Day 1 Wrap-Up

John M. Butler, PhD

NIST Fellow & Special Assistant to the Director for Forensic Science
National Institute of Standards and Technology
We Are At the End of Day 1…

Welcome to:
FORENSICS@NIST
November 5, 2020
Day 1 of 2
8 AM - 5 PM EDT

8:00 - 8:10  Introduction
8:10 - 8:20  Forensics Overview
8:20 - 9:45  Statistics
9:45 - 10:00 Break
10:00 - 11:25 C-Safe Overview
11:25 - 12:30 Lunch Break
12:30 - 2:30 Forensic Genetics
2:30 - 2:45 Break
2:45 - 4:45 Firearms and Associated Toolmarks
4:45 - 5:00 Day 1 Wrap-Up
This Presentation is Intended as an “Index” to this Meeting

• At the end of the “book”

• Developed after the “text” is available (on the fly throughout today)

• Rarely “read” unless you are looking for a specific topic

• Cannot provide all details – go see the original material!
Acknowledgments and NIST Disclaimer

NIST Special Programs Office: Corrine Lloyd, Robert Ramotowski, Shyam Sunder
NIST Conference Program and Audiovisual Services: (many people behind the scenes – Crissy Robinson, Pauline Truong, Kevin Hill, Joseph Nastus)

Points of view are mine and do not necessarily represent the official position or policies of the National Institute of Standards and Technology.

Certain commercial entities are identified in order to specify experimental procedures as completely as possible. In no case does such identification imply a recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that any of the entities identified are necessarily the best available for the purpose.
A Brief History of the Forensics@NIST Meetings

• 2010 (December 6-8): limited to NIST and NIJ staff
  • Keynotes: Dr. Patrick Gallagher, NIST Director and Dr. John Laub, NIJ Director

• 2012 (November 28-30)
  Keynote: Dr. Tjark Tjin-a-Tsoi, Netherlands Forensic Institute CEO,
  • “Trends, Challenges and Strategy in Forensics”

• 2014 (December 3-4)
  Keynote: Judge Jed Rakoff, U.S. District Court Justice,
  • “Are Judges Losing Confidence in Forensic Science?”

• 2016 (November 8-9)
  Keynote: Professor Jules Epstein, Professor of Law at Temple University,
  • “Forensic Evidence: Thoughts of an Accidental Tourist”

• 2018 (November 7-8)
  Keynotes: Dr. John Butler (Nov. 7) & Dr. Sheila Willis (Nov. 8)
Forensics@NIST 2020 Day 1 “Index”

Welcome

Special Programs Office

Shyam Sunder
Acting Director,
Special Programs Office

Robert Ramotowski
Forensic Sci. Program Manager,
Special Programs Office

Statistics

Statistical Engineering Division,
Information Technology Laboratory

Will Guthrie
SED Division Chief

Nien-Fan Zhang
SED Statistician

Steve Lund
SED Statistician

Hari Iyer
SED Statistician

CSAFE Efforts

NIST Center of Excellence

Alicia Carriquiry
Iowa State University

Charless Fowlkes
UC - Irvine

Heike Hofmann
Iowa State University

Brandon Garrett
Duke University

Forensic Genetics

Applied Genetics Group,
Material Measurement Laboratory

Peter Vallone
Group Leader

Katherine Gettings
Research Biologist

Firearms & Toolmarks

Surface and Interface Metrology Group,
Physical Measurement Laboratory

Johannes Soons
Team Leader

Alan Zheng
Research Engineer

Michael Stocker (video)
Physical Scientist

Robert Thompson (SPO)
& Brian Renegar (PML)

1633 registrants

State and Local 28.6%
Industry 21.6%
Academia 18.4%
U.S. Government 16.1%
Non-U.S. government 8.6%
Unknown Affiliations 4.5%
Legal 2.2%
Welcome Introductory Remarks

Shyam Sunder
Acting Director,
Special Programs Office

Robert Ramotowski
Forensic Sci. Program Manager,
Special Programs Office

Research program (7 focus areas funded)
Standards program (OSAC community)
Foundation studies (4 reviews ongoing)

>1600 Registered from all 50 states +
>50 other countries
Statistics Focus Area

15 current research projects (foundational and applied) including

- New reference materials for trace elements in glass
- Uncertainty of drug mass measurements
- Optimization of GC/MS for fire debris analysis
- Statistical comparison of paint spectra
- Complex DNA mixture interpretation
- Characterization of noise in next generation sequencing data
- Use of next generation sequencing for DNA mixture analysis
- Assessment of thresholds for CE STR profiles
- Error rate assessment for firearms ID
- Likelihood ratios as weight of evidence
- Quantitative evaluation of footwear evidence

Overview of NIST Statistical Research in Forensic Science

Will Guthrie
NIST Statistical Engineering Division
Statistical Research Projects Discussed Today

- Statistical Models for Similarity Score Comparisons in Firearms Evidence Identifications
- The NIST Footwear Impression Comparison System
- A New Statistical Procedure to Assess Calibration Accuracy of Likelihood Ratio Systems

Nien-Fan Zhang
Steve Lund
Hari Iyer
CSAFE Overview

CSAFE 2.0 (Center for Statistics and Applications in Forensic Evidence) is a NIST Center of Excellence.

Center established in 2015, recently renewed for an additional five-year period, until 2025.

Consortium of six major academic partners:
- Carnegie Mellon University (PI Robin Mejia)
- Duke University (PI Brandon Garrett)
- Iowa State University (PI Alicia Carriquiry, Director)
- University of California Irvine (PI Hal Stern)
- University of Virginia (PI Karen Kafadar).
- West Virginia University (PI Keith Morris).

Three affiliated institutions: Swarthmore College (Amanda Luby), University of Nebraska Lincoln (Susan VanderPlas), University of Pennsylvania (Maria Cuellar).

- Funding available for internship, data collection, presentations, collaboration with forensic laboratories
- Offer periodic webinars (next one in December)
- Upcoming firearms workshop (Nov 30-Dec1)
- See their website [https://forensicstats.org/](https://forensicstats.org/)

- They hope to hear from you for collaboration!
CSAFE Projects Discussed Today

Charless Fowlkes (UC Irvine)

Heike Hofmann (Iowa State)

Brandon Garrett (Duke)

Footwear Impression Analysis

- Research Area Objectives
  - Currently established comparison standard: AFTE Theory of identification
  - 1. examine class characteristics
  - 2. use microscopic analysis to assess detailed features

- Identified Problems:
  - 1. establishing error rates of identification process
  - 2. subclass characteristics (determined by proficiency tests in Europe) are a key risk factor for false identifications.

Firearms and Toolmarks

Implementation and Practice

- How to communicate effectively to triers of fact
- Database in development of court decisions
- Challenge of lay people understanding the likelihood ratio

See their website (https://forensicstats.org/)
**NIST Applied Genetics Group**: Advancing technology and traceability through quality genetic measurements to aid work in forensic and clinical genetics.
Forensic Genetics Research Projects Discussed Today

Projects Discussed Today:

- Next generation Sequencing
- Future directions
- DNA extraction efficiency
- Y-SNP Interlaboratory Study
- Future Directions
- Population Sample Sequencing
- Combining marker types
- STRSeq
- Sequence Noise Characterization

Platforms at NIST:
- STR, SNP, mtDNA

Standards:
- SRM 2391d (PCR-based DNA profiling std)
- SRM 2372a Human DNA Quantitation std
- STRBase 2.0
- Open data set (new)

https://strbase-b.nist.gov/
https://data.nist.gov/od/id/mds2-2157

Peter Vallone
Katherine Gettings
Future Directions

Implementation... what is needed?

Vendors create/adapt assays and analysis methods

Developmental validation

Casework Laboratories evaluate cost/benefit

Internal validation

Proficiency Tests

Databases of the Future

Sequence Nomenclature

Match Statistics

Probabilistic Genotyping for NGS

Slide from Katherine Gettings (Forensics@NIST 2020)
Firearms & Toolmarks Focus Area

Firearm and Toolmark Identification

Challenges:
- No consensus on “best” comparison method
- No consensus on “best” processing procedure
- Human skill/expertise is difficult to measure
- Large variability in same-source patterns
- Evaluation and expression of weight

Outlook:
- Significant and promising research efforts
- Results are finding their way into standardization
- 3D metrology and virtual comparison
- Application of computer aided techniques

Thank You
soons@nist.gov

Susan Ballou, Zhe Chen, Maria Nadal, Brian Reneger, Robert Ramotowski, Harry Song, John Song, Michael Stocker, Robert Thompson, Ted Vorburger, James Yen, Clarence Zarobila, Nien-Fan Zhang, Xiaoyu Alan Zheng

Johannes Soons
Firearms and Toolmark Examination Research Projects Discussed Today

- Reference Population Database of Firearm Toolmarks (RPDFT)
- A Metrology Foundation for Firearm and Toolmark Examination
- Digital Preservation of the President John F. Kennedy Assassination Ballistic Artifacts

- Pre-recorded video shown

Michael Stocker

Robert Thompson
Brian Renegar

https://www.nist.gov/blogs/taking-measure/how-jfk-assassination-bullets-were-digitally-preserved-nist
Thank you for Attending (or Watching Later)!

• Tomorrow (November 6):
  • Digital & Identification Evidence
  • Trace Evidence
  • Drugs & Toxins
  • Biometrics Human Examiner

• Communication
• Collaboration

www.nist.gov/forensics
john.butler@nist.gov