oxidative stress. In this study, we found that thymine DNA glycosylase was completely inhibited by an abasic site adjacent to a T/G mismatch. However, AP endonuclease 1 (APE1) efficiently 5'-incised the lesion. Surprisingly, we found that DNA polymerase β efficiently extended the 3'-terminus mismatched T. Interestingly, we found that APE1 3'-5' exonuclease removed the 3'-T/G mismatch efficiently, thus enhanced pol β fidelity.

23. Characterization of toners using SEM-EDS and laser-based micro-spectrochemical techniques (LA-ICP-MS and LIBS).

Ruthmara Corzo, Tatiana Trejos and José R. Almirall, International Forensic Research Institute

The physical and chemical characteristics of toners can be used to differentiate documents printed from different sources or to associate documents that originated from the same printing source. In this study SEM-EDS, LA-ICP-MS and LIBS were used to characterize the elemental composition of black toners. Comparison of the performance of each of these methods is presented, including their figures of merit, discrimination capability and error rates. A total of 26 black laser toners originating from different manufacturing sources and/or batches were examined to evaluate the discrimination capability of each method. The results suggest that SEM-EDS offers relatively poor discrimination capability for this set (~59% discrimination, 41% type II error rate). Laser ablation methods showed a superior performance and produced a maximum false exclusion (type I error) rate of 2.1% and a maximum false inclusion (type II error) rate of 12.8% for this ink set.). Nonetheless, SEM-EDS can still be used as a complementary method of analysis since it has the advantage of being non-destructive to the sample in addition to providing imaging capabilities to further characterize toner samples by the particle morphology.

24. Validation of LA-ICP-MS method for the identification of forensic chemical coding systems

Tatiana Trejos and José R. Almirall, International Forensic Research Institute

Laser Ablation ICP-MS can be used for the characterization of traceable chemical tagging systems for property and valuable objects prone to theft. These taggants are now commercially available in the USA (SmartWater CSI, LLC TM) and therefore it is anticipated that this evidence will reach the US courts soon. The aim of this work was to evaluate and validate the scientific foundation of the methods of recovery and analysis. The analytical performance of the LA-ICP-MS method was evaluated in terms of repeatability, reproducibility, bias and limits of detection. A total of 150 coding samples were measured as “unknown specimens” in order to evaluate the discrimination potential and error rates of the method. LA-ICP-MS analytical results were compared to those obtained by a solution-based-ICP-MS method and to the chemical signature provided from the company database. Mock cases were also received as part of the validation study. The study demonstrated that both SmartWater tracer and index products represent an effective tagging source due to its high discrimination potential, selectivity, ease of recovery and persistence on objects.

25. Advances in the Forensic Use of Human Scent

Lauren J. Colón-Crespo, Jessica S. Brown, Norma Iris Caraballo and Kenneth G. Furton, International Forensic Research Institute

Presently, human scent discriminating canines are employed to discriminate individuals, crime scenes and objects. This practice is based upon the theory that every individual possesses a distinct odor that is generated from a complex combination of the body’s metabolism, gland secretions, hormonal control, and interactions with the residing bacterial populations. Such interactions occur on dead skin cells, commonly referred to as “rafts”, which can be deposited into the environment allowing canines the opportunity to pick up a person’s scent. To understand what canines smell, human scent has been studied in the laboratory using a variety of specimens. A large portion of research has been conducted on hand odor since there is a high likelihood that a suspect’s hands will come into contact with an object while committing a crime. Hand odor can be collected through two different methods. Upon collection, scent samples are analyzed using solid-phase microextraction gas chromatography-mass spectrometry (SPME-GC-MS) and statistically evaluated to determine the distinguishability of the scent profiles obtained from different individuals.

26. Direct Analysis in Real Time(DART) Analysis With a Modified GC/MSD System for Rapid Drug Screening

Brian Musselman, Joseph LaPointe, and Robert Goguen Saugus, IonSense Inc.

Ambient ionization sources such as Direct Analysis in Real Time (DART) and Desorption Electrospray Ionization (DESI) were facilitated by the availability of high performance liquid chromatography/ mass spectrometry systems (LC/MS). Compared to gas chromatography MS (GC/MS) the number of these LC/MS systems in operation is relatively small. DART, an ambient pressure ionization source, generates intact [M+H]+ molecules by introducing the sample to a gas stream of metastable nitrogen molecules which can be heated to permit thermal disorption. In order to provide a more widely available platform for ambient ionization we have enabled an atmospheric pressure inlet for use with the Agilent 5973 series GC/MS along with DART. The instrument design includes a three stage vacuum system with capillary inlet and ion guide for optimum transfer of ions into the mass selective detector (MSD). The interface enables both DART and micro-electrospray ionization sources. Sensitivity of the device was measured using typical standards employed for DART. The modified GC/MSD system was utilized for the analysis of synthetic drugs available to the public.

27. Analysis of Volatile Organic Compounds of Heroin for canine detection by Using Solid-Phase Micro extraction / Gas Chromatography-Mass Spectrometry (SPME/GC-MS)

Claudia L. Sanchez, Howard Holness, Paola A. Prada, and Kenneth G. Furton, International Forensic Research Institute

Presently, very little information about volatile components in heroin can be found and there exists even less scientific literature on which of these volatile components from heroin produce a canine alert; most likely due to a lack of comprehensive sequential analytical procedures used to analyze heroin components, particularly when some of those components may change in heroin samples during the illegal drug trade during manufacture and transport. Analysis of such volatile compounds is crucial for the development of new training aids particularly for narcotic detection canines. This study has determined the volatile organic compounds (VOCs) present in seven heroin drug samples and has identified which of these VOC’s most likely produces an alert by narcotic detector canines. Headspace analysis of heroin samples was conducted by SPME-GC/MS for the identification of VOCs present in the each sample. Optimal results were obtained when 100µg of heroin powder sample were extracted at room temperature for 1 hour with a polydimethylsiloxane/divinylbenzene coated fiber. According with the investigation, none of the volatile compounds produced a positive alert.

28. High resolution gas-phase, MS-based post-ionization separation for molecular imaging and conformational dynamics

E.R. Schenk, J.D. DeBord, C. Lydon, A. McKenzie, F.A. Fernandez-Lima, Florida International University Department of Chemistry and Biochemistry

The Fernandez-Lima research group uses state-of-the-art and new generation analytical tools for the generation of molecular ions of interest from intact surfaces followed by structural identification and characterization. In particular, our group works on the design and generation of MS imaging calibration procedures and standards, the incorporation of high-throughput post-ionization separation and fragmentation techniques, the analysis of the gas-phase conformational space of molecular ions, and the characterization of the chemical environment at the single cell and sub-cellular level of model biological systems.

Oral Presentation Abstracts

PLENARY SESSION – WEDNESDAY 2 P.M.

1. Toolmark Examinations in the Lindbergh Kidnapping Case

John M. Mancini, Miami-Dade Police Department: Crime Laboratory

The Lindbergh kidnapping was one of the most high profile and publicized investigations of its time. This presentation discusses the facts about the toolmark examinations performed during this case and the unorthodox evidence used. The examination led to some interesting breakthroughs in the investigation and helped to solve the case.

2. Go With The Flow: Palm Beach County Sheriff's Office Early User Evaluation Of The Rapidhit 200

Karin Crenshaw, Palm Beach County Sheriff's Office

The Palm Beach County Sheriff's Office has been involved in the application of microfluidic devices for rapid DNA analysis since 2006. Advances in rapid DNA technology have included the introduction of the Rapid HIT™ 200 Human Identification System from IntegenX. The Rapid HIT™ 200 instrument is a fully automated sample-to-answer system for STR-based human identification. A Rapid HIT™ 200 instrument was released to the Palm Beach County Sheriff's Office Forensic Biology Unit in December 2012 for early user evaluation studies. Forensic laboratory involvement in the evaluation of a new product is a crucial step in establishing a working relationship between the forensic community and the manufacturer, ensuring the credibility of a particular instrument and maintaining the integrity of DNA analysis. The results, to date, demonstrate the instrument's compatibility with existing commercially available chemistries to generate STR profiles in less than 90 minutes.

3. Research Study for the Reliability of the ACE-V Process; Accuracy, Precision, Reproducibility and Repeatability in Latent Fingerprint Examinations

Igor Pacheco and Brian Cerchiai, Miami-Dade Police Department

Over 100 latent print examiners (LPE) from various local, state and federal law enforcement agencies participated in a research study to evaluate and compare unknown latent impressions to known standards. Eighty (80) unknown latent impressions and ten (10) known fingerprint and palm print standards were evaluated in three (3) phases over a ten (10) month period. Each latent impression was assigned a difficulty rating based on several metrics, including quality and quantity of minutiae. Over 5,900 suitability for identification determinations were reported. Participants were presented over 6,100 ACE and 1,500 ACE-V trials and conducted a search of multiple fingerprint and palm print standards. Findings will be presented on the sufficiency for "of value" and "no value" determinations and accuracy of results. This study was funded by the National Institute of Justice (NIJ) under their program for understanding the accuracy, reliability, and measurement validity of forensic science disciplines. (Award # 2010-DN-BX-K268)

4. Application of LA-ICP-MS for the elemental profiling of glass, ink, paper and chemical taggants.

Tatiana Trejos and José R. Almirall, International Forensic Research Institute

Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) is a micro-sampling leading technology that has been adopted by forensic laboratories worldwide for the elemental analysis and comparison of glass. The International Forensic Research Institute at FIU has been a leader in the validation of LA-ICP-MS for glass analysis and in the development of standard methods for the forensic examination of glass. This study presents results for interlaboratory studies conducted to validate the methodology and evaluate error rates. Our research group has extended the application of laser ablation methods to other matrices of forensic interest such as ink, paper and chemical taggants. This study presents a critical evaluation of the performance of LA-ICP-MS for these matrices, including the analytical performance of the technique, discrimination potential, homogeneity of the samples at the micro-scale, reproducibility, sampling strategies, availability of matrix match standards, statistical analysis and interpretation of results. In addition, the utility of this technique in forensic science is demonstrated by presenting real casework examples.

5. Advanced Genome Technology and Forensics, Looking Forward Through the Lens of 25 Years of Casework (Keynote)

Kevin C. McElfresh, Genome Identification Group

The very first forensic DNA cases were done in 1987, twenty six years ago. STRs have been in use for the last 18 years. During this period, the human genome has been sequenced and advances in technology and science have delivered clear successors to STRs, specifically; Ultra-High Density SNP arrays, Next, Third and Fourth Generation whole genome sequencing, and all of these technologies have a clear application to forensics. STRs by most scientific standards are an antiquated technology yet they continue to provide sound results day in and day out in forensic laboratories around the world. The last 25 years of casework operations provides deep insight as to how best to consider the adoption of new technology. The challenge before us is to carefully weave the capabilities of the forensic laboratory, advanced technology, and the rigors of law enforcement into a coherent whole, that serves the lives of the people who have been victimized in the production of the samples that we analyze every day.

SESSION 1: VETERINARY FORENSIC SCIENCE AND FIREARMS – THURSDAY 8:30 A.M.

6. Veterinary Forensic Sciences

J.H. Byrd, University of Florida

The recognition of veterinary medical sciences as an applied discipline within the forensic sciences is often critical for the proper investigation and prosecution of animal cruelty cases. Recent high profile cases of animal cruelty is serving to generate an increasing number of requests for assistance from law enforcement worldwide, particularly in the United States. Although a tremendous body of knowledge exists in veterinary medicine that can be readily applied to a forensic investigation, many aspects of the science are untested and unproven for casework. This presentation will highlight educational programs with focus on veterinary forensic sciences and discuss areas where research is lacking and demonstrate when active research engagement can produce an immediate and positive impact in cases of animal cruelty.

7. Animal Cruelty Crime Scenes: The Role of the Forensic Veterinarian

Rachel Touroo, The American Society for the Prevention of Cruelty to Animals

Veterinary forensics is a recently emerging branch of veterinary medicine. Veterinarians play a critical role in animal abuse cases, encompassing an array of duties within the context of veterinary forensic sciences. In some ways, the role of the forensic veterinarian can be compared to that of a human medical examiner. However, the duties of a forensic veterinarian include the triage of live victims, examination and treatment of live victims, necropsy of deceased victims, evidence identification, and assessment of the scene and its effects on the victims. The forensic veterinarian can also be an invaluable resource in the evaluation of evidence and crime scene reconstruction. Having knowledge of the role of a forensic veterinarian is crucial when determining the resources that are available when investigating and processing a crime scene involving animal cruelty.

8. Application of forensic principles to the protection of fish and wildlife resources and other cases involving examination of animal-related evidence

Hector Cruz-Lopez and Kristen Hoss, Florida Fish and Wildlife Conservation Commission

The Fish and Wildlife Forensic Research Laboratory is operated by the Division of Law Enforcement of the Florida Fish and Wildlife Conservation Commission. Its main purpose is to provide forensic and crime scene investigation support to law enforcement operations involving Florida wildlife, aquatic and marine resources. The laboratory provides expertise to local, state, federal and international jurisdictions in cases involving illegal trade of fish and wildlife resources and crime scene investigations requiring expertise related to wildlife and domestic animals. Laboratory capabilities focus on examination of biological, physical, and trace evidence analysis, taxonomic and biochemical species identification, relatedness, cause of death, crime scene reconstruction, underwater forensic operations and classical forensic techniques. The presentation outlines current capabilities, study cases, and an overview of services provided to the general law enforcement community.

9. Illegal Slaughter of horses in Miami-Dade and Broward Counties.

DeEtta Mills, International Forensic Research Institute

It has been illegal to slaughter horses in the US since 2007. Yet, in 2009, twenty horses were found slaughtered for their meat in Miami-Dade County, FL. And the numbers have continued to rise. Before 2010, it was legal to raise, slaughter and eat horsemeat if raised for personal consumption but illegal slaughter activity becomes a huge food safety issue because of the medications used in equine husbandry. FL HB 765 passed in 2010 and it is now a 3rd degree felony to *"knowingly transport, distribute, sell, purchase, or possess horsemeat for human consumption that is not clearly stamped, marked, and described as horsemeat for human consumption or horsemeat that is not acquired from a licensed slaughterhouse."* FIU's Forensic DNA Profiling Facility has been able to assist with two equine cases in S FL by providing DNA typing analyses of confiscated meat and tissue evidence samples.

10. Possible sources for false positives when conducting the Modified Griess Test for the detection of gunshot residues, Phase IV.

Jorge Bello and Christopher Barr, Miami-Dade Police Department: Crime Laboratory

This project aims to research some different sources of possible contamination when conducting the Modified Griess Test to detect gunshot residues (GSR). There are many substances which contain nitrites and could possibly cause a contamination if found at the crime scene or on a garment to be examined. This project will investigate such things as processed meats, spinach, detergents, and romaine lettuce further expanding phase I - III of the project.

11. An Empirical Study to Improve the Scientific Foundation of Forensic Firearm and Tool Mark Identification Utilizing Consecutively Manufactured Glock EBIS Barrels with the Same EBIS Pattern

Gabriel A. Hernandez, Miami-Dade Police Department

The purpose of this research was to conduct an empirical study to evaluate the reproducibility and uniqueness of striations/impressions imparted to consecutively manufactured Glock Enhanced Bullet Identification System (EBIS) Barrels with the same EBIS pattern, as well as to determine the error rate for the identification of same gun evidence. The Glock EBIS barrel is a polygonal barrel, which has a bar code like pattern added to it during the manufacturing process. Consecutively manufactured EBIS barrels with the same EBIS pattern are significant to the study because these barrels will be manufactured with the same EBIS equipment/tools and exhibit a similar pattern. Even though these barrels are consecutively made, their signatures should still be different. Test sets were assembled which included test fired bullets as well as unknowns. Participants were firearm & tool mark examiners throughout the United States. The error rate for the identification of same gun evidence will be discussed.

12. Evidentiary value continued research of swabbing the front sight on handguns for DNA Analysis

Sara Cole, Earl Gordon, Victor Morillo and Cara Lopez, Miami Dade Police Department

Handguns obtained in criminal investigations are handled by numerous people prior to being impounded and submitted to the crime laboratory for DNA analysis. The DNA profiles obtained from swabs of these handguns are usually unresolvable mixtures of DNA with low statistical weight due to a low combined probability of inclusion (CPI). Suspects frequently carry their handguns inside their clothing in a manner that places the front sight of the weapon in direct contact with their skin. This results in the transfer of epithelial cells to the front sight of the handgun, which can be swabbed for DNA analysis. The front sights, triggers and grips of 100 handguns were swabbed for DNA. The DNA on the swabs was typed using the AmpFISTR Indentifiler Plus® kit. When swabbing handguns for DNA, the front sight should be swabbed separately in addition to swabbing the trigger and grip.

SESSION 2: DRUG ANALYSIS/TOXICOLOGY – THURSDAY 8:30 A.M.

13. Broad-Based Screening of Bath Salts, Synthetic Cannabinoids, and Other Designer Drugs by LC-QQQ-MS and LC-QTOF-MS

Anthony P. DeCaprio, Ana-Michelle Broomes, Joshua Z. Seither, Madeleine J. Swortwood, and Luis E. Arroyo-Mora, International Forensic Research Institute

Designer drugs are synthetic compounds sold on the illicit market to evade law enforcement. Routine screening by immunoassay cannot detect the hundreds of designer drug entities that have been identified. Validated analytical methods are necessary to screen for and confirm their presence in ante- and post-mortem specimens. This presentation will describe work on the development of LC-MS/MS methods for rapid screening of designer drugs for forensic toxicology. We recently validated an LC-QQQ-MS/MS method for analysis of 32 designer drugs in serum and are expanding the screening, confirmation, and quantification capabilities to include ~300 designer drugs. While QQQ-MS is useful for known drug entities, exact mass analysis is an ideal approach for unknown or novel drugs. Consequently, we have also created a MS/MS spectral library for ~300 designer drugs using LC-QTOF-MS. It is hoped that these LC-MS based approaches will provide forensic toxicologists with new tools for high-throughput, comprehensive screens capable of identifying compounds across multiple designer drug classes with high sensitivity.

14. Quantitation of Ethanol and Identification of Other Volatiles by Headspace Gas Chromatography with Simultaneous Flame Ionization and Mass Spectrometric Detection

Nicholas B. Tiscione, Ilene Alford, Dustin Tate Yeatman, Xiaoqin Shan, Palm Beach County Sheriff's Office
Joe Kahl, Miami-Dade Medical Examiner Department

Ethanol is the most frequently identified compound in forensic toxicology. Although confirmation involving mass spectrometry is desirable, relatively few methods have been published to date. Other volatiles are commonly abused as inhalants. The methods used for identification of those inhalants are generally non-specific if analyzed concurrently with ethanol or require an additional analytical procedure that employs mass spectrometry. A novel technique utilizing a capillary flow technology (CFT) splitter to simultaneously quantitate and confirm ethyl alcohol and identify inhalants by flame-ionization (FID) and mass spectrometric (MS) detection after headspace sampling and gas chromatographic separation is presented.

15. Fast Detection Of Peroxide Explosives Using Planar Solid Phase Microextraction (PSPME) Coupled To Ion Mobility Spectrometers (IMS)

Wen Fan, Mimy Young, José R. Almirall, International Forensic Research Institute

A novel planar solid phase microextraction (PSPME) sorbent-coated disk has been developed and evaluated for the sampling and preconcentration of volatile compounds in the headspace for either illicit drugs or explosives. In this research, the PSPME disks are used to preconcentrate the headspace odors of peroxide explosives such as triacetone triperoxide (TATP) and hexamethylene triperoxide diamine (HMTD) followed by the detection in various commercial off-the-shelves ion mobility spectrometers (IMS) without further instrumental modifications. Quantitation of the retention capabilities were determined using TATP standards and static and dynamic headspace extractions were also performed and compared for PSPME extractions, in which low mg quantities of TATP were detected within 30 seconds of static mode sampling and less than 5 seconds in the dynamic mode sampling for PSPME-IMS. For HMTD, 2 h-16 h extractions have been performed in the headspace of a 100 mg of HMTD in a gallon jar and three peaks were detected in the MobileTrace IMS instruments in which one of these peaks alarm for the ammonia nitrate (AN)/urine nitrate (UN)/HMTD. The other two peaks remain unconfirmed so far.

16. Submerged Remains: A Study on the Scent of Death

Norma Iris Caraballo and Kenneth G. Furton, International Forensic Research Institute

The decomposition process is highly influenced by the environment that surrounds the body. Factors, such as moisture, temperature, scavengers, and oxygen availability, can alter the manner in which a body decomposes and thus, the liberation of volatile organic compounds (VOCs). Previous studies have evaluated the effects of soil on the evolution of VOCs from decomposing remains; however, little to no research has been performed on the effects of water. Thus, this study used solid-phase microextraction coupled to gas chromatography-mass spectrometry to evaluate the VOCs that were released from decomposing submerged remains. The compounds detected ranged in chemical functionality and abundance, which was expected since mammalian decomposition is a process and not a single event. Differences and similarities between submerged and non-submerged remains will be discussed, as well as the impact that water has on the release of VOCs from decomposing submerged remains.

17. Rapid Screening of 725 Drugs and Metabolites in 7.5 Minutes with GC/MS TOX Analyzer

Fred Feyerherm, Agilent Technologies

Laboratories that perform toxicology screens are challenged by the requirement to look for large numbers of target compounds in samples that contain complex matrix interferences. GC/MS methods are widely used and accepted for this analysis. Full-scan EI methods offer many advantages for broad-range screening, such as unlimited numbers of targets, full-spectrum identity confirmation, and library searching for identification of nontargets. With recent advances in GC/MS technology, there are several opportunities to substantially increase the number of targets screened for and simultaneously reduce the time required per sample.

18. Cross-Reactivity of Cathinone Derivatives and Other Designer Drugs in Commercial Immunoassays

Madeleine J. Swortwood and Anthony P. DeCaprio, International Forensic Research Institute

Designer drugs have been no stranger to the drug market in the United States over the past few decades. While a number of bans have been put in place regarding such compounds, the abuse of these designer drugs has been on the rise while manufacturers have stayed one step ahead of the law with constantly evolving modifications to structures. Since cathinone derivatives are fairly new, few assays have been created for the detection of such compounds. It is hypothesized that during routine drug screens by immunoassays, the cathinone derivatives and other designer drugs may be missed. In a toxicology lab, a negative screen would not be further investigated and the substances may never be detected. For this reason, it is important to investigate the cross-reactivity of such designer drugs by analyzing in across several commercial immunoassays. This presentation will discuss a large-scale study that evaluated the cross-reactivity of these compounds in various commercial screening assays.

19. A Study of Blood Alcohol Stability in Forensic Antemortem Blood Samples

Dustin Tate Yeatman, Xiaoqin Shan, Nicholas B. Tiscione and Ilene Alford, Palm Beach Sheriff's Office Crime Laboratory

Forensic toxicologists are occasionally challenged in court about the difference in blood alcohol concentration (BAC) results for the same case generated from analyses conducted months or years apart, as well as the possibility of microorganism-generated alcohol in antemortem blood samples. To address these issues, long-term storage effects on alcohol stability in preserved authentic forensic antemortem blood samples were investigated. Our study with authentic DUI blood samples showed that 1) there was no microorganism-generated alcohol in forensic preserved antemortem blood samples; 2) long term storage either under refrigeration, at or above room temperature decreased BAC, indicating that reanalysis of blood alcohol after long term storage would result in lower BAC results than the true values at the time of blood collection.

SESSION 3: DNA ANALYSIS AND FORENSIC LABORATORY MANAGEMENT – THURSDAY 8:30 A.M.

20. ParaDNA®: The Technology

Randy Nagy, Mark Dearden, Paul Rendell, Simon Wells, Stephen Blackman, LGC Forensics

ParaDNA® is a recently launched technology from LGC Forensics to screen DNA evidence. Two chemistries using fluorescent HyBeacons™ technology will be discussed and validation data presented. Details regarding the collection of samples using the ParaDNA® Sample Collector and results generated from the ParaDNA® Screening Unit will also be presented. The ParaDNA® Screening Test is designed to determine if the sample contains human DNA, the gender of the contributor, and provides a confidence level on generating a full DNA profile. The ParaDNA® Intelligence Test provides STR data from five loci as well as amelogenin and can be used to eliminate suspects or compare results to a small database. The impact of adopting ParaDNA® DNA screening technology into your workflow will also be summarized.

21. Obtaining genotype out of low-copy number DNA

Pero Dimsoski, Julian Mendel, Bruce R. McCord and DeEtta Mills, International Forensic Research Institute

A method for efficient amplification of the low-copy number DNA is presented. The DNA, obtained by swabbing touched stainless still bar, collected from three individuals, was extracted and quantified by Micro and Quantiplex kits (Qiagen), respectively. The control DNA was also obtained from the same individuals. The [DNA] obtained from the fingerprints were 0.03ng/µl, 0.13ng/µl, and 0.02ng/µl for the three individuals. The PCR was performed with Power Plex HS kit (Promega), as well as with in-house developed MiniBio kit, designed for amplification of low-copy and degraded DNA samples. The MiniBio kit, based on the previously published primers, located closer to the repetitive regions of THO1, CSF, TPOX, FGA, D21, and D7 loci, was modified to take advantage of the IPCRp amplification method, and multiplex PCR-plus kit chemistry (Qiagen). Full genotypes were obtained by both kits, although, the in-house developed MiniBio produced "cleaner" genotypes (higher peak heights with lower background noise).

22. DNA methylation markers as a powerful technique to discriminate body fluids present in crime scenes

Joana Antunes, Tania Madi, Kuppareddi Balamurugan, Robin Bombardi, George Duncan, Bruce R. McCord, International Forensic Research Institute

The goal of this paper is to demonstrate the application of epigenetic markers in forensic tissue typing. With the increasing sensitivity of DNA typing, it has become critical to determine the origin of DNA found at a crime scene. For example the presence of blood can indicate foul play while skin cells merely indicate DNA from the victim. Unfortunately, current methods employed for the determination of body fluids in forensic serology utilize protein and other chemical markers which lack specificity and sensitivity. We have developed a method to discriminate body fluids based on quantitative assessment of methylation levels at specific CpG sites in the human genome. Detection is performed via pyrosequencing of PCR amplified DNA from saliva, sperm, blood and skin that has been modified through bisulfite treatment. Our results indicate that this method can be used to clearly discriminate between different stains present at crime scenes.

23. Cutting Out the Middle (Wo)Man: Implementing a Direct Outsourcing Strategy for DNA Cases

Celynda Sowards, Palm Beach Sheriff's Office

The Palm Beach County Sheriff's Office Forensic Biology Unit (FBU) has been outsourcing DNA evidence from property crimes since 2003. In September of 2012 the FBU introduced the Direct DNA Initiative as a means to bypass the FBU in the evidence submission process to the vendor DNA laboratory. Traditionally a law enforcement agency (LEA) submitted evidence to the PBSO Evidence Unit where the FBU would then take custody. The evidence was catalogued on a manifest, packed into shipping containers and overnight expressed to the vendor by the FBU. When the cases were complete, the entire process was reversed. All hardcopy and electronic data and reports generated at the vendor laboratory were submitted to the FBU for review. Following review of the data, qualifying DNA profiles were entered into CODIS. Regardless if a DNA profile was obtained, an FBU report was generated for each case and distributed to the appropriate law enforcement agency contact. Hundreds of cases a year underwent this technical and administrative process, draining resources. Through the Direct DNA Initiative the vendor laboratory interacts directly with the LEA's, eliminating the FBU from all but the review of cases in which potential qualifying DNA profiles may be uploaded to CODIS. Considering a significant portion of the samples are negative for the detection of DNA, profiles match the victim or elimination standards or partial profiles are generated and are not of CODIS quality, the process is substantially more efficient. The goals of this Initiative include allowing LEA's to have ownership of their cases, returning DNA results to LEA's more quickly, decreasing the FBU's backlog while also saving time technically and administratively. The process of developing the Initiative, LEA buy-in, logistics and initial results will be discussed.

24. Divide And Conquer: A Novel Approach To Tackling A Growing Dna Backlog And Increasing Turnaround Times

Angela Spessard, Palm Beach County Sheriff's Office

The Palm Beach County Sheriff's Office Forensic Biology Unit (FBU) is the only DNA forensic service provider for all law enforcement agencies within Palm Beach County. Despite continuing National Institute of Justice (NIJ) grant funding to increase efficiency and decrease the backlog, the FBU was still experiencing a growing backlog and increasing case report turnaround times. In 2009, grant monies from the NIJ Efficiency Improvement Program were requested to construct a central Biology Processing Laboratory (BPL) in an existing space within the Boca Raton Police Services Department. The BPL would serve southern Palm Beach County law enforcement agencies as a screening laboratory, processing evidence for the confirmation of blood and semen and swabbing evidence items for DNA. All informative evidence would then be submitted to the FBU for DNA analysis. The BPL opened its doors in April 2012 and functions in collaboration with the FBU. A dual laboratory perspective on the challenges, changes, and initial results of the collaboration will be presented which illustrate how the BPL and FBU have grown together to handle case management and flow.

25. The ABC's of Forensic Certification

Angie Vassalotti, Palm Beach County Sheriff's Office

In response to the 2009 National Academy of Sciences Report recommendation, there has been a slow trend to certify forensic professionals. Certification is currently a voluntary process through which a practitioner can be recognized for attaining the professional qualifications necessary to practice in one or more disciplines of criminalistics. While multiple accredited certification bodies exist for other forensic disciplines such as toxicology, latent prints, and firearms, the American Board of Criminalistics (ABC) is the only organization that is accredited to offer certification to DNA analysts through their Molecular Biology examination. In 2009 it became the goal of the Palm Beach County Sheriff's Office Forensic Biology Unit (FBU) to certify all of its DNA analysts. In 2012, after three phases of testing, the FBU achieved ABC certification of thirteen staff members, becoming the first DNA laboratory in the state of Florida to have 100% of qualified DNA analysts certified.

26. Spatial autocorrelation of soil biota profiles with soil type can be used for soil provenance.

Natalie Damaso, Maria Mendoza and DeEtta Mills, International Forensic Research Institute

Background: A common ecological hypothesis is that soil type (i.e., chemical/physical properties) drives which microbes occupy a particular soil. Therefore, soil metagenome profiling should be able to produce a unique biotic profile and subsequent DNA analyses of the microbial community can enable a rapid method for soil provenance. Objective: Spatial autocorrelation analysis was used to test the assumption that geographic location and metagenomic content are linked. Method: Bacteria, archaea, fungi, and plant DNA universal markers were PCR amplified separated by capillary electrophoresis and queried across six soil types in Miami-Dade County, FL. Autocorrelations were conducted using Mantel test and R programming language. Significance: Autocorrelations linked metagenomic content to soil type, to specific transects, and could even discriminate at subplot level with strong accuracy. Seasonal changes (rain) did lessen the correlation at some sites. Significance: Spatial autocorrelation was observed and metagenomic biotic profiles could be used for provenance of soil evidence.

Workshop Abstracts

Designer Drug screening using DART and GC-QQQ by by Agilent Technologies and IonSense (OE 107)

The aim of this workshop is to introduce different mass spectrometry techniques for use in the screening and identification of seized drugs with particular attention given to the identification of the "designer" drugs (cathinones and synthetic cannabinoids). Instructors from Aglient, IonSense and FIU will present the theory, background and practical use of a variety of mass spectrometers in four 20-minute lectures followed by laboratory demonstrations with the instrumentation. The use of GC coupled to a triple quadrupole mass spectrometer for the identification of these drugs will presented. The utility of chemical ionization (CI) for easily fragmented drugs will also be presented and the use of accurate mass (time-of-flight) spectrometers for the identification of "designer" drugs will also be presented. Finally, the use of Direct Analysis in Real Time (DART) for the rapid screening of drugs when coupled to TOF-MS will be presented. A new library containing ~ 275 "designer" drugs has been developed at FIU with a GC-QQQ-MS and will be described during the workshop.

Improving Differential Workflow Efficiency By Qiagen (SIPA 103)

The QIAgility® system is a bench-top liquid handling instrument allowing hands-free PCR setup for real-time PCR-based DNA quantification. The instrument also allows automated adjustment of DNA concentration in forensic samples to a specified concentration (normalization), making use of resultant real-time PCR-based quantification values. The reaction setup for the Quantiplex HID assay can be performed by the instrument. Combining the assay with instrumentation significantly shortens time to result, with increased accuracy and sensitivity. In summary, with the combination of the Quantiplex HYres kit for accurate and rapid quantification, the QIAcube for automated differential washing, and the QIAgility for automated assay setup, the processing of differential samples workflow can be further streamlined and time-consuming, error-prone manual interactions can be minimized.

6-Dye Evolution: Prepare Your Lab for the Future of CE Fragment Analysis" by Life Technologies (SIPA 103)

Learn about the latest tools enabling a new era of performance, efficiency and data recovery, including: GlobalFiler™ Kits: development updates and casework test site data, Next generation Y-STR and quantification assay development updates, Software update paths for 6 Dye capabilities.

ParaDNA® Workshop by LGC Forensics (SIPA 100)

This workshop is designed to provide hands-on experience with the new ParaDNA® DNA Screening System. We will use the ParaDNA® Collector to collect samples from evidence and screen the evidence to determine the gender of the contributor and determine the level of DNA that was recovered from the item. This workshop will demonstrate the ease of collecting and screening samples to determine if they are good candidates for further STR analysis. There will be a review of the validation completed to date and a discussion on the value of including a ParaDNA® screening step in the evaluation of your evidence.

Big & Small; Inside & Out; Long & Short Sample Analyses for Forensic Sciences Using Vibrational Spectroscopy Techniques by Agilent Technologies (SIPA 100)

Big & Small; Inside & Out; Long & Short Sample Analyses is a presentation discussing the use of modern interferometer based spectroscopy techniques for Forensic & Anti-Counterfeit sample identification. This presentation will demonstrate using real-world samples how state-of-the-art FT-IR hardware and a variety of sampling accessories are used for modern day identification of potential counterfeit species ranging from chemical and biological to pharmaceutical in origin. Techniques discussed will include macro & micro samples, surface & depth profiling, UV-Visible through Far-IR regions of the spectrum, and cover both in-lab and out-of-lab FT-IR spectrometers keeping the lab bench high-end researcher to out of lab field technician user in mind.

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