Breakout Sessions - Schedule & Abstracts

Thursday, May 8

Scholarship Winners - Grand Ballroom Salon F

Moderator: MAAFS President Jennifer Bonetti, Virginia Department of Forensic Science

1:00 pm **Discovering Microscopic Clues for Shooting Reconstruction Using Rapid On-site Screening Laser-Induced Breakdown Spectroscopy (LIBS) Method.**
Leah Thomas, B.S., Roger Jefferys, M.S., Luis Arroyo, Ph.D., and Tatiana Trejos, Ph.D. - West Virginia University*

1:15 pm **Novel Time-Since-Deposition Signatures for Canine Blood and Implications for Animal Cruelty Investigations**
Alysia Townsley, Christopher Ehrhardt, Kate Philpott, Julie Burrill - Virginia Commonwealth University*

1:30 pm **Identification of microRNA Biomarkers for Body Weight and Muscularity Prediction in Forensic Samples**
Xiaomeng Yang, MS; Kimberly Lettner, BS; Jennifer Shealy, MS; J Paul Brooks, PhD; Sarah Seashols-Williams, PhD - Virginia Commonwealth University*

Interdisciplinary Session - Grand Ballroom Salon F

Moderator: MAAFS President Jennifer Bonetti, Virginia Department of Forensic Science

1:50 pm **Testimony Review and Discussion**
Randi Simpson - Virginia Department of Forensic Science*

2:35 pm **Building Strategic Partnerships to Advance Forensic Science: Education, Research, & Training**
Tracey Dawson Green, Ph.D. - Virginia Commonwealth University

Biology Session - Grand Ballroom Salon F

Moderator: Charlotte Word - Charlotte J Word

3:20 pm **Sensitivity Evaluation of the Applied Biosystems RapidHIT™ ID System v2.0 and RapidINTEL™ Plus Sample Cartridge**
Emily Yen Dang, B.S., Morgan Eaton, M.S., Raygan Harrington, B.S., and Tracey Dawson Green, Ph.D. - Virginia Commonwealth University*

3:50 pm **Evaluation of Compromised Teeth Using an Optimized Sample Preparation Method and the Applied Biosystems™ RapidHIT™ ID System**
Raygan Harrington, Emily Yen Dang, Morgan Eaton, Tracey Dawson Green - Virginia Commonwealth University*

4:20 pm **The Use of Optical Tweezers with Direct Amplification for Separation of Mixed Biological Samples**
Celeste Willetts, BS, Dr. Sarah Seashols-Williams, PhD, Dr. Tracey Dawson Green, PhD, Dr. Joseph Reiner, PhD - Virginia Commonwealth University, Richmond, VA*

*Presenting Author

Chemistry Session - Grand Ballroom Salon E

Moderator: Rich Meyers - Drug Enforcement Administration

2:45 pm **Nitrous Nonsense : The Analysis of Commercially Available Nitrous Oxide Products**
Imani Buford, Justin Poklis, Dr. Sarah Riley, Dr. Michelle Peace, Dr. Alaina Holt, Dr. Murrell Godfrey, James H. Fleming - Virginia Commonwealth University*

3:00 pm **Blood Alcohol Content by Simultaneous GCMSFID**
Thomas Mancuso - PerkinElmer AES

3:15 pm **Isomer Differentiation of Synthetic Cathinones by ATR-FTIR and Chemometrics**
Samantha Appollo, Jack Prothero, Amber McConnell, Cathy Savage - Maryland State Police*

3:45 pm **The Advancement of Seized Drug Analysis by Gas Chromatography Mass Spectrometry (GC/MS) Using Deconvolution Reporting Software and Retention Time Locking**
Nicole Lattanzio and Kyle Brown* - NMS Labs*

4:15 pm **Determination of Volatile Compounds in Recreational Inhalants ("Poppers") by GC/MS**
Heather L Harris, MFS, JD, Jessica Enos, BS, Aracelis Velez, MSFS, Samuel Krug, MSFS - Arcadia University*

4:30 pm **Researchers -Practitioners Partnerships to Improve Public Crime Lab Efficiency and Accuracy in Tape and Glass Examinations**
Tatiana Trejos[1], Troy Ernst[2], Kris Gates[3], Lacey Leatherland[1], Zachary Andrews[1], Addio Fiordigiggli[1], and Allison Carranza[1].*
[1]West Virginia University, Department of Forensic and Investigative Science [2]Forensic Science Division, Michigan State Police [3]Oregon State Police, Clackamas, OR (retired)

Physical Evidence Session - Grand Ballroom Salon ABCD

Moderator:

2:45 pm **The Forensic Examination of Polyethylene Film Products**
Taylor Grazulewicz - Federal Bureau of Investigation

3:15 pm **Collection and Characterization of Modern Nail Polish Products as Forensic Trace Evidence**
Madison Lindung, B.S., Allison Carranza, Tatiana Trejos, Ph.D. - West Virginia University*

3:45 pm **Examination of Glock Marksman Barrels**
Jack McKeon - Federal Bureau of Investigation

4:15 pm **Gel Pens**
Sarah Baquero- Federal Bureau of Investigation

4:45 pm **Characterization of Nuclei Shapes in Human Hair Roots**
Joseph Donfack - FBI Laboratory

Friday, May 9th

Biology Session - Grand Ballroom Salon F

Moderator: TBD

8:30 am **Post-Conviction Issues – Why it is Critical to Get it Right the FIRST Time!**
Charlotte Word - Charlotte J Word

9:00 am **Transforming "inconclusive" Results Into Informative DNA Evidence**
Mark W. Perlin, PhD, MD, PhD, Matthew M. Legler, BS, Kari R. Danser, MS, Jeremy D. Curto, BS - Cybergenetics*

9:30 am **Biology/DNA Standards and Best Practice Recommendations Update – 10 Years**
Charlotte Word - Charlotte J Word

10:00 am **Break**

10:20 am **The Path to Precedent for Maryland Probabilistic Genotyping**
Jennifer M. Bracamontes, MS, William P. Allan, MS, Mark W. Perlin, PhD, MD, PhD - Cybergenetics*

10:50 am **TrueAllele® Casework Takes NGS from the Laboratory Into the Courtroom**
William P. Allan, MS, Kari R. Danser, MS, Mark W. Perlin, PhD, MD, PhD- Cybergenetics*

11:20 am **DNA Profile Calculator (ProCalc) – A Tool to Streamline Comparisons and Develop CODIS Entries**
Caitlin Oliver - Bureau of Alcohol, Tobacco, Firearms and Explosives

Chemistry Session - Grand Ballroom Salon E

Moderator: Kimberlie Ross - US Postal Inspection Service - National Forensic Laboratory

8:30 am **Feasibility of pepper gel brand identification using FTIR-ATR and GC-MS**
Andrea Ramirez and Ellen Hondrogiannis - Towson University*

8:45 am **Extrapolation of Unit Count - in Theory**
Jennifer Bonetti, PhD - Virginia Department of Forensic Science

9:00 am **Extrapolation of Unit Count - in Practice**
Johnnie Bennett - Virginia Department of Forensic Science

9:15 am **Update on NIST Sampling APP and the Implementation at MSP FSD**
Cathy Savage - Maryland State Police Forensic Sciences Division

9:30 am **Extraction, Characterization, and Identification of Diphenylamine Derivatives in Smokeless Powders via Raman Spectroscopy, GCMS and HPLC**
Nicole Green, B.S. Ellen Hondrogiannis, PhD, and Mary Sajini Devadas, PhD - Towson University*

9:45 am **Break**

10:00 am **Evaluating the Storage Stability of Xylazine in Postmortem and Antemortem Blood Samples Using Liquid Chromatography-Tandem Mass Spectrometry for Quantitative Analysis**
Paige Riley-Carrier and Rebecca Wagner - Virginia Department of Forensic Science*

10:30 am **New Vaping Products and Neutraceuticals: Different Products, Same Quality Assurance Challenges**
Lillie D. Thomas, Abby M. Veeser, Justin L. Poklis, Michelle R. Peace - Virginia Commonwealth University*

11:00 am **Vaporizing Nicotine: Unveiling the Dynamics of Aerosolization in a Eutectic Mixture**
Jessemia Meekins, Abby M. Veeser, Justin L. Poklis, Michelle R. Peace - Virginia Commonwealth University*

11:15 am **2025 Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Update**
Jennifer Bonetti, PhD - Virginia Department of Forensic Science

11:30 am **An Overview of Virginia's Breath Alcohol Calibration Laboratory and Adherence to Accreditation Standards**
Rebecca Daner - Virginia Department of Forensic Science

Physical Evidence Session - Grand Ballroom Salon ABCD
Moderator: Lorie Cousin - FBI (Retired)

8:30 am **The Forensic Use of Detection Dogs**
Aryn Alcala - Loyola University Maryland

8:45 am **Method Development for 3D Scanning of Knife Perforations in Clothing**
Gabriel Flores and Rhys Williams - Loyola University Maryland*

9:00 am **Evidence in the Ether: Establishing of a Digital Forensics Unit within the Forensic Division at the Baltimore Police Department**
Nicole Ortiz - Baltimore Police Department

9:30 am **The Effect of Latent Print Processing Prior to Electrostatic Processing**
Brandi Ragsdale - Federal Bureau of Investigation

10:00 am **Break**

10:15 am **Examination of Indented Handwritten Signatures using ESDA**
Melissa Andris - Federal Bureau of Investigation

10:45 am **Virtual Comparison Microscopy Workflow for Firearms/Toolmarks Discipline**
Rachael Gominsky and Theo Chavez - Federal Bureau of Investigation*

11:15 am **New Combination-Type Primer Residue Particles Containing Bismuth Resulting From Memory Effect**
Nicole Palmer - Virginia Department of Forensic Science

11:30 am **47 Years Later: How Hyperspectral Imaging Aided in the Eventual Identification of Unidentified Human Remains**
Sara Nedley - Federal Bureau of Investigation

Scholarship Winner Abstracts

Discovering Microscopic Clues for Shooting Reconstruction Using Rapid On-site Screening Laser-Induced Breakdown Spectroscopy (LIBS) Method.

Leah Thomas, B.S., Roger Jefferys, M.S., Luis Arroyo, Ph.D., and Tatiana Trejos, Ph.D. - West Virginia University*

Trace evidence is essential for crime scene reconstruction, as microscopic residues are often transferred between surfaces during shooting events. Mobile Laser-Induced Breakdown Spectroscopy (LIBS) technology offers innovative capabilities for in-situ enhanced imaging, rapid single-particle analysis, and sensitive multi-elemental detection. This study demonstrates the versatility of mobile LIBS in analyzing the transfer of gunshot residues (GSR) and traces from impacted targets and ammunition components, including bullets and cartridge cases. Spectral comparisons show that GSR and target residues were transferred onto the shooter's hands in all experiments, and residue transfer from substrates was confirmed on recovered bullets from seven out of the eight substrates. These findings underscore the potential of LIBS as an effective screening tool in the early stages of investigations, providing critical information to guide the development of investigative leads.

Novel Time-Since-Deposition Signatures for Canine Blood and Implications for Animal Cruelty Investigations

Alysia Townsley, Christopher Ehrhardt, Kate Philpott, Julie Burrill - Virginia Commonwealth University*

Dogfighting is a felony in all 50 states and is often tied to other organized crime activities including gambling, narcotics, and weapons trafficking. Because of the clandestine nature of dogfighting crimes, it may be necessary to determine the age of blood samples from suspected dogfighting events, not just the source. Autofluorescence signatures were developed for determining TSD (time since deposition) of canine blood based on distinct changes in autofluorescence intensity and size profiles of individual cells over time. Robust signatures were identified for TSD intervals up to 6 months old. These results suggest that flow cytometry can be used to link the relative age of canine blood samples to the known time period of a dogfighting event, leading to increased prosecution of dogfighting crimes in the U.S.

Identification of microRNA Biomarkers for Body Weight and Muscularity Prediction in Forensic Samples

Xiaomeng Yang, MS; Kimberly Lettner, BS; Jennifer Shealy, MS; J Paul Brooks, PhD; Sarah Seashols-Williams, PhD - Virginia Commonwealth University*

Forensic DNA phenotyping (FDP) utilizes genetic markers to predict externally visible characteristics (EVCs). Research has shown that microRNA (miRNA) expression can change in response to external factors such as metabolism and activity levels. This project introduces an innovative FDP approach exploiting miRNA expression in DNA extracts from blood and saliva to predict an individual's body weight and muscularity class. In a study of 100 blood and saliva DNA extracts, we identified associations between body weight and specific miRNA markers, including miR-145-5p and let-7i-5p. These findings highlight the predictive ability of miRNAs and contribute to the development of prediction models for environmentally influenced EVCs. Future work will focus on increasing sample size and expanding the list of tested miRNAs to enhance the accuracy of prediction models.

Interdisciplinary Session Abstracts

Testimony Review and Discussion
Randi Simpson - Virginia Department of Forensic Science

This presentation aims to facilitate an interactive discussion focused on reviewing and sharing best practices and experiences related to expert testimony. We will cover appropriate appearance and demeanor while on the stand, along with strategies for handling difficult questions and common interactions. Additionally, we will discuss recommendations for dos and don’ts to help the expert witness succeed during their testimony. Expect audience participation, light role-playing, and hopefully, some laughter as we share experiences and ideas.

Building Strategic Partnerships to Advance Forensic Science: Education, Research, & Training
Tracey Dawson Green, Ph.D. - Virginia Commonwealth University

In the U.S., the Technical Working Group for Education (TWGED) laid the foundation for the Forensic Science Education Programs Accreditation Commission (FEPAC) to maintain and enhance the quality of forensic science education, which describes that research “shall be conducted in an environment conducive to research and scholarly inquiry” which shall “contribute to the knowledge base of forensic science.” To this end, collaborative relationships between academia and forensic science practitioners have flourished in recent years and have proven to be productive partnerships for advancing applied research and education focused on forensic science. Additionally, these established collaborations have been exploited for advancing professional training and continuing education programs in an effort to ease the tremendous associated burden placed on operational crime laboratories. Yet, barriers to establishing successful relationships between academics and practitioners continue to exist. In this talk, pathways for creating strategies that serve to strengthen the foundations of forensic science will be explored. This will include approaches for building collaborative research projects and training programs that meet national standards within the practicing laboratory.

Biology Session Abstracts

Sensitivity Evaluation of the Applied Biosystems RapidHIT™ ID System v2.0 and RapidINTEL™ Plus Sample Cartridge

Emily Yen Dang, B.S., Morgan Eaton, M.S., Raygan Harrington, B.S., and Tracey Dawson Green, Ph.D. - Virginia Commonwealth University*

The RapidHIT™ ID is a fully automated system that is designed to develop STR profiles from saliva or blood sample swabs with less than one minute of hands-on preparation and 90 minutes of processing time. In this study, the range of detection and performance of the updated instrument and software were experimentally evaluated using buccal swab samples from four different donors with total DNA inputs of 5ng, 7ng, 10ng, 20ng, 50ng and 65ng. Across the six tested DNA input groups, all STR profiles obtained were fully concordant with the reference profiles, and profile quality consistently improved with higher DNA input used, especially with 20ng DNA or higher. Interestingly, the QTL quantification values indicated that only ~1.13% of the total input of each sample was metered for amplification. Overall, the results show that the updated system provides several improvements to the rapid DNA process, including valuable quantification data. However, with such a small volume of the DNA extract moved into the amplification chamber of the cartridge (and the remainder unrecoverable in the waste chamber), it will be important for examiners to carefully consider the specific nature of evidence items being tested.

Evaluation of Compromised Teeth Using an Optimized Sample Preparation Method and the Applied Biosystems™ RapidHIT™ ID System

Raygan Harrington, Emily Yen Dang, Morgan Eaton, Tracey Dawson Green - Virginia Commonwealth University*

DNA profiles are most often generated from high quality forensic samples such as blood and saliva; however, these specific sample types are not always available, especially in scenarios of mass disasters. It is not unusual in these situations for individual remains to be extremely compromised, causing scientists to search for alternative sources of DNA. Bones and teeth are common secondary sources, although there are several downfalls that arise when using these sample types. Perhaps the most prominent issue is the time and labor it takes to process these types of hard tissue samples. Additionally, when considering teeth over bone samples, scientists may not be sure of which specific teeth to look for, how oral conditions may affect the quality of the sample, or if there is even enough DNA present to generate a usable profile. This research aims to answer these questions by using an optimized sample preparation protocol specifically for teeth samples using the Applied Biosystems™ RapidHIT™ ID System. The system is able to process a sample and produce a DNA profile in approximately 90 minutes, which is a significant improvement from the traditional workflow, which can take anywhere from days to months. For this study, 115 teeth from donors of various ages with different tooth pathologies and treatments were collected and separated into four categories which included: donor age, storage time, tooth type, and oral conditions. The teeth were cleaned with a 5 minute soak in deionized water, followed by a 30 minute air dry in a biological safety cabinet. From there, the surface of each tooth was cleaned using sterile cotton swabs dipped in 10% bleach, deionized water, and 95% ethanol to remove any external contaminants. If the teeth were larger than 6mm at the widest point, they were fragmented using a common household hammer. The samples were then inserted into the RapidIntel Plus cartridges, which were loaded into the instrument for processing. The results demonstrated that 11% of all samples generated profiles that were able to be passed without analyst review. Additional data, variation among sample groups, and recommendations will be discussed.

The Use of Optical Tweezers with Direct Amplification for Separation of Mixed Biological Samples
Celeste Willetts, BS, Dr. Sarah Seashols-Williams, PhD, Dr. Tracey Dawson Green, PhD, Dr. Joseph Reiner, PhD - Virginia Commonwealth University, Richmond, VA*

Forensic samples that contain multiple DNA contributors (i.e., mixtures) are often challenging samples for forensic DNA laboratories to analyze due to the unlikely occurrence of each contributor contributing equal parts and the subjectiveness of interpretations. In order to reconcile this issue, many alternative cell separation methods have been explored. The use of a microfluidic device, combined with optical trapping, can aid in cell separation by applying a hydrodynamic force within a channel and providing a closed system, thus reducing contamination. This method of separating cells, along with the use of direct amplification, can generate a single-source DNA profile with fewer cells than traditional methods. Previous research at VCU has found that a complete STR profile was generated from 40 to 50 sperm cells and 15 to 20 epithelial cells, when following the traditional workflow; however, by implementing direct amplification into the workflow, and removing the steps that are often associated with DNA loss (extraction and purification), it is expected that less cells would be needed. The research aims to evaluate a lower limit for the generation of complete STR profiles using optical trapping and the PowerPlex Fusion 6C PCR Amplification Kit for direct amplification. Both vaginal epithelial cells and sperm cells were trapped in decreasing cell numbers to determine the minimum number of cells needed for a complete STR profile, when coupled with direct amplification. It was found that when using direct amplification, fewer cells were needed for a complete STR profile than when following the traditional workflow.

Post-Conviction Issues – Why it is Critical to Get it Right the FIRST Time!
Charlotte Word - Charlotte J Word

There has been a belief by some members of the forensic science community that errors made in a case pre-trial or during trial do not need to be reported or addressed because they will be caught on appeal or during post-conviction review if the individual is convicted. This belief has been buttressed by the high number of cases that have been overturned in the past 30 years for a variety of reasons, with many being due primarily to DNA testing performed on preserved evidence years after the trial. However, there are many cases where a defendant does not have the ability to initiate any possible post-conviction relief for case review due to legal restraints in many jurisdictions. This presentation will focus on the need for transparency and appropriate best practice in evidence collection, storage, testing, and reporting and testimony, from the beginning of the case through post-trial, since the option for review and re-testing post-conviction is either not available in many jurisdictions or the road blocks are extensive to overcome.

Transforming “Inconclusive” Results into Informative DNA Evidence
Mark W. Perlin, PhD, MD, PhD, Matthew M. Legler, BS, Kari R. Danser, MS, Jeremy D. Curto, BS - Cybergenetics*

Informative DNA evidence often goes unreported as “inconclusive” results. This evidential loss can be due to analytical thresholds, software insufficiency or reporting protocols. However, more intensive interpretation can transform previously unusable data into informative DNA evidence that assists the court. This talk presents criminal cases that illustrate this transformation, including the controversial Thompson JFS case report.

Biology/DNA Standards and Best Practice Recommendations Update – 10 Years
Charlotte Word - Charlotte J Word

For the past 10 years, the Biology/DNA Scientific Area Committee of the Organization of Scientific Area Committees for Forensic Science (OSAC) and the DNA Consensus Body of the American Academy of Forensic Sciences Academy Standards Board (ASB) have been drafting and developing standards and best practice recommendation documents for implementation in forensic DNA testing laboratories. To date, 19 have been published as ANSI/ASB documents and an additional 4 documents are available as proposed standards from OSAC, for a total of 23. This presentation will provide: 1) a summary of the 23 documents currently available for implementation in laboratories; 2) updates on the status of documents undergoing their 5 year revision; and 3) information regarding documents being developed or drafted for future implementation. Information on how to access the documents and how to participate in the standards development process will be provided.

The Path to Precedent for Maryland Probabilistic Genotyping
Jennifer M. Bracamontes, MS, William P. Allan, MS, Mark W. Perlin, PhD, MD, PhD - Cybergenetics*

The Maryland appellate court recently affirmed a favorable TrueAllele® probabilistic genotyping (PG) Daubert outcome. The Baltimore Police Department forensic laboratory processed the case and testified in court. PG software has had an interesting trajectory in the Maryland courts, culminating in this precedential decision. This talk describes how to prepare and present an PG admissibility hearing in the context of the Maryland rulings.

TrueAllele® Casework Takes NGS from the Laboratory Into the Courtroom
William P. Allan, MS, Kari R. Danser, MS, Mark W. Perlin, PhD, MD, PhD - Cybergenetics*

Next generation sequencing (NGS) is a modern modality for laboratory DNA analysis. Hundreds, or hundreds of thousands, of genetic loci can be simultaneously examined on a single evidence item. TrueAllele® probabilistic genotyping technology has been validated on NGS for complex DNA mixtures. But how can a crime lab use NGS data with PG software in court? This talk walks through the steps, showing how to interpret NGS data, produce match statistics, prepare a case report, and deliver courtroom testimony.

DNA Profile Calculator (ProCalc) – A Tool to Streamline Comparisons and Develop CODIS Entries
Caitlin Oliver - Bureau of Alcohol, Tobacco, Firearms and Explosives*

Due to the nature of the evidence received, forensic biology casework performed at the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Forensic Science Laboratory often results in multiple mixed DNA profiles, each with multiple components that are suitable for comparison. The probabilistic genotyping software (PGS) STRmix™ is used during data interpretation to aid in the deconvolution of these mixed DNA profiles and provide genotype weights for the various contributors that are then used to generate contributor profiles that must be compared to one another and evaluated for CODIS eligibility. To streamline this process, a Microsoft® Excel-based software tool utilizing Visual Basic for Applications (VBA) called ProCalc was developed by the DNA Section of the ATF Laboratory. Using the genotype weights present within the STRmix™ results file as input, ProCalc automatically calculates both 99% and 95% contributor profiles and their corresponding CODIS eligibility level that can then be compared across many samples to determine the best profile for CODIS entry. This user-friendly, automated tool has improved efficiency and maximized the amount of information that can be utilized for CODIS searching.

Chemistry Session Abstracts

Nitrous Nonsense : The Analysis of Commercially Available Nitrous Oxide Products
Imani Buford, Justin Poklis, Dr. Sarah Riley, Dr. Michelle Peace, Dr. Alaina Holt, Dr. Murrell Godfrey, James H. Fleming - Virginia Commonwealth University*

Nitrous oxide, N2O, was first synthesized by Joseph Priestly in 1772 and is primarily used as a dental anesthetic since 1844. There has been an increase in the recreational use of N2O occurring worldwide, which is attributed to its euphoric effects and easy accessibility. For recreational use, N2O is typically inhaled directly from steel bulbs or “whippets” that contain around 10 mL of liquid N2O or from balloons filled from the bulbs. Commercially manufactured N2O products were analyzed for N2O and contaminants using a Shimadzu GCMS-QP2020 Gas Chromatograph – Mass Spectrometer and a Millipore Sigma polydimethylsiloxane divinylbenzene (PDMS/DVB) (24 ga, 65 µm) solid phase microextraction (SPME) fiber assembly. N2O was identified in all tested products and residual solvents were identified as chemical components in some products.

Blood Alcohol Content by Simultaneous GCMSFID
Thomas Mancuso - PerkinElmer AES

The determination and quantification of ethanol in blood is typically done by headspace gas chromatography. This analysis is a very common test in the toxicology department of many forensic laboratories. Accuracy of the analysis is most important because if the data is bad, the offender can be determined not guilty. In this presentation, an overview will be given of the different choices of detectors, with a focus on FID with Mass Spectrometry as the optimal choice.

Isomer Differentiation of Synthetic Cathinones by ATR-FTIR and Chemometrics
Samantha Appollo, Jack Prothero, Amber McConnell, Cathy Savage - Maryland State Police*

The difficulty regarding isomer differentiation is a growing issue in the field of forensic drug analysis. Gas Chromatography Mass Spectrometry (GC-MS), which is typically seen as the industry’s “gold standard”, has the potential to yield results that are undifferentiable based on visual comparisons. This study proposes the use of Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR) as well as principal component analysis (PCA) and linear discriminant analysis (LDA) to differentiate between 16 isomers of N,N-dimethylpentylone. An analysis was conducted of case samples provided by analysts for the Maryland State Police to test the possibilities and limitations of applying this new technique to future casework.

The Advancement of Seized Drug Analysis by Gas Chromatography Mass Spectrometry (GC/MS) Using Deconvolution Reporting Software and Retention Time Locking

Nicole Lattanzio and Kyle Brown* - NMS Labs*

The forensic drug chemistry field is plagued with the emergence of Novel Psychoactive Substances (NPS) and their increasingly complex combinations with various illicit and licit drugs. One powerful remedy to these challenges is to develop and implement tools that elevate the ability to interpret complicated data. This presentation will look at the use of Deconvolution Reporting Software (DRS) coupled with retention time locking (RTL) as they are tools readily available and yet not commonly used within the community. Examples will include how DRS and RTL provide accuracy in interpretation of data, especially in scenarios such as structurally similar compounds and coelution. An evaluation will also be provided on the impact with regards to lab standardization across a network, as well as the effects on the efficiency needed to stay ahead of case backlogs and impactful evolving drug trends.

Determination of Volatile Compounds in Recreational Inhalants ("Poppers") by GC/MS

Heather L Harris, MFS, JD, Jessica Enos, BS, Aracelis Velez, MSFS, Samuel Krug, MSFS - Arcadia University*

In 2021, the Food and Drug Administration issued an announcement regarding the prevalence of alkyl nitrite inhalants, more commonly known as "poppers," and their association with hospitalizations and deaths. This research developed a novel gas chromatography/mass spectrometry (GC/MS) method for the analysis of volatile compounds present in commercial popper products. Then, a number of commercial poppers were analyzed for their volatile compound profiles. The majority of products were found to have inaccurate labels, and duplicate products from different vendors contained different contents. This research will show that the current labeling of commercial popper products is neither comprehensive nor accurate with regard to the volatile compounds present.

Researchers -Practitioners Partnerships to Improve Public Crime Lab Efficiency and Accuracy in Tape and Glass Examinations

Tatiana Trejos[1]*, Troy Ernst[2], Kris Gates[3], Lacey Leatherland[1], Zachary Andrews[1], Addio Fiordigiggli[1], and Allison Carranza[1].*

[1]West Virginia University, Department of Forensic and Investigative Science [2]Forensic Science Division, Michigan State Police [3]Oregon State Police, Clackamas, OR (retired)

Innovations in forensic science are crucial for advancing the administration of justice and public safety. However, new methods require rigorous demonstration of their scientific validity to meet adoption criteria in the laboratories and admissibility standards in the courtroom. In this presentation, we discuss successful interlaboratory collaborations to update standard methods and incorporate μ-XRF SDD systems in analytical workflows of glass and electrical tapes. The physical and digital database consists of 3220 μ-XRF spectra from 53 tape rolls and 4155 spectra from 160 glass sources, including architectural, vehicle, and phone glass. The methods provide improved precision, accuracy, and discrimination over traditional μ-XRF SiLi systems while allowing for the analysis of smaller samples and faster acquisition times (~2-5 minutes per sample).

Feasibility of Pepper Gel Brand Identification Using FTIR-ATR and GC-MS
Andrea Ramirez and Ellen Hondrogiannis - Towson University*

Pepper gels are a viscous pressurized solution of capsaicin and dihydrocapsaicin intended for self-defense; Currently, there is no literature on their analysis. We examined the feasibility of using ATR-FTIR and GC/MS to identify and differentiate five different pepper gels on various textiles over a six-week period. We found that the GC/MS had a shorter time frame of identification, however, was better at differentiating the five brands of pepper gel. This research will benefit forensic laboratories by identifying the best analytical techniques needed for pepper gel identification. In addition, it will inform the laboratories of the timeframe for when pepper gel samples must be analyzed before the sample is lost.

Extrapolation of Unit Count - in Theory
Jennifer Bonetti, PhD - Virginia Department of Forensic Science

When cases with a large number of specimens are submitted for drug analysis, it can be prohibitively time-consuming for a forensic scientist to accurately count each individual unit. Further, in many jurisdictions there are no statutory limits based on unit count meaning that this is not an efficient use of examiner time. Using the SWGDRUG Supplemental Document 6 as a guide, this presentation will showcase how one laboratory system has incorporated unit count extrapolation into their analysis procedures. This will include a discussion on the associated extrapolated uncertainty as well as reporting options.

Extrapolation of Unit Count - in Practice
Johnnie Bennett - Virginia Department of Forensic Science

Cases with large quantities that require a count to be reported are on the rise for some laboratories. Is it worth an examiners time to count thousands of specimens? With a side-by-side comparison this presentation will discuss pros and cons of manual counting versus a unit count extrapolation method for a case that was submitted for analysis.

Update on NIST Sampling APP and the Implementation at MSP FSD
Cathy Savage - Maryland State Police Forensic Sciences Division

We are presenting a Workshop at the 2025 AAFS meeting on a new NIST CDS Sampling App. This will be an update to that App as well as how the Maryland State Police Forensic Sciences Division CDS Unit is planning to incorporate it in casework.

Extraction, Characterization, and Identification of Diphenylamine Derivatives in Smokeless Powders via Raman Spectroscopy, GCMS and HPLC

Nicole Green, B.S., Ellen Hondrogiannis, PhD, and Mary Sajini Devadas, PhD - Towson University*

The composition of smokeless powders is proprietary information, and is not disclosed by propellant manufacturers; this information can be pivotal in their characterization and identification. Smokeless powders contain additional organic components such as stabilizers and plasticizers to decrease smoke production and prevent degradation over time. In this work, these organic components were extracted with simple solvent extraction and characterized via Gas Chromatography Mass Spectrometry (GCMS) and High-Performance Liquid Chromatography (HPLC) to supplement peak identification via Raman Spectroscopy. The compounds dibutyl phthalate (DBP), 2,4-dinitrotoluene (2,4-DNT), ethyl centralite (EC), diphenylamine (DPA), and derivatives of DPA (2-nitroDPA, 4-nitroDPA, 4,4-dinitroDPA) were successfully quantified via GCMS while the DPA derivative N-nitrosoDPA required quantitative corroboration via HPLC. All stabilizers, plasticizers, and DPA derivatives were identified via Raman spectroscopy, supplemented by the quantification data derived from GCMS and HPLC.

Evaluating the storage stability of xylazine in postmortem and antemortem blood samples using liquid chromatography-tandem mass spectrometry for quantitative analysis

Paige Riley-Carrier and Rebecca Wagner - Virginia Department of Forensic Science*

The prevalence of xylazine in illicit drug preparations containing fentanyl, heroin, and cocaine has significantly increased in the United States in recent years. Xylazine is a non-opioid sedative approved for use in veterinary medicine but is not intended for human consumption and is currently not a Drug Enforcement Administration controlled substance. Because of this, little is known about its stability in stored biological matrices for purposes of forensic toxicological analysis and reporting. A storage stability study was designed to evaluate xylazine in postmortem and antemortem blood at two different concentrations (0.003 mg/L and 0.16 mg/L) in three different storage conditions (23 °C, 2-8 °C, and -20 °C). Results for each condition will be shared and discussed within this presentation.

New Vaping Products and Neutraceuticals: Different Products, Same Quality Assurance Challenges

Lillie D. Thomas, Abby M. Veeser, Justin L. Poklis, Michelle R. Peace - Virginia Commonwealth University*

Nutraceuticals are naturally derived compounds with claims of therapeutic benefits. Nootropics, cannabidiol (CBD), and compounds in aromatherapy vaping devices can be considered nutraceuticals. Many of these products are unregulated, and companies that produce them practice predatory marketing toward first responders and young adults. All products in this study were analyzed by Gas Chromatography-Mass Spectrometry; cannabinoids were quantitated using a Liquid Chromatograph- Tandem Mass Spectrometer, and volatiles analysis was performed on aromatherapy vaping devices by Headspace- Gas Chromatography- dual Flame Ionization Detection. Results proved that many products contained unlisted ingredients, had labeled concentrations inaccurately, and aromatherapy devices were more like electronic cigarettes with batteries and vegetable glycerine used as a carrier.

Vaporizing Nicotine: Unveiling the Dynamics of Aerosolization in a Eutectic Mixture
Jessemia Meekins, Abby M. Veeser, Justin L. Poklis, Michelle R. Peace - Virginia Commonwealth University*

Electronic cigarette liquids (e-liquids) are typically made from propylene glycol (PG), vegetable glycerin (VG), flavorants, and pharmacologically active compounds like nicotine. Advances in e-cig technology have allowed them to be used with drugs other than nicotine (DOTNs), including substances that form eutectic mixtures to aid aerosolization. This experiment aimed to determine how varying ethanol concentrations affect nicotine aerosolization efficiency and recovery. E-liquids were created using different PG:VG ratios, nicotine concentrations, and various ethanol concentrations; captured using an in-house aerosol trapping system; and analyzed by Headspace-Gas Chromatography-Flame Ionization Detection and Liquid Chromatograph- Tandem Mass Spectrometry. The concentration of ethanol had varying effects on the aerosolization of nicotine and the formation of a eutectic mixture.

2025 Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Update
Jennifer Bonetti, PhD - Virginia Department of Forensic Science

The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) was founded in 1997 with the mission of improving the quality of the forensic examination of seized drugs and responding to the needs of the forensic community. This is done through developing internationally accepted minimum standards, identifying best practices within the international community, and providing resources to help laboratories meet these standards. The SWGDRUG core committee is comprised of representation from federal agencies, regional associations, international organizations, as well as academic institutions. This presentation will showcase the resources provided by SWGDRUG and highlight recent updates, on-going developments, and future directions.

An Overview of Virginia's Breath Alcohol Calibration Laboratory and Adherence to Accreditation Standards
Rebecca Daner - Virginia Department of Forensic Science

The Virginia Department of Forensic Science's laboratory system includes four regional testing laboratories and one calibration laboratory for the Breath Alcohol Section. The role of the Breath Alcohol Section, as well as the science behind breath testing, will be explained. As accredited by ANSI National Accreditation Board (ANAB), an overview of how the calibration laboratory meets the accreditation standards will be discussed.

Physical Evidence Section Abstracts

The Forensic Examination of Polyethylene Film Products
Taylor Grazulewicz - Federal Bureau of Investigation

Polyethylene film products, such as garbage bags, zipper-seal bags, and plastic drop cloths, are prevalent in today's society. The manufacture of these products imparts unique features that can be used to connect polyethylene film items found at crime scenes with items in a suspect's possession. This presentation intends to introduce the audience to the manufacturing process and provide a recent example in which a polyethylene drop cloth was recovered from a decedent and forensically compared to a roll of drop cloth recovered from a suspect's home.

Collection and Characterization of Modern Nail Polish Products as Forensic Trace Evidence
Madison Lindung, B.S., Allison Carranza, Tatiana Trejos, Ph.D. - West Virginia University*

In investigations of homicides, kidnappings, or assaults, nail polish serves as a readily transferable material during a physical altercation, potentially linking a person of interest to a scene or the victim. However, the chemistry of modern nail products remains relatively uninvestigated, which may hinder the effective interpretation and contextualization of this trace material. This project aims to characterize several modern nail polish products using the analytical workflow outlined in ASTM E1610 and to assess its utility for forensic casework through four methods: 1) microscopical examination, 2) micro-solubility tests, 3) ATR-FTIR, and 4) SEM-EDS on three modern, color-matched nail polish types: nitrocellulose, gel, and dip powders. By characterizing inter- and intra-sample variability through optical and chemical features, this study can establish a knowledge base regarding the performance rates, classification, and discrimination capabilities of the analytical workflow.

Examination of Glock Marksman Barrels
Jack McKeon - Federal Bureau of Investigation

The Glock Marksman Barrels (GMB) were introduced for their 5th generation lineup, and along with it came an additional rail component in their rifling process that has resulted in much debate amongst firearm examiners regarding its effectiveness for identifications. This study aims to answer important questions regarding their production, the presence of subclass, how the resulting striations differ barrel to barrel, how they change with increased wear, and if the addition of the rail component offers a benefit or hinderance for examiners. This was accomplished via virtual comparison microscopy, where in test fires collected from each of ten consecutively manufactured barrels, as well as a 5000-round sample set collected from a Gen 5 Glock 47, underwent an objective algorithmic comparison to measure performance and similarity. In addition, test sets from these sample were prepared and given to FBI examiners to demonstrate their ability to make identifications when the only information given is the rail component.

Gel Pens
Sarah Baquero- Federal Bureau of Investigation

The purpose of this research was to assess how gel pens differ from other types of pens. This was accomplished by reviewing literature and comparing several brands of gel pens. Results revealed how characteristics of gel pens differ from other pen types, their uses over the years, the pros and cons of gel pens, and the latest in gel pen technology. These findings will prove to be useful in distinguishing between various writing instruments in forensic document examinations.

Characterization of Nuclei Shapes in Human Hair Roots
Joseph Donfack - FBI Laboratory

In this study, human scalp hair roots were stained using the DNA binding dye 4', 6-diamidino-2-phenylindole (DAPI) and visible nuclei were counted. The DAPI-stained nuclei were visualized via high magnification fluorescent microscopy. A variety of nuclei shapes and sizes were identified and included ellipsoidal, spheroidal, elongated, and trailing. The diversity of nuclei shapes and sizes described here can serve as a practical guide to assist forensic examiners in conducting examination of DAPI-stained hair roots and DAPI-stained nuclei counting.

The Forensic Use of Detection Dogs
Aryn Alcala - Loyola University Maryland

Detection dogs are forensic tools that are regularly seen in everyday life to help law enforcement locate illegal and harmful substances. Despite attempts at standardization of training, these dogs have an error rate that would not be allowed in any other forensic discipline. Detection dogs suffer from poor scent discrimination and generalization, handler bias, and jury bias. These factors contribute to wrongful conviction and disproportionately impact people of color.

Method Development for 3D Scanning of Knife Perforations in Clothing
Gabriel Flores and Rhys Williams - Loyola University Maryland*

Knives are commonly used in criminal activity, with around 22% of homicides worldwide involving knives. However, clothing perforations are malleable and there is currently no method to capture them in 3D. This research developed a 3D scanning method to capture perforations caused by a range of knives with precise topography of the clothing and fiber threads. This research also categorized clothing perforations based on knife type and performed identification tests with students and researchers.

Evidence in the Ether: Establishing of a Digital Forensics Unit within the Forensic Division at the Baltimore Police Department
Nicole Ortiz - Baltimore Police Department

As cybercrime continues to be a pivotal part of criminal investigations, the need for digital forensic disciplines within law enforcement has never been greater. This presentation will dive into the process of creating a Digital Forensics Unit within an existing forensic science division, covering considerations such as budget, training, backlog, quality assurance, and technological resources. Attendees will gain insight into best practices for handling and seizing digital evidence from crime scenes, ensuring compliance with legal authority, and integrating digital forensic analysis into law enforcement investigations. By the end of this session, participants will have a clearer understanding of what is involved in creating a digital forensics unit that enhances investigative capabilities and strengthens the pursuit of justice in the digital age.

The Effect of Latent Print Processing Prior to Electrostatic Processing
Brandi Ragsdale - Federal Bureau of Investigation

My research was conducted to explore the impact of latent print processing on semi-porous paper prior to electrostatic processing, specifically investigating how this may hinder the ability to visualize indented writing using ESDA.

Examination of Indented Handwritten Signatures using ESDA
Melissa Andris - Federal Bureau of Investigation

In this study, two objectives were explored. First, the term, original writing, was defined and interpreted as it relates to forensic document examination. The definition and interpretation of the definition of original writing was discussed among qualified document examiners. Second, indentations of genuine, simulated, and traced signatures were developed using the Electrostatic Detection Apparatus (ESDA), and the resulting ESDA lifts were compared to inked standards. It was determined that characteristics of genuine and distorted writing can be observed on the ESDA lifts dependent upon the limitations present.

Virtual Comparison Microscopy Workflow for Firearms/Toolmarks Discipline
Rachael Gominsky and Theo Chavez - Federal Bureau of Investigation*

Virtual comparison microscopy (VCM) is a powerful tool for the firearms/toolmarks discipline and is becoming more prevalent in casework. This presentation is designed to explain how the FBI has set up a workflow around VCM in casework. This description will include topics such as instrument validation, implementation, testimony experience as well as resources currently available to the community.

New Combination-Type Primer Residue Particles Containing Bismuth Resulting From Memory Effect
Nicole Palmer - Virginia Department of Forensic Science

Combination particles, produced as a result of memory effect, have been well-documented in the primer residue community. With the rise of non-toxic and lead-free ammunitions, new combination particle types are becoming increasingly common in forensic casework. Bismuth is an element not typically considered allowable in primer residue particles. The increase in use of Federal Syntech ammunition, which uses a bismuth only primer, provides a known firearm source that can produce characteristic particles that also contain bismuth. This presentation aims to provide training and casework-based observations and examples that support the confirmation and reporting of these combination-type particles.

47 Years Later: How Hyperspectral Imaging Aided in the Eventual Identification of Unidentified Human Remains
Sara Nedley - Federal Bureau of Investigation

In the analysis of questioned documents, the visual enhancement of writing can be critical. This presentation examines the use of non-destructive imaging to provide additional investigative leads to aid in the identification of a body discovered in 1991. With the aid of hyperspectral imaging, writing was rendered visible that allowed investigators to identify the remains in 2025. A review of the benefits of non-destructive imaging will be provided, as well as a summary of the impacts on a cold case that spanned 47 years.