Day 1 Wrap-Up

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National Institute of Standards and Technology

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We Are At the End of Day 1…

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"

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%

https://www.business2community.com/big-data/statistics-big-datas-biggest-hurdle-01214657

DATA MODELS MATHEMATICAL ANALYSIS STATISTICS APPLICATIONS RISK METHODS RESEARCH EVENTS SCIENCE

csafe — Center for Statistics and Applications in Forensic Evidence

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)

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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

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Statistical Research Projects Discussed Today

Nien-Fan Zhang

Steve Lund

Hari Iyer

Statistical Models for Similarity Score Comparisons in **Firearms Evidence** Identifications
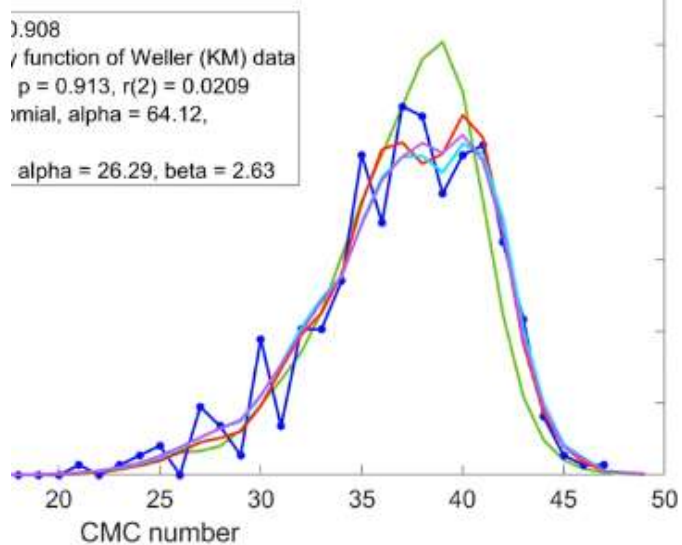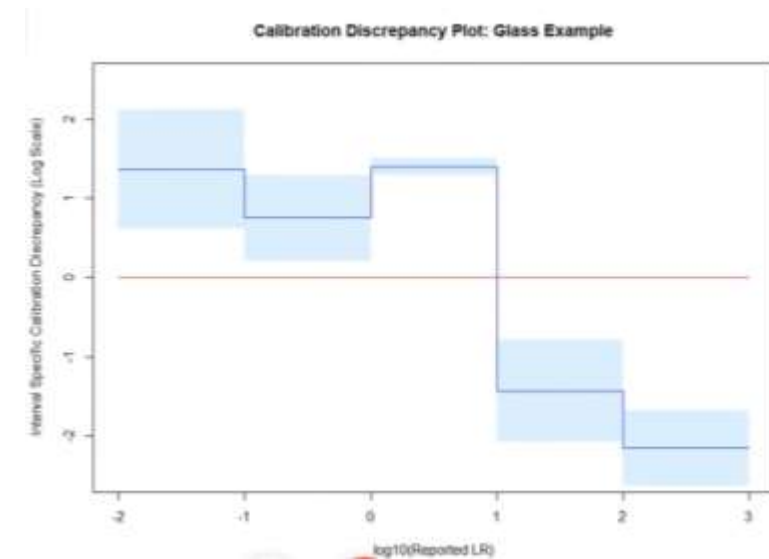
The NIST **Footwear Impression** Comparison System

A New Statistical Procedure to Assess Calibration Accuracy of **Likelihood Ratio Systems**

CMC

RACs

ROC

LR

CSAFE Overview

Alicia Carriquiry
(Iowa State)

CSAFE 2.0

- 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/

- **They hope to hear from you for collaboration!**

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CSAFE Projects Discussed Today

Charless Fowlkes
(UC Irvine)

Camera not used

Heike Hofmann
(Iowa State)

Brandon Garrett
(Duke)

Footwear Impression Analysis

Firearms and Toolmarks

Implementation and Practice

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.

forensicstats.org | 2

See their website (https://forensicstats.org/)

How to communicate effectively to triers of fact

Database in development of court decisions

Challenge of lay people understanding the likelihood ratio

Forensic Genetics Focus Area

Peter Vallone · Becky Steffen · Erica Romsos · Katherine Gettings · Kevin Kiesler · Margaret Kline · Lisa Borsuk · Sarah Riman · David Duewer *Statistical Support* · Hari Iyer · Tunde Huszar PostDoc

Peter Vallone

NIST Applied Genetics Group

Forensic Genetics – Forensic DNA Typing Workflow

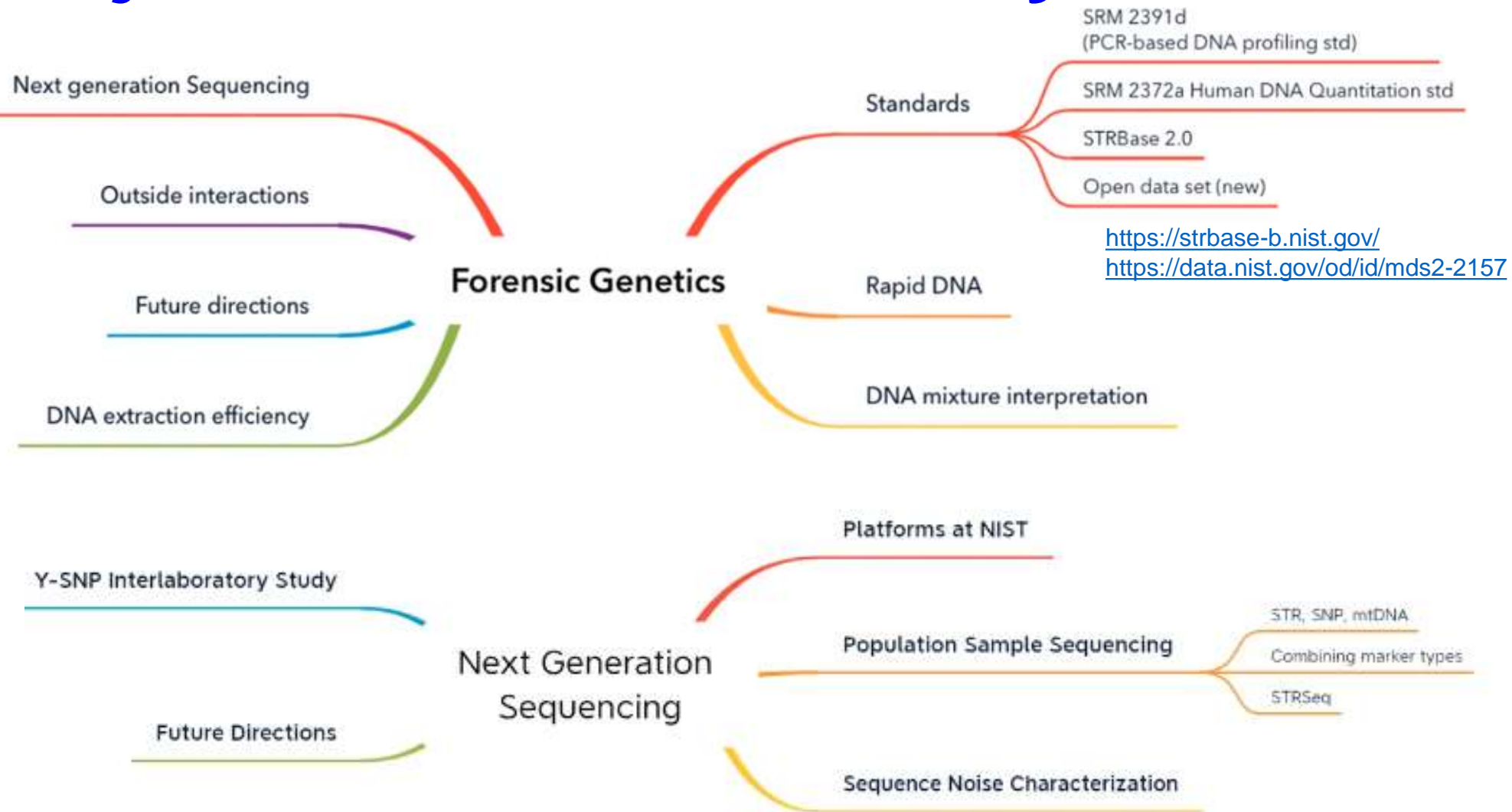DNA Extraction → DNA Quantitation → PCR Amplification → Genotyping & Sequencing → Interpretation

NIST Applied Genetics Group: Advancing technology and traceability through quality genetic measurements to aid work in <u>forensic</u> and clinical genetics

Standards and data · Applied research and assessing emerging technologies · Community Engagement

Forensic Genetics Research Projects Discussed Today

Peter Vallone

Katherine Gettings

Forensic Genetics

- Next generation Sequencing
- Outside interactions
- Future directions
- DNA extraction efficiency
- Standards
  - SRM 2391d (PCR-based DNA profiling std)
  - SRM 2372a Human DNA Quantitation std
  - STRBase 2.0
  - Open data set (new)
- Rapid DNA
- DNA mixture interpretation

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

Next Generation Sequencing

- Y-SNP Interlaboratory Study
- Future Directions
- Platforms at NIST
- Population Sample Sequencing
  - STR, SNP, mtDNA
  - Combining marker types
  - STRSeq
- Sequence Noise Characterization

NIST Forensic Genetics Research Efforts

Future Directions

Implementation... what is needed?

Vendors create/adapt assays and analysis methods

Developmental validation

Casework Laboratories evaluate cost/benefit

Internal validation

Katherine Gettings

Sequence Nomenclature

Match Statistics

Probabilistic Genotyping for NGS

Proficiency Tests

Databases of the Future

Slide from Katherine Gettings (Forensics@NIST 2020)

Firearms & Toolmarks Focus Area

Firearm and Toolmark Identification

Johannes Soons

Challenges:
- No consensus on "best" comparison
- No consensus on "best" processing p
- Human skill/expertise is difficult to m
- Large variability in same-source patt
- Evaluation and expression of weight

Outlook:
- Significant and promising research ef
- Results are finding their way into sta
- 3D metrology and virtual comparison
- Application of computer aided techn

Thank You
soons@nist.gov

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

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Firearms and Toolmark Examination Research Projects Discussed Today

Alan Zheng

Pre-recorded video shown

Michael Stocker

Robert Thompson

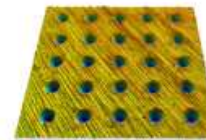**Brian Renegar**

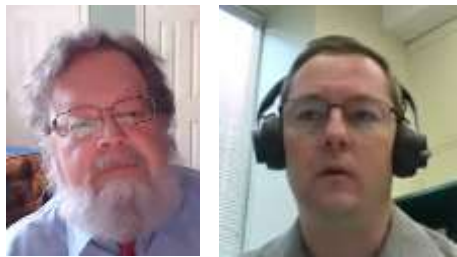Reference Population Database of Firearm Toolmarks (RPDFT)

A Metrology Foundation for Firearm and Toolmark Examination

Digital Preservation of the President John F. Kennedy Assassination Ballistic Artifacts

https://www.nist.gov/blogs/taking-measure/how-jfk-assassination-bullets-were-digitally-preserved-nist

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Thank you for Attending (or Watching Later)!

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

- **Communication**
- **Collaboration**

RESEARCH. STANDARDS. FOUNDATIONS.

www.nist.gov/forensics

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