Are We on the Right Side of the Equation?

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National Institute of Standards and Technology
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.
NIST Forensic Science Activities

Conduct Research and Collaborate

**Intramural Research**
- **Why we are here for this meeting…**
  - DNA
  - Digital Fingerprints
  - Firearms
  - Footmarks
  - Statistics
  - Toxins
  - Trace

**Extramural Research**
- funding a NIST Center of Excellence in Forensic Science (CSAFE: since 2014)

1920s - present

Partner with Community to Strengthen Policies and Practices

**National Commission on Forensic Science (NCFS) with DOJ**
- **2013 - 2017**

Convene Meetings to Examine Issues

**Human Factors Working Groups (with NIJ)**
- **2009 - present**

Explore Scientific Foundations

- Initial efforts with DNA mixture interpretation and bitemark analysis

Public comment period: September 24, 2018 through November 19, 2018

**NISTIR 8225 DRAFT**
NIST Scientific Foundation Foundation
What Has Happened in the Past Two Years since Forensics@NIST 2016?
Detective X Film awarded an Emmy® this year!

Awarded June 23, 2018 by the National Academy of Television Arts & Sciences: National Capital Chesapeake Bay Chapter

Detected X: (Re) Discovering Wilmer Souder

NIST staff members Leon Gerskovic, Robin Materese and Jose Garcia show off their Emmy® Award for "Detective X: (Re) Discovering Wilmer Souder."

Credit: J. Stoughton/NIST

https://www.nist.gov/video/detective-x-re-discovering-wilmer-souder

Article: https://www.nist.gov/featured-stories/who-was-detective-x

Wilmer Souder Notebooks (Special Collection)

https://nistdigitalarchives.contentdm.oclc.org/digital/collection/p16009coll67/search

NIST Digital Archives
Digital Collections of the National Institute of Standards and Technology

Notebook #2 (Oct 1933)

Notebook #5 (July-Oct 1930)

Notebook #9 (Sept 1950)
Then NIST Director Willie E. May speaking at the Forensics@NIST 2016 meeting. **He retired in January 2017 after 45 years at NIST.**

Walter G. Copan, NIST Director since October 5, 2017

https://www.nist.gov/people/walter-g-copan
NCFS Closed with Charter Expiration

- The Attorney General's National Commission on Forensic Science's (NCFS) charter expired on April 23, 2017

- Completed two 2-year terms involving 13 meetings and approving 43 work products (20 recommendations to the Attorney General and 23 views of the Commission)

See summary document (58 pages) describing what was accomplished and thoughts on what needs still exist

NIST maintains video recordings of the NCFS meetings:
https://www.nist.gov/topics/forensic-science/national-commission-forensic-science
National Commission on Forensic Science (NCFS) operated for 13 meetings from February 2014 to April 2017

Coordinating Government Efforts

NIST Director (Patrick Gallagher), Deputy Attorney General (James Coles), and the President’s Science Advisor (John Holdren) speak at the first National Commission on Forensic Science meeting in February 2014

Learning from Previous Efforts

Judge Harry Edwards, who chaired the National Academy of Sciences committee that wrote the 2009 NAS Report, addressed the NCFS

Introducing New Efforts

Mark Stolorow introduced NIST plans for OSAC at the first NCFS meeting

140 presenters spoke to the NCFS in its 13 meetings
Mark Stolorow Has Announced Plans to Retire

He started in 1968 as a beat cop in Ann Arbor, Michigan

Mark will retire in January 2019 as Deputy Director of the NIST Special Programs Office and Director for OSAC Affairs

50 years in forensic science!

Michigan and Illinois State Police Crime Labs, Cellmark, NIST

Forensic Science is in My DNA

September 18, 2018
By: Mark Stolorow

NIST Has Organized Multiple Meetings to Assist the Community since Forensics@NIST 2016

Coming Next Summer…

June 19-20, 2019

https://www.nist.gov/topics/forensic-science/conferences-and-events
Lots of Great NIST Research… and (Rich) Press Coverage

This is why we are here for Forensics@NIST 2018

Trace Evidence Databases: A Force Multiplier for Forensic Investigators
November 7, 2016

Sniffing Like a Dog Can Improve Trace Detection of Explosives
December 1, 2016

NIST Research Enables Enhanced DNA “Fingerprints”
December 15, 2016

Database of Software “Fingerprints” Expands to Include Mobile Apps
December 15, 2016

Fentanyl Can Sicken First Responders. Here’s a Possible Solution.
May 9, 2017

Do You Have What It Takes to be a Forensic Fingerprint Examiner?
May 18, 2017

Scientists Lay the Groundwork for a Reliable Marijuana Breathalyzer
July 5, 2017

Scientists Automate Key Step in Forensic Fingerprint Analysis
August 14, 2017

Speaking of Error in Forensic Science
September 5, 2017

Trace

Trace

DNA

Digital

Feature Story

OSAC Update

21 articles since 2016

Trace

Fingerprints

Toxins

Fingerprints

Rich Press
richard.press@nist.gov
(301) 975-0501

Standard for Sampling Seized Drugs Approved for OSAC Registry
April 3, 2017

Meeting Summary
Great NIST Research…and (Rich) Press Coverage (cont.)

Scientific Foundations

NIST to Assess the Reliability of Forensic Methods for Analyzing DNA Mixtures
October 3, 2017

How Good a Match is It? Putting Statistics into Forensic Firearms Identification
February 8, 2018

Free Software Can Help Spot New Forms of Fentanyl and Other Illegal Drugs
March 7, 2018

NIST Builds Statistical Foundation for Next-Generation Forensic DNA Profiling
July 23, 2018

Database of Software “Fingerprints” Expands to Include Computer Games
September 10, 2018

NIST Updates Forensic Standard Reference Materials
September 19, 2018

NIST details plans for reviewing the scientific foundations of forensic methods
September 24, 2018

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September 19, 2018

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September 24, 2018

 Springer
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)
Previous Keynote Speakers

2012 Dr. Tjark Tjin-a-Tsoi
Trends, Challenges and Strategy in Forensics
Keynote Remarks
Forensics@NIST
29 November 2012
Dr. T. Tjin-a-Tsoi
Chief Executive Officer

MOU signed between NFI and NIST
34 slides

2014 Judge Jed Rakoff
Are Judges Losing Confidence in Forensic Science?
by Jed S. Rakoff

When I first went on the bench nearly 20 years ago, it was virtually unheard of for any judge to question the admissibility or reliability of such familiar forensic disciplines as fingerprint analysis, toxicology, firearms and toolmark analysis, DNA analysis, and much more. Indeed, as judges - across the

12 pages of text

2016 Professor Jules Epstein

FORENSIC EVIDENCE: THOUGHTS OF AN ACCIDENTAL TOURIST
PROFESSOR JULES EPSTEIN
NIST, NOVEMBER 2016

60 slides and 45 minute video
2012 Dr. Tjark Tjin-a-Tsoi
“Trends, Challenges and Strategy in Forensics”

• The challenges of **backlogs** can be addressed with (1) service level agreements, (2) process redesign, and (3) speed focused R&D

• More **objective interpretation** can be obtained with (1) research, (2) defragmentation of forensic disciplines, and (3) improved training & education
2014 Judge Jed Rakoff
“Are Judges Losing Confidence in Forensic Science?”

• “There remains a tendency…to admit forensic evidence because it is traditional to do so.”

• “The many highly responsible forensic specialists who have devoted years of their time and skill to one or another forensic discipline should not be defensive about this growing judicial uncertainty, but should instead see it as an invitation and opportunity to help their chosen fields become more rigorous and reliable.”

• “…give your attention to what can be done to make forensic science a more useful tool of justice…”
2016 Professor Jules Epstein
“Forensic Evidence: Thoughts of an Accidental Tourist”

- “Daubert’s ‘evidentiary’ reliability test does not necessarily mean ‘accurate’” and “Frye’s ‘general acceptance’ test varies with the community.”
  - “Daubert is applied far more stringently in civil cases than in criminal ones, and even in criminal ones, Daubert serves a more effective screening role for filtering out flawed defense expert testimony than weak prosecution and police-generated forensic science.”

- Problems from his perspective:
  1. “We still permit risky evidence” – bitemark matching and 2014 study of odontologists
  2. Ethics – “honestly communicate with all parties” when “permitted by law or agency practice”
  3. Communicating Results – example testimony: “[a match is] probable…I’m 100% confident with that opinion”
  4. “Do we yet know how reliable experts are?” – what data exists?
  5. “When is enough enough?” – when trying to conclude that two items have a common origin if their marks are in “sufficient agreement” – what does that mean?
Are We on the Right Side of the Equation?
Perspective gained from focused thinking about scientific foundations this past year:
Are We Check-List Focused or Outcome Focused?

• Do we understand principles behind how things work and why things are done?

• Do we regularly step back and critically consider our performance with activities we are involved in as researchers or practitioners?

• What data demonstrate what we think we know about the performance of a particular methodology or interpretation approach?
Are We on the Right Side of the Equation?

*Systems Thinking* is Looking at the Big Picture and How Inputs Impact Outputs…

Component(s) + Process(es) = Outcome

**Left Side**
- Task-Driven

**Right Side**
- Performance-Based

How?  How well?

What?  So what?
Accreditation & Audits: Are we considering the right side of the equation?

Austin (TX) Police Department (APD) DNA Laboratory Accreditation Timeline and Discussion March 2004--May 2016

Summary of Audits and Findings 2004-TFSC Audit

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Two-thirds of the APD audits had zero findings

- Austin, Texas PD DNA Laboratory was shutdown in May 2016 over concerns with DNA testing protocols
- They passed 17 audits over a 13 year time span
- In response to TX FSC concerns raised, a representative of the accrediting body stated “there is no consensus on what is acceptable in the DNA community” and “we [ANAB] do not establish the scientific foundation, but we assess to that. We expect the technical community to be establishing what scientifically needs to be done.”

Texas Forensic Science Commission Meeting August 18, 2017
https://www.youtube.com/watch?v=-p_30-20kQI (at 4:03 of 5:45)
Validation Studies: Are we considering the right side of the equation?

A common claim is that a check-list of criteria have been met: “validation of the [DNA test kit] was carried out in accordance with guidelines …issued by the Scientific Working Group on DNA Analysis Methods (SWGDAM) and a series of tests …were conducted.” (FSIG 27:67-73)

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**Left side of the equation**

- Task-driven

**Right side of the equation**

- Performance-based

SWGDAM Validation Guidelines for DNA Analysis Methods (2016)

- 4.1 Known and nonprobative evidence samples
- 4.2 Sensitivity and stochastic studies
- 4.3 Precision and accuracy: repeatability
- 4.3 Precision and accuracy: reproducibility
- 4.4 Mixture studies
- 4.5 Contamination assessment

- 4.4 Mixed DNA samples that are representative of those typically encountered by the testing laboratory should be evaluated

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ROC Plot for Different Conditions

Studies assessing sensitivity and specificity

- Ideal ROC
- Very Good
- Good
- Average
- So So
- Bad
A new standard that proposes working from the right side of the equation

**Foreword:** “Following development, it is critical for a laboratory to verify that the interpretation protocols work as designed.” (i.e., to be performance-based rather than task-driven)

“4.3 The data from the validation studies performed by the laboratory shall be the basis for the interpretation parameters and protocols developed by the laboratory and shall provide guidance for the types of mixed DNA profiles that will be interpreted by the laboratory.”

“4.4 The laboratory shall verify and document that the mixture interpretation protocols developed from the validation studies generate reliable and consistent interpretations and conclusions for the types of mixed DNA samples typically encountered by the laboratory.”
Dr. Wilmer Souder and the National Bureau of Standards’ Identification Laboratory (1935)

One of Our Nation’s First Forensic Laboratories

Physics PhD, University of Chicago (1916)

Worked more than 800 forensic cases from 1929 to 1953

Handwriting, typewriter identification, and ballistics analysis

Helped set up the FBI Laboratory (1932)

Testified as a handwriting expert in the Lindbergh baby kidnapping case (1935)
Perspectives from History:
Are we on the right side of the equation?

In his 1933 talk to the International Association of Chiefs of Police entitled “Beware the Amateur Expert”, Wilmer Souder from the National Bureau of Standards states:

- “Today many workers are operating without the least supervision or concern as to what is correct scientific procedure. Too often their enthusiasm outruns their training and ability. Some serious complications naturally develop under such conditions.” He continues: “Success comes from skill in selecting the proper method and following it through in its correct application.” And later: “The safe investigator has standards to be observed.” He concludes: “I hope this bold admission of our lack of standards in what should be a highly scientific field will not discourage you.”

In 1933 and 1934, Wilmer Souder spoke to the IACP. His remarks were reprinted in a 1977 book entitled “Silent Witness: The Emergence of Scientific Criminal Investigations”, which is the third volume of a Police History Series.
Perspectives from History:
Are we on the right side of the equation?

L.J. O’Rourke of the U.S. Civil Service Commission spoke to the International Association of Chiefs of Police in 1936; his talk was entitled “Scientific Standards in Criminal Investigations”:

• “…the use as a basis for evidence of instruments whose validity is not known will merely discredit investigation work.”

• He pleads “for greater knowledge of validity of [scientific] methods and the development of more valid measures.”

• O’Rourke proposes setting up “a National Bureau of Standards in Criminology to conduct scientifically controlled experiments and to evaluate present practices.” He emphasizes: “To make better use of [scientific] methods, law enforcement agencies must be certain of their limitations as well as of their merits.”

His remarks were reprinted in a 1977 book entitled “Silent Witness: The Emergence of Scientific Criminal Investigations”, which is the third volume of a Police History Series.
With What Mindset Do You Approach a Problem?

• Are you using the left side or the right side of your brain in problem solving?
  • Left-side = linear, verbal, and sequential thinking
  • Right-side = spatial perception & creativity
  • *We need both sides to create the best solutions*

• Are we task-driven (left-side of the equation) or performance-based (right-side of the equation) in our work?
  • *We need both sides to create the best solutions in forensic science*
  • This applies to both researchers and practitioners
Take Time to Go on a NIST Tour While You are Here…

NIST researcher Mike Riley describing NIST test methods for evaluating body armor (bulletproof vests) to Forensics@NIST 2016 participants
Thank you for your attention!

www.nist.gov/forensics

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