FORENSICS @ NIST
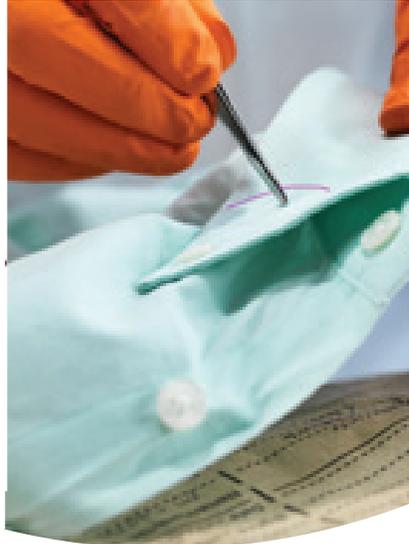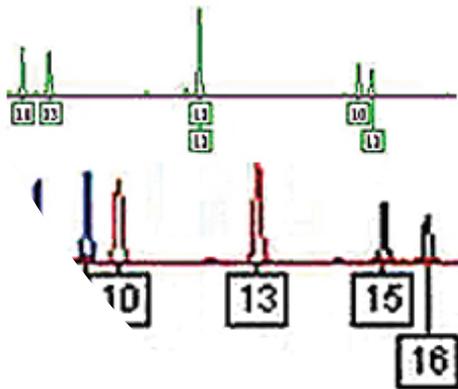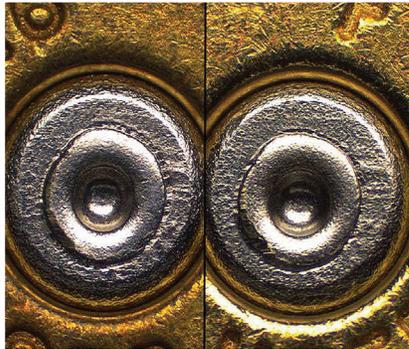
November 8-9, 2016

NOVEMBER 8, 2016

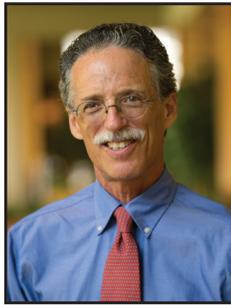**8:30 am – 8:45 am** **WELCOME**
Willie E. May, Director, NIST
Moderator - Richard R. Cavanagh, Director,
Special Programs Office (SPO)

8:45 am – 9:30 am **KEYNOTE - JULES EPSTEIN, Professor of Law**
and Director of Advocacy Programs Temple Beasley
School of Law, Philadelphia

"Accidental Traveler" An Attorney, with No Scientific Background, Immersed in Worlds of Science and Law – How Do We Connect?

Professor Epstein is a member of the National Commission on Forensic Science, has worked on two DNA workgroups and in capital case trainings for the National Institute of Justice, and on a working group on latent print issues for the National Institute of Standards and Technology. He is co-editor of *Scientific Evidence Review: Admissibility* and the *Use of Expert Evidence in the Courtroom*, Monograph no. 9, (ABA, 2013) and *The Future of Evidence* (ABA, 2011) and served as section editor for the *Encyclopedia of Forensic Sciences*, 2nd Edition (2013). Professor Epstein has lectured on forensics to judges, attorneys, and forensic scientists.

PROGRAM OVERVIEW

9:30 am – 9:50 am **Susan Ballou, Forensic Science, Research Program**
Manager, Federal Program Officer
Alicia Carriquiry, Distinguished Professor,
Director, CSAFE

NIST and the Forensic Science Center of Excellence – CSAFE (Center for Statistics and Applications in Forensic Evidence)

STATISTICS

9:50 am – 10:00 am **Will Guthrie, Chief, Statistical Engineering Division**

Overview of work in the statistics forensic science focus area at NIST and applicable CSAFE research

10:00 am – 10:20 am **Steve Lund, NIST**
A Measurement Science Perspective on Assessing the Weight of Evidence

We discuss the role of measurement science in facilitating calibrated communication among a group of stakeholders and examine how these principles relate to experts informing others about the weight of forensic evidence.

10:20 am – 10:40 am **BREAK**

10:40 am – 11:00 am **Martin Herman, NIST**
Measurements and Scoring Procedures for Footwear Impression Comparisons

A software system under development at NIST, called SHOECALC, will be described. It is designed to help both researchers and footwear examiners in the assessment of metrics or scoring procedures that provide objective characterizations of correspondences and discrepancies between features from two footwear impressions being compared. The presentation will provide the current status of the system, focusing on matching algorithms, similarity scores, and image quality metrics.

11:00 am – 11:20 am **Charless Fowlkes, CSAFE-UCI**
Statistical Models for the Generation and Interpretation of Shoeprint Evidence

This presentation will discuss developed prototype software for detection of tread ridges in outsole imagery to facilitate the extraction and analysis of tread patterns. The method is now being adapted to better handle the specific shading patterns observed in outsole images and impressions which provide cues to 3D shape, in particular which components of the tread (e.g. ridges) are likely to leave behind impressions or prints.

11:20 am – 11:40 am **Neil Spencer, CSAFE-CMU**
Modeling the Distribution of RACs (Accidentals) in Footwear Evidence

To develop statistically sound methods for matching shoe prints and appropriately quantifying the uncertainty in matching decisions. This research will focus on the problem of matching a crime scene impression to a particular shoe, as opposed to identifying the sizes, brands, or models of shoes consistent with a given print.

11:40 am – 11:50 am **Q&A SESSION - Moderator Will Guthrie**

DIGITAL AND IDENTIFICATION FORENSICS

11:50 am – 12:00 pm **Barbara Guttman, Software Quality Group**

NIST has decades of experience in the innovation, evaluation, and standardization of biometric pattern comparison technologies and a large impact on the computer forensics field.

12:00 pm – 12:20 pm **Elham Tabassi, NIST**
Quantifying the Weight of Friction Ridge Evidence: Score-based Likelihood Ratio for Fingerprints

The presentation will highlight our work on computing score based likelihood ratios for fingerprints by modeling the behavior of comparison scores under the competing source-level propositions.

12:20 pm – 12:40 pm **Michael Ogata, NIST**
New Data Collections in the NSRL: The NSRL Goes Mobile

The National Software Reference Library (NSRL) seeks to provide cryptographic hash sets for use by law enforcement. Since its inception, the world of software has changed in two distinct ways. First is the invention and then meteoric rise mobile applications. The second is the transition in software distribution from physical media to digital downloads across the internet. This talk will describe the tactics the NSRL is taking to adapt to these changes in order to continue to fulfill its mission to law enforcement.

12:40 pm – 12:45 pm **Wilmer Souder Video**

12:45 pm – 1:30 pm **LUNCH on your own**

1:30 pm   **Highlighting CSAFE research**

1:30 pm – 1:50 pm   **Jennifer Newman, CSAFE-ISU**

StegoDB: An Image Dataset for Benchmarking Steganography Detection Algorithms

No databases are known by the authors that support steganography software analysis for practical imaging forensic cases as needed by crime labs. Additionally, in the academic forensic imaging community, publically available databases have only recently appeared for image forgery detection. Therefore, we propose that the forensic community use the following criteria to construct a useful database for steganalysis.

1:50 pm – 2:10 pm   **Padhraic Smyth, CSAFE-UCI**

Statistical Methods for Change Detection Over Time in Digital Forensics Data

Digital forensics software, both commercial and open-source, produces a wealth of information about device usage in the form of detailed logs, metadata, and timeline information. A significant problem, however, is that there are no quantitative techniques available that allow an investigator, using this data, to pose questions such as "is there evidence that more than one person used this account or device?" The proposed research will develop algorithmic and statistical techniques that can provide quantitative support to statements related to the identity of a user using a device at a particular time.

2:10 pm – 2:30 pm   **Joseph B. Kadane, CSAFE-CMU**

Fingerprint Science

This research focuses both on the nature of fingerprint databases and their use in identification via automated systems such as AFIS as well as formal statistical modeling so that when a forensic expert testifies as to a possible match, formal statistical statements can be made about the error associated with the matching process and the uncertainty associated with the forensic judgment.

2:30 pm – 2:45 pm   **Q&A SESSION - Moderator Barbara Guttman**

2:45 pm – 3:30 pm   **BREAK and POSTER SESSION - Held in Hallway**

ILLICIT DRUGS AND TOXINS

3:30pm – 3:40pm   **Eric Steel, Microscopy and Microanalysis Research Group**

The effort is in the identification of emerging designer drugs and synthetic marijuana. A sample of research projects will be presented.

3:40 pm – 4:00 pm   **William Wallace, NIST**

Gas Chromatography Mass Spectrometry (GC-MS) Libraries for the Identification of Controlled Substances

We will discuss the use of standard reference mass spectral libraries for the identification chemical compounds in both seized drug and in toxicological forensics work.

4:00 pm – 4:20 pm   **Tara Lovestead, NIST**

A Better Understanding of Cannabis Chemistry to aid in Vapor Phase Detection

Description of research aimed at marijuana intoxication employing breath measurement.

4:20 pm – 4:40 pm   **Aaron Urbas, NIST**

NMR in Forensic Drug Analysis

The talk will focus on the current role of NMR in the characterization and analysis of illegal drugs with an emphasis on emerging synthetic drugs. The potential utility of benchtop, permanent magnet, NMR for routine analysis of seized drugs will also be discussed.

4:40 pm – 4:50 pm   **Q&A SESSION - Moderator Eric Steel**

4:50 pm   **CLOSING REMARKS – Susan Ballou**

Visit Detective X: Wilmer Souder

Wilmer Souder, was a physicist at the National Bureau of Standards who built a crime lab in the 1920's. Souder's research covered a range of fascinating topics including rum running, murder, kidnapping, and forgery. This work laid a foundation for NIST's role in forensic science that continues today. Visit the Souder display in the NIST Museum in front of the library on the first floor of building 101.

NOVEMBER 9, 2016

8:30 am – 8:40 am   **WELCOME**
                    Robert M. Thompson, Senior Forensic Science Research Manager, SPO

BALLISTICS AND ASSOCIATED TOOL MARKS

8:40 am – 8:50 am   **Rick Silver, Surface & Nanostructure Metrology**

NIST is working to establish a sound metrology infrastructure for ballistics and tool mark forensics with scientifically justified protocols that yield objective determinations of identification with well-characterized error rates for use in forensic laboratories.

8:50 am – 9:10 am   **Johannes Soons, NIST**

Next Generation National Integrated Ballistic Information Network (NIBIN)

The National Integrated Ballistic Information Network (NIBIN) is the only national network in the United States for the acquisition and comparison of images of ballistic evidence to aid in solving and preventing violent crimes involving firearms. The managing agency, the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), is making major improvements to the capabilities and efficiency of the network. The presentation describes a recently initiated collaboration to realize interoperability of the network with sample measurement systems from various sources. We conclude with an outlook describing possible additions to the network to aid examiners in characterizing the strength of the evidence.

9:10 am – 9:30 am   **Alan Zheng, NIST**

Ballistics Toolmark Research Database

An open-access research database of bullet and cartridge case reference data, consisting of traditional reflectance microscopy images and three-dimensional surface topography. The database will foster the development and validation of advanced algorithms, mathematical similarity criteria, and quantitative confidence limits for objective ballistics identification.

9:30 am – 9:50 am   **Heike Hofmann, CSAFE-ISU**

Statistical and Algorithmic Approaches to Matching Bullets

This research will provide firearms examiners with an objective approach to quantify the strength of a match and will enable the profession to establish clear thresholds to determine whether two sets of striae are indistinguishable.

9:50 am – 10:10 am   **Xiao Hui Tai, CSAFE-CMU**

Developing Methods for Comparison of Cartridge Breechface Images

The creation of an open-source method for computing numerical signatures from cartridge breechface images as well as the development of statistical methods for comparing signatures will be discussed.

10:10 am – 10:20 am   **Q&A SESSION - Moderator Rick Silver**

10:20 am – 10:50 am   **BREAK**

NOVEMBER 9, 2016

TRACE EVIDENCE

10:50 am – 11:00 am   **Eric Steel, Microscopy and Microanalysis Research Group**

11:00 am – 11:20 am   **Stephanie Watson, NIST**

Assessment of a Portable Spectrophotometer for Measuring Color of Automotive Paint Trace Evidence

Discussion of the results of instrumental methods, particularly those currently used in the automotive paint industry, to discriminate colors that the average human eye cannot distinguish. Results will also include the differences between information obtained using a micro spectrophotometer (MSP) and a portable spectrophotometer for automotive paint and the limitations encountered in using portable spectrophotometry techniques.

11:20 am – 11:40 am   **Amanda Forster, NIST**

Evaluating Sources of Variability in Forensic Fiber Trace Evidence Examination

Fourier Transform Infrared (FTIR) Spectroscopy is commonly used by trace evidence examiners to analyze fibers. Typically, examiners rely heavily on diamond compression cells to flatten fiber samples for analysis in transmission using a FTIR microscope. In an effort to better standardize this compression step, an adapter has been designed to use a reproducible amount of torque to flatten the sample prior to analysis. The results of work to standardize the compression step will be discussed, in addition to considerations for the development of a robust forensic fiber reference database.

11:40 am – 12:05 pm   **Greg Gillen, NIST**

Materials Deposition Inkjet Printing for Spatially Resolved Chemical Standards of Relevance to Forensics

Reliability of forensic techniques depends on the validation of analytical tools. NIST has been working for several years to develop protocols for utilization of drop on demand printing as a method to produce standard test materials for validation and calibration of analytical techniques of relevance to forensics. In this presentation, we will provide a review of the inkjet printing process, advantages and potential pitfalls of the technique and select examples of producing test materials of explosives, narcotics, fingerprint material and inorganic analytes. These test materials are being used to validate the performance of fingerprint developing agents, ion mobility and mass spectrometry, Raman and IR, and ICP-MS.

12:05 pm – 12:15 pm   **Q&A SESSION - Moderator Eric Steel**

12:15 pm – 12:20 pm   **Wilmer Souder Video**

12:20 pm – 1:25 pm   **LUNCH on your own, Visit POSTERS**

FORENSIC GENETICS

1:30 pm – 1:40 pm   **Pete Vallone, Applied Genetics Group**

The NIST Forensic Genetics Focus Area strives to ensure the reliability and accuracy of forensic DNA testing which applies to the human identification, paternity testing, and genetic genealogy communities.

1:40 pm – 2:00 pm   **Mike Coble, NIST**

Interpretation of Complex DNA Mixtures

Complex DNA mixtures from more than two individuals and/or profiles amplified with low-level quantities of DNA, can be challenging for the analyst to interpret. Across the U.S., laboratories are recognizing the limits of a threshold-based interpretation together with CPI statistics for very complex mixtures. A promising solution for the analysis of challenging DNA mixtures are probabilistic approaches to interpretation. This presentation will provide an overview of software solutions and discuss the benefits and challenges of moving to a probabilistic approach to interpretation of complex mixtures.

2:00 pm – 2:20 pm   **Katherine Gettings, NIST**

Population Sample Sequencing at NIST

In the past year, next generation sequencing (NGS) efforts in the Applied Genetics Group have focused on producing sequence-based allele frequencies for four common U.S. populations at 27 Autosomal STR Loci, 24 YSTR Loci and 7 XSTR Loci. With the project nearing completion, this presentation will give an overview of the work and demonstrate how the data can be utilized by the forensic community.

2:20 pm – 2:40 pm   **Becky Steffen, NIST**

Development of the Next Generation of the PCR-Based DNA Profiling Standard: SRM 2391d

SRM 2391c PCR-Based DNA Profiling Standard is set to be depleted in February 2018 so development of the next generation has already begun. The steps in production of SRM 2391d and techniques that are planned to be used for certification will be explained and discussed in this presentation.

2:40 pm – 3:00 pm   **Q&A SESSION - Moderator Pete Vallone**
3:00 pm – 3:20 pm   **BREAK**
3:20 pm – 3:30 pm   **CSAFE Highlights – Robert M. Thompson**
3:30 pm – 3:50 pm   **Daniel Murrie, CSAFE-UVA**

Latent Fingerprint Proficiency Testing

Fingerprint analysts rely on commercial proficiency testing to demonstrate and document their skills, but commercial test materials may differ in important ways from routine, "real world" evidence. The research will assess the degree to which results of commercial fingerprint proficiency testing are similar to results of proficiency testing with a realistic sample of actual lab work.

3:50 pm – 4:10 pm   **Daniel Attinger, CSAFE-ISU**

Combining Fluid Dynamics, Statistics and Pattern Recognition in Bloodstain Pattern Analysis, to Quantify Spatial Uncertainty and Remove Human Bias

Recent research on the fluid dynamics of bloodstain pattern analysis provide a sounder understanding of the associated atomization, drop trajectories, drop impact and wicking phenomena. The proposed research will build onto these advances in physical understanding to add a quantification of the uncertainty and of its propagation, from e.g. uncertainties in the measurement of individual blood stains to the related uncertainty in the determination of the region of origin of a blood spatter.

4:10 pm – 4:30 pm   **Cleotide Gonzalez, CSAFE-CMU**

Human Factors in Identification Decisions: Cross-cutting Interdisciplinary Research

To build basic scientific foundations of behavioral decision making in forensic science this research will support the development of models of human decision making, which ultimately can be integrated into current and future statistical models being developed for latent prints, firearms, tool marks, and other pattern evidence techniques.

4:30 pm – 4:45 pm   **Q&A SESSION - Moderator Robert M. Thompson**
4:45 pm   **CLOSING REMARKS & SYMPOSIUM REVIEW**
            Robert M. Thompson