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RAISING THE BAR: PROGRESS AND FUTURE NEEDS IN FORENSIC SCIENCE

HEARING

BEFORE THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ONE HUNDRED SIXTEENTH CONGRESS

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C O N T E N T S

September 10, 2019

	Page
Hearing Charter	2

Opening Statements

Statement by Representative Eddie Bernice Johnson, Chairwoman, Committee on Science, Space, and Technology, U.S. House of Representatives	8
Written statement	9
Statement by Representative Frank Lucas, Ranking Member, Committee on Science, Space, and Technology, U.S. House of Representatives	9
Written statement	11

Witnesses:

Ms. Susan Ballou, Program Manager, Office of Special Programs, National Institute of Standards and Technology	
Oral Statement	13
Written Statement	15
Ms. Lynn Garcia, General Counsel, Texas Forensic Science Commission	
Oral Statement	20
Written Statement	22
Ms. Vicki Zemp Behenna, Executive Director, Oklahoma Innocence Project	
Oral Statement	35
Written Statement	37
Dr. Karen Kafadar, Professor and Chair, Department of Statistics, University of Virginia, and President, American Statistical Association	
Oral Statement	43
Written Statement	45
Mr. Matthew Gamette, Crime Lab Director, Idaho State Police Forensic Services	
Oral Statement	59
Written Statement	61
Discussion	87

Appendix I: Answers to Post-Hearing Questions

Ms. Susan Ballou, Program Manager, Office of Special Programs, National Institute of Standards and Technology	110
Ms. Lynn Garcia, General Counsel, Texas Forensic Science Commission	116
Ms. Vicki Zemp Behenna, Executive Director, Oklahoma Innocence Project	120
Dr. Karen Kafadar, Professor and Chair, Department of Statistics, University of Virginia, and President, American Statistical Association	123
Mr. Matthew Gamette, Crime Lab Director, Idaho State Police Forensic Services	126

Appendix II: Additional Material for the Record

Statement submitted by Representative Eddie Bernice Johnson, Chairwoman, Committee on Science, Space, and Technology, U.S. House of Representatives	130

Page

Statement submitted by Representative Bill Posey, Committee on Science, Space, and Technology, U.S. House of Representatives 132

Documents submitted by Mr. Matthew Gamette, Crime Lab Director, Idaho State Police Forensic Services 133

RAISING THE BAR: PROGRESS AND FUTURE NEEDS IN FORENSIC SCIENCE

TUESDAY, SEPTEMBER 10, 2019

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Committee met, pursuant to notice, at 10:45 a.m., in room 2318, Rayburn House Office Building, Hon. Eddie Bernice Johnson [Chairwoman of the Committee] presiding.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

Raising the Bar: Progress and Future Needs in Forensic Science

Tuesday, September 10, 2019
10:00 am – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

On Tuesday, September 10, 2019, the Science, Space, and Technology Committee will hold a hearing to assess the progress in forensic science since the 2009 National Academy of Sciences report, *Strengthening Forensic Science in the United States: A Path Forward*, and to examine the role of the National Institute of Standards and Technology in the advancement of forensic science research and standards. In addition, the Committee will receive testimony on the *Forensic Science and Standards Act*, last introduced in the 114th Congress (H.R. 5795), including any recommendations for updates to the bill.

Witnesses

- **Ms. Susan Ballou,** Program Manager, Office of Special Programs, National Institute of Standards and Technology
- **Ms. Lynn Garcia,** General Counsel, Texas Forensic Science Commission
- **Ms. Vicki Zemp Behenna**, Executive Director, Oklahoma Innocence Project
- **Dr. Karen Kafadar,** Professor and Chair, Department of Statistics, University of Virginia, and President, American Statistical Association
- **Mr. Matthew Gamette**, Crime Lab Director, Idaho State Police Forensic Services

Overarching Questions

- Ten years after the release of the National Academy of Sciences report on the state of forensic science in the United States, what advances have been made in the science, standards, and practice of forensics in the criminal justice system? What work remains to be done?

- What is the role of the National Institute of Standards and Technology (NIST) in advancing forensic research, standards, and practice, in particular through the Organization of Scientific Area Committees for Forensic Science (OSAC) process? How effective has the OSAC been? What changes, if any, should be made to the organization, composition, or practices of the OSAC?

- In what ways could the *Forensic Science and Standards Act* help strengthen forensic science practices in the United States? Are there any recommendations for updates or improvements to the legislation?

Background

According to the Innocence Project[1], to date, 367 individuals convicted of murder, rape, and other violent crimes across 37 states have been exonerated as a result of DNA evidence. Those individuals served an average of 14 years in prison prior to their release. Twenty of them spent time on death row.[2] In one study of 108 cases involving 143 DNA exonerations (some of the cases had multiple defendants), researchers found that 121 of the actual perpetrators - later identified as such - went on commit 337 additional crimes, 61 percent of which were felonies or violent crimes, including rape and murder, while the innocent were wrongly imprisoned.[3]

Nearly half (44 percent) of the 367 total DNA exoneration cases involved the misapplication of forensic science, defined by the Innocence Project in their analysis as the use of an unreliable or invalid discipline, insufficiently validated method, misleading testimony, mistakes, and misconduct. Misapplication of the forensic discipline of serology accounted for 89 of these cases and the discipline of hair comparison for 75 of them.[4]

In 2012, the *Washington Post* published a series of investigative articles reporting on flawed forensic analyses that may have been responsible for wrongful convictions in thousands of criminal cases.[5] That series, by journalist Spencer Hsu, made him a finalist for the Pulitzer Prize that year. On July 17, 2013 Hsu reported that a federal review of old criminal cases undertaken just since their initial reporting had uncovered as many as 27 death penalty convictions in which FBI forensic experts may have presented scientifically invalid testimony as if it was scientific fact.[6] His April 15, 2015 article on this topic began with the following sentence:[7]

> *The Justice Department and FBI have formally acknowledged that nearly every examiner in an elite FBI forensic unit gave flawed testimony in almost all trials in which they offered evidence against criminal defendants over more than a two-decade period before 2000.*

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[1] The Innocence Project and the National Registry of Exonerations define DNA exonerations and forensic science problems differently. They are currently working to reconcile the differences. Data here are provided by the IP.
[2] https://www.innocenceproject.org/all-cases/#
[3] https://onlinelibrary.wiley.com/doi/abs/10.1111/1745-9133.12463
[4] https://www.innocenceproject.org/overturning-wrongful-convictions-involving-flawed-forensics/
[5] https://www.washingtonpost.com/local/crime/convicted-defendants-left-uninformed-of-forensic-flaws-found-by-justice-dept/2012/04/16/gIQAWTcgMT_story.html
[6] https://www.washingtonpost.com/local/crime/us-reviewing-27-death-penalty-convictions-for-fbi-forensic-testimony-errors/2013/07/17/6c75a0a4-bd9b-11e2-89c9-3be8095fe767_story.html
[7] https://www.washingtonpost.com/local/crime/fbi-overstated-forensic-hair-matches-in-nearly-all-criminal-trials-for-decades/2015/04/18/39c8d8c6-e515-11e4-b510-962fcfabc310_story.html

In 2009, under the direction of Congress,[8] the National Research Council of the National Academy of Sciences (NAS) published a report entitled, *Strengthening Forensic Science in the United States: A Path Forward.*[9]

The NAS study committee found that forensic science, throughout the federal, state, and local levels, needed more scientific rigor and scientifically-based national standards. The committee further found that forensic science professionals had significantly overstated the reliability of "pattern matching" forensic disciplines, such as bite mark analysis, an example for which there was no scientific research to support its use. After discussing further weaknesses in the science and practice of forensic science nationwide, the committee provided 13 recommendations for improvements:

- Establish the National Institute of Forensic Science—an independent federal entity
- Establish standard terminology for reports and testimony about forensic science investigations
- Fund research to address the issues of accuracy, reliability, and validity of forensic science investigations
- Separate public forensic laboratories from administration and control of law enforcement agencies or prosecutors' offices
- Fund research on sources of human bias in forensic science
- Develop tools to improve the application of metrology, validation, proficiency testing, and the exchange of information
- Require laboratory accreditation and individual certification of forensic science professionals
- Establish routine quality assurance and quality control procedures
- Create a national code of ethics for forensic science professionals
- Develop programs, scholarships and fellowships to attract students to pursue graduate studies in fields critical to forensic science practice
- Establish regional, accredited, modernized medical examiner offices with forensic pathologists
- Establish standards for interoperability of Automated Fingerprint Identification Systems
- Prepare forensic science professionals for their potential roles in managing and analyzing evidence from events that affect homeland security

[8] Science, State, Justice, Commerce, and Related Agencies Appropriations Act of 2006
[9] Report available at: https://www.nap.edu/catalog/12589/strengthening-forensic-science-in-the-united-states-a-path-forward

The NAS report spurred a series of actions by the Obama Administration. In 2013, NIST and the Department of Justice established the National Commission on Forensic Science (NCFS), a federal advisory committee composed of more than 40 lawyers, judges, statisticians, research scientists, victim advocates, law enforcement agencies, forensic lab directors, and forensic practitioners. The NCFS was charged with making recommendations to enhance the practice and improve the reliability of forensic science. The NCFS reached a consensus on more than 40 working documents on forensic topics as varied as professional accreditation, trial testimony, human factors, and basic research.[10] The NCFS was disbanded in 2017 on the order of then-Attorney General Jeff Sessions.

Organization of Scientific Areas Committees for Forensic Science

In 2014, NIST established the Organization of Scientific Area Committees for Forensic Science (OSAC). While NIST has a handful of employees dedicated to OSAC administration, the OSAC committees are primarily run by the 500 plus volunteer practitioners, statisticians, scientists, researchers, judges and lawyers. The OSAC is funded at about $3 million per year. An additional $1 million is provided to support assessment of the technical merit of existing foundational science for different forensic disciplines.

Five Scientific Area Committees (SAC) cover broadly defined forensic science topic areas and oversee 25 discipline-specific subcommittees. The subcommittees work to identify existing high-quality standards and to facilitate the development of new standards. The standards developed in the subcommittees are then forwarded to the respective Scientific Area Committee(s) for approval. After SAC approval, the standards are then forwarded to the Forensic Science Standards Board (FSSB) for final approval. (See Figure 1 on the next page.)

The FSSB also administers overall operation of the organization, approves standards for inclusion on the OSAC Registry, approves membership nominations, resolves disputes and appeals, and engages in international efforts related to forensic science standards. NIST is currently soliciting feedback from stakeholders and OSAC participants for implementing a possible update to the OSAC structure—"OSAC 2.0."

Research at NIST

NIST carries out measurement research in support of forensic science and standards, both within its own laboratories and through a center of excellence at Iowa State University, the Center for Statistics and Applications in Forensic Evidence (CSAFE). The total budget for this research is about $8.5 million. There are six focus areas for the intramural research: DNA, toxicology, trace evidence, tool marks, statistical methods, and digital evidence. NIST also has a number of forensics projects relevant to the opioid crisis, specifically developing tools to help identify the composition of seized drugs. CSAFE was established in 2015 under a 5-year grant at $4 million per year and focuses on pattern matching disciplines.

[10] https://www.justice.gov/archives/ncfs/work-products-adopted-commission

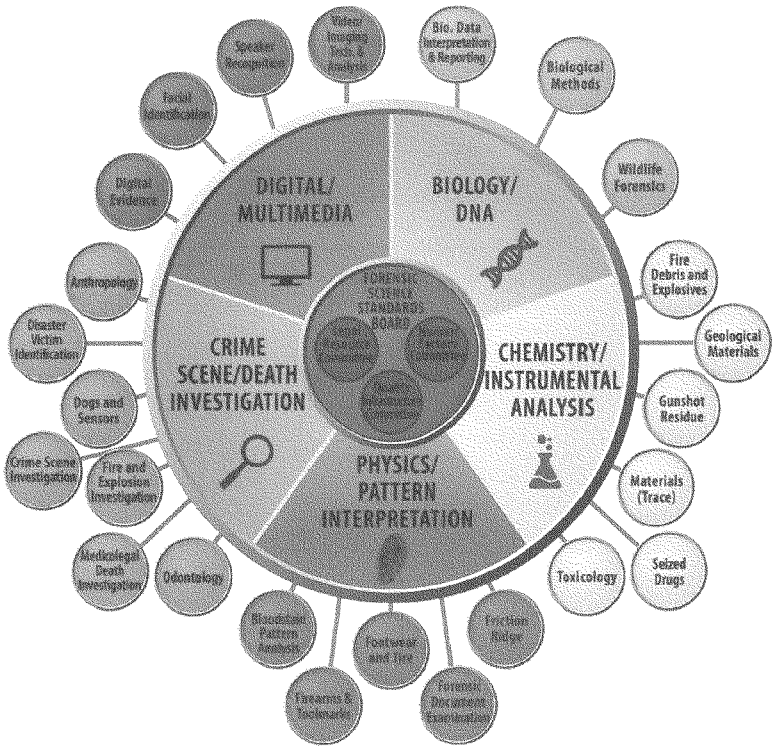

Figure 1 OSAC Structure

Research at the National Science Foundation (NSF)

The National Science Foundation supports foundational research in forensics across several disciplines, including digital forensics and human factors, e.g. understanding expert testimony and eyewitness identification. In 2017, NSF awarded a 5-year Industry University Cooperative Research Center grant to Florida International University and a number of partner institutions to establish the Center for Advanced Research in Forensic Science (CARFS).

National Institute of Justice (NIJ) at the Department of Justice (DOJ)

While not a focus of this hearing, the NIJ also supports grants for improved forensic science practice, including some research. The Coverdell Forensic Science Improvement Grants, funded at about $30 million per year, awards grants to states and units of local government to help improve the quality and timeliness of forensic science and medical examiner/coroner services.[11] NIJ has a separate program to provide support for DNA, in large part to increase the capacity of laboratories to process DNA and reduce the backlog. NIJ also supports research and evaluation grants for forensic laboratories to improve their practices.[12] The most recent solicitation in April 2019 was supported at a total of $2.5 million, with individual awards up to $500,000 over 5 years.

Forensic Science and Standards Act

Chairwoman Johnson, in previous Congresses, has introduced the *Forensic Science and Standards Act*. The bill, each time, was referred to the Science Committee and the Judiciary Committee but no further action was taken. The latest version was H.R. 5795, introduced during the 114th Congress.

The Act seeks to establish scientific standards and protocols across forensics disciplines using a variety of measures:

- Establishes a national initiative in forensic science to coordinate federal research in forensic science and develop a unified federal forensic science research strategy
- Authorizes forensic science research at NSF and NIST, including the establishment of research centers at both agencies
- Encourages the use of prizes and challenges to advance forensic science
- Authorizes a follow-on report by the NAS to assess progress under the initiative
- Establishes NIST-managed committees focused on forensic science standards, providing broad authorization for the OSAC process
- Establishes a joint commission run by NIST and the Department of Justice to review forensics standards and promote wide adoption of acceptable standards, providing broad authorization for the now defunct National Commission on Forensic Science

The hearing will examine how an updated version of the *Forensic Science and Standards Act* could be helpful in advancing forensic science research and the development and adoption of effective forensic standards.

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[11] https://nij.ojp.gov/coverdell-national-forensic-science-improvement-grants-program
[12] https://nij.ojp.gov/research-and-evaluation-publicly-funded-forensic-laboratories

Chairwoman JOHNSON. Good morning. This hearing will come to order.

I have to apologize for being late. There was a significant program commemorating 400 years since the first slaves were brought to this country over in Emancipation Hall, and I tried to show my presence and was late getting over. So I apologize for that.

But without objection, the Chair is authorized to declare recess at any time.

I'd like to welcome everyone to the hearing.

The criminal justice system relies on forensic science to identify and prosecute criminals and exonerate the falsely accused. Unfortunately, for too long, the science in forensic science was a misnomer. According to data from the Innocence Project, 367 individuals convicted of violent crimes across 37 States have been exonerated as a result of DNA evidence. Nearly half of these false convictions involved the misapplication of forensic science, most often because of the lack of science standards and training, but in some cases involving misconduct. I am deeply troubled by the likelihood that these numbers represent just the tip of the iceberg.

As revealed over many years of investigative reporting by the *Washington Post*, for decades there were people in this system who knew there were significant problems and stayed silent or perhaps tried to speak up but were silenced by those above them.

The 2009 report from the National Academy of Sciences (NAS), "Strengthening Forensic Science in the United States: A Path Forward" finally broke the silence and brought this issue into the public discourse. The central conclusion of the report was that the interpretation of forensic evidence across many disciplines was severely compromised by the lack of supporting science and standards. The National Academies recommended a number of steps to improve the accuracy, reliability, and validation for forensic evidence.

With a focus on the role of Federal science agencies, especially the National Institute of Standards and Technology (NIST), in 2012, I joined colleagues in the Senate to introduce the *Forensic Science and Standards Act*. I continued to reintroduce that legislation, but it never received a hearing until today.

As forensic science plays an increasing role in our criminal justice system, we are here today to explore how the Science Committee can help improve forensic science practices in the Nation. We'll learn about improvements since the NAS report, with an eye to the improvements that will need to be made. We will hear from the witnesses their recommendations on how to strengthen existing legislation. This is an excellent panel representing diverse perspectives, and we have a lot to learn from you.

We have all heard heartbreaking stories of men and women who have spent years, sometimes decades, in prison for a crime they did not commit. These wrongful convictions take a profound human toll on innocent men and women and their families and mar the reputation of the justice system. And that's not all. One study of 108 DNA exoneration cases found that 121 of the actual perpetrators went on to commit an additional 337 crimes, including rape and murder.

However, I am encouraged by all of the new partnerships and efforts among the various stakeholders that were spurred by the National Academies report. I look to my own State of Texas, which has a troubled history with false convictions, as an exemplar for forensic science transparency and improvements. If we can do this in Texas, we can do this anywhere.

I look forward to a spirited discussion and to working with my colleagues across the aisle to move bipartisan legislation through this Committee. And I thank the expert witnesses for your testimony today.

[The prepared statement of Chairwoman Johnson follows:]

Good morning and welcome to today's hearing.

The criminal justice system relies on forensic science to identify and prosecute criminals and exonerate the falsely accused. Unfortunately, for too long, the science in forensic science was a misnomer. According to data from the Innocence Project, 367 individuals convicted of violent crimes across 37 states have been exonerated as a result of DNA evidence.

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As revealed over many years of investigative reporting by the *Washington Post*, for decades there were people in this system who knew there were significant problems and stayed silent, or perhaps tried to speak up but were silenced by those above them. A 2009 report from the National Academies, *Strengthening Forensic Science in the United States: A Path Forward*, finally broke the silence and brought this issue into the public discourse. The central conclusion of the report was that the interpretation of forensic evidence, across many disciplines, was severely compromised by the lack of supporting science and standards.

The National Academies recommended a number of steps to improve the accuracy, reliability, and validity of forensic evidence. With a focus on the role of Federal science agencies, especially the National Institute of Standards and Technology, in 2012, I joined colleagues in the Senate to introduce the *Forensic Science and Standards Act*. I continued to reintroduce that bill but it never received a hearing, until today.

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I look forward to a spirited discussion and to working with my colleagues across the aisle to move bipartisan legislation through this Committee. And I thank the expert panel for your testimony today.

Chairwoman JOHNSON. I now will recognize Mr. Lucas.

Mr. LUCAS. Thank you, Chairwoman Johnson, for holding today's hearing on the state of forensic science in the United States.

Forensic science is the study and application of science to matters of law. As Members of the Science Committee, we're focused on the science part of the equation, but we can't ignore the law ei-

ther. The integrity of forensic science can have a profound impact on the lives of Americans who are victims of crime and those accused of committing a crime.

The Constitution states only one command twice. The Fifth Amendment says to the Federal Government that no one shall be "deprived of life, liberty or property without due process of law." The Fourteenth Amendment uses the same 11 words, called the due process clause, to describe a legal obligation of all States. These words are a commitment to fair trials and judgments at all levels of American government.

This is important because most forensic science methods, programs, and evidence are governed by State and local law enforcement entities or are covered by statutes and rules governing State judicial proceedings. Our task is to look at what role the Federal Government can play to advance the accurate, reliable, and fair use of forensic science. As forensic science plays an increasing role in our criminal justice system, it is important to make sure we are getting the science right and that all Americans have confidence in the fairness and integrity.

DNA evidence has revolutionized the justice system. When properly collected and analyzed, DNA can be useful to identify criminals with incredible accuracy. DNA can also be used to clear subjects and exonerate people mistakenly accused of committing crimes.

To date, over 350 individuals have been totally exonerated by DNA analysis. The science of DNA is well-established, but there are many other areas of forensic science that are still evolving such as human hair analysis and bite mark identification. The truth is forensic science is more complex than what is portrayed on popular television shows.

Even when the science is well-supported, putting it into practice in the field is a challenge. In many small police departments across the country, law enforcement is not afforded the luxury of specialization due to the community's size and caseload. Not all police officers can be experts in collecting and evaluating forensic evidence and may not be able to utilize groundbreaking new tools.

The National Science Foundation (NSF) and the National Institute of Standards and Technology can help address this. Both agencies do important work on forensic science, strengthening fundamental research and improving standards for the practice of forensic science in criminal investigation. I have said before that many Americans may not know the critical role NIST plays in our Nation's innovation.

Today is another fine example. We will hear more about their research in several forensic science disciplines and their administration of the Organization of Scientific Area Committees on Forensic Science (OSAC). Through OSAC, NIST is bringing together experts in science, measurement, statistics, law, and policy to develop and evaluate forensic science standards. It is challenging work getting these communities to cooperate, and I look forward to hearing how that process is going and any recommendations to make it better.

As the Chairwoman stated, it has been 10 years since the National Research Council issued their report, "Strengthening Forensic Science in the United States: A Path Forward." I'm glad we

have this opportunity to hear what progress has been made since then and what work still needs to be done.

We have a distinguished panel of witnesses today who will represent the science, law enforcement, and legal communities to help us understand the challenges and opportunities in forensics. I look forward to a balanced discussion of how we can all work together to ensure Americans trust in the use of science in our criminal justice system.

Thank you again, and I yield back, Madam Chair.

[The prepared statement of Mr. Lucas follows:]

Thank you, Chairwoman Johnson for holding today's hearing on the state of forensic science in the United States.Forensic science is the study and application of science to matters of law. As Members of the Science Committee, we're focused on the science part of the equation. But we can't ignore the law either. The integrity of forensic science can have a profound impact on the lives of Americans who are victims of crime, and those accused of committing a crime.

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I look forward to a balanced discussion of how we can all work together to ensure American trust in the use of science in our criminal justice system.

Thank you, and I yield back.

Chairwoman JOHNSON. Thank you, Mr. Lucas.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time I'd like to introduce our witnesses. Our first witness is Ms. Susan Ballou. Ms. Ballou is a Program Manager for the Forensic Science Research Program within the Special Programs Office of NIST. Prior to her time at NIST, she worked as a lead serologist for the Montgomery County Police Department Crime Laboratory in Rockville, Maryland. She has obtained expert status in Federal, State, and county circuit and district courts.

She holds a master of science in biotechnology from the Johns Hopkins University and a degree in criminal justice from the University of New Haven in Connecticut.

Our next witness, Ms. Lynn Garcia. Ms. Garcia is the General Counsel for the Texas Forensic Science Commission, a position she has held since December 2010. In this role, she assists the commission with investigations, manages the commission's laboratory accreditation and analyst licensing program, provides legal advice, and represents the commission at various public meetings. She obtained her J.D. from Georgetown University Law Center.

I would now like to recognize the Ranking Member Mr. Lucas to introduce the next witness.

Mr. LUCAS. Thank you, Madam Chair. And it's my honor to introduce my fellow Oklahoman, Ms. Vicki Zemp Behenna, who serves as the Executive Director of the Oklahoma Innocence Project. She was previously an Assistant United States Attorney for the Western District of Oklahoma, where she served with distinction for 25 years. As a prosecutor, she was involved in many high-profile cases, including serving on the team that prosecuted and attained the conviction of Timothy McVeigh in the Oklahoma City bombing case. The recipient of numerous awards in her career and she's now in private practice teaching as an adjunct professor at Oklahoma City University School of Law.

She received her bachelor's degree in journalism from the University of Oklahoma and her J.D. from the Oklahoma City University School of Law. Welcome and thank you for participating today, Vicki.

Chairwoman JOHNSON. Thank you, Mr. Lucas.

Our fourth witness is Dr. Karen Kafadar. Dr. Kafadar is Commonwealth Professor and Chair of Statistics at the University of Virginia. She currently serves as the President of the American Statistical Association. She served on the National Academy of Sciences committee that led to the publication of the 2009 report, "Strengthening the Forensic Science System in the United States: A Path Forward." She also previously chaired the Organization of Scientific Area Committees Statistical Task Group. Dr. Kafadar's research focuses on robust methods, characterization of uncertainty in the physical, chemical, biological, and engineering sciences and methodology for the analysis of screening trials.

She received her B.A. and M.S. from Stanford University and her Ph.D. in statistics from Princeton University.

Our final witness is Mr. Matthew Gamette. Mr. Gamette is Crime Lab Director with the Idaho State Police Forensic Services, a position he has held since 2014. He previously worked in the Spokane Laboratory of Washington State Patrol. Mr. Gamette currently serves as an elected board member of the American Society of Crime Lab Directors where he is President and Chair of the Advocacy Committee. He's also served as Chair of the Consortium of Forensic Science Organizations. In addition, he currently serves on the NIST Organization of Scientific Area Committees Quality Infrastructure Committee.

He received his bachelor's and master's degrees from Brigham Young University.

As our witnesses know, you will have 5 minutes for your spoken testimony. Your written testimony will be included in the record for the hearing. And when you have completed your spoken testimony, we will begin questions. Each Member will have 5 minutes to question the panel.

We will start now with Ms. Ballou.

TESTIMONY OF SUSAN BALLOU, PROGRAM MANAGER, OFFICE OF SPECIAL PROGRAMS, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Ms. BALLOU. Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, I am Susan Ballou, the Program Manager of the Forensic Science Research Program at the Department of Commerce's National Institute of Standards and Technology known as NIST. Thank you for the opportunity to appear before you today to discuss NIST's role in forensic science. I'll address three different ways that NIST contributes to forensic science: Research, development of reference materials standards and guidelines, and convening the forensic science community.

NIST established six focus areas of research: Firearms and associated tool marks, digital and identification forensics, forensic genetics, statistics, toxins, and trace. NIST frequently collaborates with other Federal agencies including the FBI (Federal Bureau of Investigation), DEA (Drug Enforcement Administration), DOD (Department of Defense), ATF (Bureau of Alcohol, Tobacco, Firearms and Explosives), and DHS (Department of Homeland Security), as well as State and local crime laboratories to identify key research areas.

The release of the 2009 National Research Council report highlighted areas where forensic science research was needed and made recommendations for improvements. NIST built on this report in areas related to strengthening the scientific foundation of forensic science examinations and focused on improving AFIS (Automated Fingerprint Identification System) interoperability and application of statistics to firearm examinations.

In 2012, NIST, based on collaboration with DOJ's National Institute of Justice, developed a process map of the steps involved in latent print examination. Important improvements have been made, and process maps are being created for other forensic disciplines, including handwriting, DNA, and firearms analysis.

Digital evidence is a growing area in forensic science. Ensuring the reliability of software tools used to extract data from computers and mobile devices is a critical need within the law enforcement community. NIST is actively assisting in testing computer forensic software tools. NIST also maintains the National Software Reference Library, which is used to improve efficiency in criminal investigation digital searches.

NIST research over the last 30 years has resulted in many improvements in DNA measurement. For example, NIST developed Standard Reference Materials or SRMs such as the human DNA standard. This SRM is used by DNA labs to make sure their instruments and methods are working properly, enabling accurate measurements of DNA markers commonly used in forensic laboratories worldwide for human identification. NIST continues to lay the statistical foundation for calculating match statistics that can help in cases with evidence that contain a mixture of DNA from several people.

To assist in firearms analysis, NIST has created a standard bullet and cartridge case to provide a calibrated measuring service to ensure 3-D surface scanning microscopes are properly calibrated. The SRM also improves interoperability between law enforcement agencies which increased hits across State borders resulting in law enforcement labs digitally comparing bullets and enabling confirmation that the same weapon was used in multiple crimes across multiple jurisdictions.

NIST research into the forensic science field of trace work on paint, glass, hair, fibers, and tape is breaking new ground. Using scientific methods, hair could be profiled using protein in the hair shaft. In this way, two specific hairs, one from a suspect and one from a crime scene, could be compared and given a stronger probability of having come from the same person. To identify anonymous hair found at a crime scene, a library of cataloged hair could be created much like the DNA database.

NIST has conducted research into trace detection of opioids and other illegal drugs to validate the accuracy of the identification and quantification of controlled substances. NIST is also developing methods to help investigators detect drugs at crime scenes, in cargo, at transit hubs, and tools to identify emerging synthetic and designer drugs. Detecting trace amounts can prevent exposure of first responders to these harmful drugs and identify the types of illicit fentanyl that drug dealers may lace their supply with. This research can also help first responders in determining the source of an overdose and how to treat the overdose victim.

Five years ago, NIST established the Organization of Scientific Area Committees for Forensic Science, or OSAC, to facilitate the development and promulgation of consensus-based documentary standards and guidelines. OSAC has a broad representation of stakeholders from the forensic science, legal, law enforcement, and research communities with more than 550 participants from 48 States. NIST stands ready to assist the forensic science community.

Thank you for the opportunity to testify on NIST's work regarding forensic science, and I'll be pleased to answer any questions you may have.

[The prepared statement of Ms. Ballou follows:]

15

Testimony of

Susan Ballou
Program Manager, Forensic Science Research Program
Special Programs Office
National Institute of Standards and Technology
United States Department of Commerce

Before the

Committee on Science, Space, and Technology
United States House of Representatives

Forensic Science and Standards: NIST's Role

September 10, 2019

Introduction
Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, I am Susan Ballou, the Program Manager of the Forensic Science Research Program within the Special Programs Office at the Department of Commerce's National Institute of Standards and Technology, or NIST. Thank you for the opportunity to appear before you today to discuss NIST's role in forensic science. I will address three different ways that NIST contributes to forensic science: research; development of reference materials, standards, and guidelines; and convening the forensic science community.

Research
Since 1929, NIST has been involved in forensic science, tackling issues that require years of dedicated research and high-tech instrumentation. With extensive expertise in many areas, NIST addresses national forensic science concerns such as DNA analysis, digital evidence, measurement science, and the opioid crisis. A few years ago, NIST established six focus areas of research: Firearms and Associated Tool Marks, Digital and Identification Forensics, Forensic Genetics, Statistics, Toxins, and Trace Detection. NIST frequently collaborates with other federal agencies as well as state and local crime laboratories.

The release of the 2009 National Research Council report, *Strengthening Forensic Science in the United States: A Path Forward*, highlighted areas where forensic science research was needed, and made recommendations for improvements. When the report was issued, NIST already had active projects addressing several of the recommendations. In response to the report's other recommendations, NIST worked to further ongoing efforts related to strengthening the scientific foundation of forensic science examinations in disciplines where NIST had existing expertise. In particular, NIST focused on improving Automated Fingerprint Identification System (AFIS) interoperability and application of statistics to firearm examinations. In the past few years, NIST has conducted research efforts in the current six focus areas.

NIST has worked with many partner federal agencies including the Federal Bureau of Investigation (FBI), the Department of Defense (DOD), the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), and the Department of Homeland Security (DHS), among others. For example, in 2012, NIST published a document entitled "*Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach*" following a two-and-a-half-year collaboration between NIST and the Department of Justice's National Institute of Justice. This document provides a process map of the steps involved in latent print examination as a means to view key decision points. Important improvements have come because of this work and process maps are being created for other forensic disciplines including handwriting, DNA, and firearms analysis.

Digital evidence is a growing area in forensic science. Ensuring the reliability of software tools used to extract data from computers and mobile devices is a critical need within the law enforcement community. NIST is actively assisting in testing computer forensic software tools. With support from numerous federal, state, and local law enforcement agencies, NIST also maintains the National Software Reference Library, which is used to improve efficiency in criminal investigation digital searches by eliminating the need to look at files from known software applications.

Development of Standards
NIST's research over the last 30 years has resulted in many improvements in DNA measurement. For example, NIST developed Standard Reference Materials (SRMs) such as the Human DNA Standard which is used by DNA labs to make sure their instruments and methods are working properly enabling accurate measurements of DNA markers commonly used in forensic laboratories worldwide for human identification.

NIST continues to lay the statistical foundation for calculating match statistics when using Next Generation Sequencing, or NGS, which produces DNA profiles that can be of greater utility in solving crimes. This research was jointly funded by NIST and the FBI. In cases where only a partial DNA profile is available, the extra data in an NGS-based profile might help solve the case. In addition, evidence that contains a mixture of DNA from several people can be difficult to interpret. The extra data in NGS-based profiles can help in those cases as well.

To assist in firearms analysis, NIST has created a standard bullet and cartridge case to provide a calibrated measuring surface for firearms examiners to test and determine whether their 3D surface scanning microscope is properly calibrated. The SRM also improves interoperability between law enforcement agencies which increased 'hits' across State borders." Previously, not using the same calibrations between agencies was a problem because a crime committed in one jurisdiction could not be linked to another crime in another jurisdiction. Using the NIST SRM, law enforcement labs can digitally compare bullets and get confirmation that same weapon was used in multiple crimes across multiple jurisdictions. NIST also continues to maintain the NIST Ballistics Toolmark Research Database, which is an open-access research database of bullet and cartridge case toolmark data.

NIST's research into in the forensic science field of trace work on paint, glass, hair, fibers and tape is breaking new ground. NIST is conducting work on improving the identification of paint chips, establishing requirements for a glass material standard, and a new way to examine hair. NIST, in collaboration with the FBI, is looking at the use of hair in human identification. Hair offers two significant advantages in linking a person with a location or a piece of clothing: it is easily transferred from the suspect, and is a resilient, non-perishable, artifact. Hair forensics currently uses physical examination such as pigmentation, diameter, scales etc. as a means of association. Using scientific methods, hair can be profiled using protein in the hair shaft. In this way two specific hairs, one from a suspect and one from a crime scene, could be compared and given a stronger probabilistic measure of having come from the same person. To identify anonymous hair found at a crime scene, a library of catalogued hair could be created in analogy to a DNA database.

NIST has conducted research into trace detection of opioids and other illegal drugs. NIST scientists developed SRMs that forensic science laboratories use to validate the accuracy of their identification and quantification of controlled substances. NIST researchers are also developing methods to help investigators detect drugs at crime scenes, in cargo, and at transit hubs, and they are developing tools to identify emerging synthetic and designer drugs. Detecting trace amounts can prevent exposure of first responders to these harmful drugs and identify the types of illicit

fentanyl that drug dealers may lace their supply with. This research can also help first responders in determining the source of an overdose and how to treat the overdose victim.

Convening the Forensic Science Community
Five years ago, NIST established the Organization of Scientific Area Committees for Forensic Science (OSAC) to facilitate the development and promulgation of consensus-based documentary standards and guidelines. This effort assesses whether these standards and guidelines are fit-for-purpose. OSAC has a broad representation of stakeholders from the forensic science, legal, law enforcement, and research communities with more than 550 participants.

NIST also conducts "scientific foundation reviews." The purpose of these reviews is to understand what is known and what data supports methods and practices used in the field. These scientific foundation reviews seek to develop a bibliography of foundational literature, to characterize capabilities and limitations, to identify knowledge gaps, and to share what is learned. The first scientific foundation review involves examining DNA mixture interpretation, and future reviews are planned with bitemark analysis, firearms examinations, and digital evidence. A challenge in conducting these reviews is that there are no standard universal methods in each forensic discipline; words like "validate" and "reliability" often have different meanings to different people. NIST has learned a lot during its initial review and will apply this knowledge during future reviews.

NIST stands ready to assist the forensic science community. Thank you for the opportunity to testify on NIST's work regarding forensic science. I will be pleased to answer any questions you may have.

Susan Ballou

Susan Ballou is the Program Manager for the Forensic Sciences Research Program within the Special Programs Office at the National Institute of Standards and Technology (NIST), Gaithersburg, Maryland. She is also the Federal Program Officer for the NIST Forensic Science Center of Excellence based at Iowa State University and appropriately titled: The Center for Statistics and Applications in Forensic Evidence (CSAFE). Prior to NIST, she served as the lead serologist for the Montgomery County Police Department (MCPD) Crime Laboratory in Rockville, Maryland. Several of her cases have been on the highly acclaimed TV series, Forensic Files. She has worked for the Commonwealth of Virginia Division of Consolidated Laboratory Services at their Merrifield location where she conducted analysis on evidence suspected of containing illicit drugs, body fluids and hairs and fibers. She also held a position as chemist in the Connecticut Office of the Chief Medical Examiner under the supervision of Chief Toxicologist, Dr. Randall Baselt. She holds a Master of Science degree in Biotechnology from The Johns Hopkins University and a Criminal Justice Undergraduate degree from the University of New Haven, West Haven, Connecticut. She has obtained expert status in Federal, State and County Circuit and District courts.

Ms. Ballou is past president of the American Academy of Forensic Sciences (AAFS), of the Mid-Atlantic Association of Forensic Scientists (MAAFS) and recipient of numerous awards to include; the ASTM Award of Merit – Honorary title of Fellow; Outstanding Contributions to the work of ASTM E30 on Forensic Sciences (2015), the AAFS, Criminalistics Section Mary E. Cowan Outstanding Service Award (2012), The ASTM Award of Appreciation – In Recognition of Outstanding Service as an ASTM Committee Chairman (2006-2007), the Department of Commerce Equal Employment Opportunity/Diversity Award (2005), the Department of Commerce Silver Medal (2003), the Outstanding Service Award Rendered for Justice and For the People of Montgomery County, The Assistant States Attorney's Office Montgomery County, MD, (1987-2000) and the Commendation Award, Partners for a Healthier Maryland, Montgomery County Department of Health and Human Services and Shady Grove Hospital, (1997).

Chairwoman JOHNSON. Thank you very much. Ms. Garcia.

TESTIMONY OF LYNN GARCIA,
GENERAL COUNSEL, TEXAS FORENSIC SCIENCE COMMISSION

Ms. GARCIA. Chairwoman Johnson, Ranking Member Lucas, and Members, my name is Lynn Garcia, and I'm the General Counsel of the Texas Forensic Science Commission (Commission). Thank you for inviting me here to discuss the progress Texas has made in the 10 years since the NAS report was published.

The Texas legislature created our Commission in 2005 in the wake of a crisis in the Houston Police Department crime lab. At first, the legislature gave our Commission one job: To investigate allegations of professional negligence and misconduct against forensic laboratories. Over time, the Commission has evolved into an oversight body that crime labs, law enforcement, and attorneys all rely upon for fair consideration of scientific issues. We have nine members—seven scientists and two attorneys—all appointed by the Governor of Texas.

Using the core values of transparency, accountability, and collaboration, the Commission has taken on major initiatives in many of the areas mentioned in the NAS report. For example, we recognize that national accreditation programs under ISO are important but not a panacea. We use our statutory authority to supplement the work of the accrediting bodies, including additional audits, where needed.

We also require our forensic analyst to be licensed. In the rare case that an analyst commits professional misconduct in our State, he or she may face disciplinary action up to and including revocation of the license. We maintain a code of professional responsibility for analysts and crime lab management so that everyone shares the same expectations. We provide ongoing guidance on challenging scientific issues from DNA mixture interpretation to efficient analytical methods for distinguishing hemp from marijuana. We also act as a facilitator and translator between the scientific and legal communities.

Texas law requires crime labs to self-disclose nonconformities. We provide an open and transparent venue for resolving them outside of the adversarial system. We also partner with the Court of Criminal Appeals to promote forensic education and training of judges and lawyers, and we recently worked with the Texas Commission on Law Enforcement to improve crime scene training provided to peace officers.

Finally, and this is a recent development, we're partnering with NIST in two key areas. The first is in the evaluation of OSAC standards for implementation in Texas, and the second is with respect to improving existing accreditation programs for our laboratories. One area where we could use Federal support is for forensic science research such as the initiatives contemplated by H.R. 5795. State and local crime labs face tremendous caseload demands, thus leaving precious little time for research. While we strongly believe the oversight of forensic laboratories should be left to the States, increased support from the Federal Government for forensic research would be helpful not just for Texas but for all States.

We would also like to stress the need to reauthorize the *Debbie Smith Act*. This legislation dedicates much-needed resources to State and local law enforcement agencies to conduct forensic analyses of crime scenes, including untested sexual assault kits.

I would like to close my remarks by reading a few lines from the murder trial of Steven Mark Chaney from Dallas, Texas. Mr. Chaney was sentenced to life in prison and served 28 years. The lines I'm about to read are from the direct examination of a forensic dentist who testified as the State's expert. Question: "Can you express your opinion?" Answer: "With reasonable dental certainty and scientific certainty I feel that Steven Mark Chaney made the bite mark on John Sweek." Question: "And you also testified that someone else in the world possibly could have made that bite mark. Do you have any odds?" Answer: "One to a million." Question: "Does that appear in the scientific literature?" Answer: "Yes."

On December 19, 2018, Mr. Chaney was declared actually innocent by the Texas Court of Criminal Appeals, the State's highest criminal court. The Commission reviewed a complaint filed by Mr. Chaney regarding the bite mark analysis in his case. Our members examined published literature, listened to presentations from a range of forensic dentists, including those who support the use of bite mark comparison and those who do not. And after listening to all sides, the Commission recommended bite mark comparison not be admitted in criminal trials unless and until sufficient data exists to indicate that such comparisons can be made reliably and accurately.

While we understand and appreciate our commission is not a court and gatekeeping decisions are ultimately the responsibility of the judiciary, we try to provide useful information to judges to assist them in making difficult gatekeeping decisions. What we found that is that, by and large, they welcome the information. The vast majority of judges want nothing more than to make the right call. They just don't always have the tools they need to do it.

Texas is a law-and-order State, and with that core value comes great responsibility. The Texas legislature understands this, the Governor of Texas understands this. Legislators from both parties have worked session after session to create meaningful progress when it comes to the quality of forensic science used in our State.

Is it perfect? No. Do we still have work to do? Absolutely. But in reflecting upon the last decade, Texas has shown tremendous leadership in forensic science reform. It has been an honor for me to share that story with you today, and I'll happily answer any questions. Thank you.

[The prepared statement of Ms. Garcia follows:]

TESTIMONY

By

Lynn R. Garcia
General Counsel
Texas Forensic Science Commission

On

Raising the Bar: Progress and Future Needs in Forensic Science

Submitted to the

UNITED STATES HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, & TECHNOLOGY

Committee Hearing
Tuesday, September 10, 2019

Chairwoman Johnson, Ranking Member Lucas and Members:

My name is Lynn Garcia, and I am the General Counsel of the Texas Forensic Science Commission (Commission). Thank you for inviting me to share the progress Texas has made in the ten years since the publication of the National Academy of Sciences Report, *Strengthening Forensic Science in the United States: A Path Forward.*

The Texas Commission was created in the wake of a crisis. In 2002, the City of Houston and the Houston Police Department (HPD) commissioned an investigation after serious questions were raised regarding the quality of the forensic analyses at the HPD crime lab. The investigation lasted two years and resulted in a report that was highly critical of the scientific practices and management of the laboratory.

In 2005, the Texas Legislature created the Commission as the main oversight body for forensic science service providers in Texas. The Commission includes seven scientists and two attorneys. All members are appointed by the Governor. A table of current appointees is attached as *Appendix A*. The Commission is administratively attached to the Office of Court Administration, a judicial branch agency. An organizational chart is attached as *Appendix B*.

The Commission's current budget is $1.4 million per biennium. We currently have four full-time staff members.

I. Investigating Complaints re: Professional Negligence and Misconduct

Initially, the Legislature gave the Commission one job—to investigate allegations of professional negligence and misconduct against forensic laboratories.

The Commission has conducted investigations and issued reports in many different forensic disciplines, including: DNA analysis; seized drug analysis, forensic toxicology; firearm and tool mark examination; materials (trace); forensic video analysis; bite mark comparison; and bloodstain pattern analysis.

Texas law requires the Commission to issue investigative reports describing: (1) the alleged negligence or misconduct; (2) a conclusion regarding whether negligence or misconduct actually occurred; (3) any corrective action required of the laboratory; (4) observations regarding the integrity and reliability of the forensic analysis conducted; and (5) best practices identified during the course of the investigation, or other recommendations the Commission deems relevant.

In addition, Commission reports may include: (1) retrospective reexamination of other forensic analyses conducted by the laboratory that may involve the same kind of negligence or misconduct; and (2) follow-up evaluations of the laboratory to review: (a) implementation of any corrective action required; or (b) conclusion of any retrospective reexamination.

However, there are important limitations on the Commission's jurisdiction. For example, the Commission may not issue a finding relating to the guilt or innocence of any party in a civil or criminal trial involving conduct investigated by the Commission. Commission reports are not

admissible in a civil or criminal action. Information filed or obtained as part of a complaint or laboratory self-disclosure is not subject to release under the Public Information Act until the conclusion of a Commission investigation.[1]

Over time, the Commission has evolved into an oversight body that crime laboratories, law enforcement, prosecutors and defense attorneys all rely upon for fair consideration of serious scientific issues. They know the Commissioners have one goal in mind: to improve forensic science in our state. Commission members bring their scientific expertise to bear for the purpose of making incremental and meaningful change. Using the core values of transparency, accountability and collaboration, the Commission has taken on major initiatives in many of the key areas mentioned in the NAS Report.

Example of a Commission Investigation—Bite Mark Comparison (Dallas, TX: Steven Chaney)

One example of an investigation performed by the Commission was with respect to the bite mark comparison used in the murder trial of Steven Mark Chaney in Dallas, Texas. Mr. Chaney was convicted of murdering Sally and John Sweeks. He was sentenced to life in prison and served 28 years. The following transcript excerpt is from the direct examination of forensic dentist Jim Hales, an expert proffered by the State:

QUESTION: Can you express your opinion?

ANSWER: With reasonable dental certainty and scientific certainty, I feel that Steven Mark Chaney made the bite mark on John Sweek.

QUESTION: And you also testified that someone else in the world possibly could have made that bite mark. Do you have any odds?

ANSWER: One to a million.

QUESTION: Does that appear in the scientific literature?

ANSWER: Yes

On December 19, 2018, Mr. Chaney was declared actually innocent by the Texas Court of Criminal Appeals, the state's highest criminal court. The Court concluded that had the bite mark evidence been presented at trial under current scientific standards, Mr. Chaney would not have been convicted. The Court further noted the bite mark evidence was central to the State's case—so much so the State argued to the jury that it should convict on the bite mark evidence. During closing argument, the State reminded the jury that Dr. Hales testified only one in a million people could have possibly made the bite mark, asking rhetorically, "What more do you need?"

In reviewing Mr. Chaney's complaint, the Commission examined published literature, listened to presentations from a range of forensic dentists, including those who support the use of bite mark comparison in criminal cases and those who do not.

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[1] *See* Tex. Att'y Gen. OR2014-16371.

Contrary to what Dr. Hales said in Mr. Chaney's trial, the scientific literature does not support the notion that an individual's dentition can be compared reliably to an impression left on human skin. Skin is a poor medium for recording impressions for comparison. The literature also does not support the idea that any statistical analysis can be validly applied to the question of how frequently such an impression would be seen in the population. After listening to all sides, the Commission, for the first time in its history, issued a recommendation to the judiciary that bite mark comparison not be admitted in criminal trials unless and until sufficient data are developed to support that such comparisons can be made reliably and accurately.

While we understand and appreciate the Commission is not a court, and gatekeeping decisions are ultimately the responsibility of the judiciary, we try to provide information to judges to assist them with making these difficult scientific gatekeeping decisions. What we have found is that by and large, they welcome the information. The vast majority of judges want nothing more than to make the right call. They just don't always have the tools they need to do it.

II. Accreditation of Crime Laboratories

The Commission is the accrediting authority for entities that perform forensic analysis in Texas.[2] There are 87 total laboratories accredited in Texas, 45 of which are located in Texas and 42 located outside of Texas.[3]

Pursuant to its accreditation authority, the Commission may also:

1. Establish minimum standards that relate to the timely production of forensic analysis;
2. Validate or approve specific forensic methods or methodologies;
3. Establish procedures, policies, and practices to improve the quality of forensic analyses.[4]

The Commission recognizes certain external accrediting bodies for purposes of determining whether a particular laboratory or entity should be considered accredited under Texas law. For purposes of this discussion, the two main accrediting bodies are the ANSI National Accreditation Board (ANAB) and the American Association for Laboratory Accreditation (A2LA). The Commission recognizes accreditation pursuant to ISO 17025 or 17020, including the forensic supplemental standards.

In addition to confirming a laboratory's accreditation status, in some cases the Commission has exercised its authority to "enter and inspect the premises or audit the records, reports, procedures, or other quality assurance matters of a crime laboratory that is accredited or seeking accreditation."[5] Historically, the Commission has reserved the exercise of this authority for situations in which either the laboratory's internal review process or the standard accreditation checks and balances were insufficient to identify and correct issues of concern.

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[2] TEX. CODE CRIM. PROC. art. 38.01 § 4-d.
[3] http://txcourts.gov/fsc/accreditation/
[4] *Id.* at § 4-d(b-1).
[5] *Id.* at § 4-d(d).

However, the Commission is not itself an accrediting body nor could it assume the role of accrediting body effectively given current resources. The Commission relies in significant part on its relationship with the external accrediting bodies to ensure the reliability of forensic analyses produced by accredited laboratories in Texas.

Understanding the Limitations of Accreditation

Accreditation is a critical component of quality forensic analysis. However, the significance of accreditation has often been overstated by criminal justice stakeholders as a guarantee of quality. For example, consider the following testimony:

> Q. Now, when we hear something like accredited, that sounds good, but what does that actually mean as far as the protocols that y'all have to follow in order to maintain that certification?
>
> A. Well, to be accredited, you're actually inspected by the accrediting agency, and they review your procedures to make sure that the procedures that you're following are scientifically valid, as well as accepted in the forensic community. They will come in and check out all of your operations, and then they routinely check—the accreditation cycle is actually a five-year cycle, but they do routinely check every year, or two years to make sure that you're following their guidelines and practices.

Similarly, an assessment team from the Major Cities Chiefs Association made the following statement in the report issued after a Texas laboratory's organization structure audit:

> "The [lab] is an ISO 17025 accredited laboratory, compliant with all relevant forensic standards and the FBI QAS, as demonstrated by its current accreditation. While the assessment team did not conduct an ISO assessment, it was readily apparent that the laboratory and its staff upheld the high standards of accreditation."

Statements like these reflect the emphasis stakeholders place on the accreditation process as an indicator of reliability and validity of scientific procedures and policy in the crime laboratory.

In this same laboratory example, the Commission observed fundamental weaknesses in the DNA section not long after the Major Cities Chiefs Association issued the statement above relying on accreditation as a key indicator of quality. Fundamental lapses persisted at the laboratory despite 17 internal and external audits from 2004 to 2015 performed by ASCLD/LAB and other auditors pursuant to the FBI's Quality Assurance Standards.

In another laboratory, Commissioners were concerned about weaknesses in the accreditation system with respect to the accrediting body's review of internal validation. The review occurred after the improper use of overblown data in DNA interpretation in a sexual assault case. ASCLD/LAB concluded there were no issues with the laboratory's validation studies without reviewing a single case file to assess how the laboratory's validation work was reflected in case analysis.

After an investigation by the Commission, the laboratory's executive management engaged in an extensive and difficult exercise in self-reflection, during which they concluded: "there was a cultural over-reliance . . . at all levels, regarding the role and purpose of ISO 17025 accreditation by ASCLD/LAB (subsequently ANAB) and FBI-QAS, and *widespread assumptions that the accreditation and the associated review and inspections could be relied on for reassurance that the laboratory's procedures were in fact in compliance with industry standards*."

These examples highlight that failed checks and balances have an adverse impact on all stakeholders—the laboratory itself, the accrediting body, and the lawyers and judges who rely on the laboratory's work product.

III. Collaboration with NIST's Standards Coordination Office on Accreditation Improvement

The National Institute of Standards and Technology (NIST) Standards Coordination Office (SCO) provides assistance to government agencies, including state regulators, regarding how to work with accrediting bodies to tailor standards and accreditation programs in a way that will best serve the impacted community. In this case, the "impacted community" includes forensic science service providers and their end-users in Texas.

The SCO has offered to assist the Commission with the development of an overarching quality infrastructure standard for laboratories that may be tailored to suit Texas' needs. Under this framework, Texas will work with existing accrediting bodies to develop a plan for improving the accreditation programs in Texas, with particular focus on internal validation, training to competence, qualifications of assessors, integration of key aspects of the Texas Code of Professional Responsibility, transparency and disclosure, and related issues.

IV. Licensing of Forensic Analysts

As of January 1, 2019, all forensic analysts must be licensed in Texas if they are to perform forensic analysis in Texas cases. The term "forensic analyst" means any person who on behalf of a crime laboratory accredited under Texas law technically reviews or performs a forensic analysis or draws conclusions from or interprets a forensic analysis for a court or crime laboratory. The term does not include medical examiners or other forensic pathologists who are licensed physicians.

The Commission established qualifications and adopted administrative rules with regard to forensic analyst licensing that are published in the Texas Administrative Code.[6] Requirements for forensic analyst and/or technicians to become licensed include:

1. Minimum education requirements;
2. Understanding and appreciation of Code of Professional Responsibility and related laws;
3. Successful completion of a General Forensic Analyst or Technician Licensing Exam;
4. Specific coursework requirements; and
5. Proficiency testing requirements.

[6] 37 Tex. Admin. Code § 651.201-220 (Tex. Forensic Sci. Comm'n., Forensic Analyst Licensing Program).

In addition to mandatory licensing for forensic analysts in accredited disciplines, the Commission may also establish voluntary licensing programs for forensic disciplines not subject to accreditation under Texas law. One example of a voluntary license program currently underway in collaboration with law enforcement is in the area of crime scene reconstruction.

To date, the Commission has licensed 1,261 forensic analysts and technicians.

V. Code of Professional Responsibility

The Commission also developed and published a Code of Professional Responsibility for Analysts and Laboratory Management, so all stakeholders involved in the critical work of forensic science share the same expectations. The Code addresses all aspects of forensic analysis, from submission of evidence through testing, interpretation of data, reporting, testimony and post-conviction obligations. A copy of the Code is attached as *Appendix C.*

VI. Statewide Triage Systems for Retroactive Case Reviews: DNA Mixtures, Hair Microscopy, Bite Mark Comparison

From time to time, the forensic community becomes aware of broad-based concerns in a given forensic discipline. Examples in the last few years include complex DNA mixture interpretation and microscopic hair comparison. Texas laboratories take these issues seriously, and are committed to reviewing casework as needed to protect against potential miscarriages of justice. The challenge in conducting any retroactive case review is to do so in a way that targets cases needing attention efficiently and effectively. Using collaborative statewide triage methods and with the support of grant funding, the Commission has facilitated reviews in DNA mixture interpretation, microscopic hair comparison and bite mark comparison. Additional work is currently underway in the discipline of bloodstain pattern analysis.

VII. Self-Disclosures of Nonconformities by Forensic Laboratories

Texas law requires crime laboratories to disclose significant nonconformities to the Commission. Though the adversarial process is a core component of fairness in our judicial system, it is not the most efficient way to address laboratory nonconformities. The Commission provides an open and transparent venue for resolution. To date, the Commission has reviewed and addressed 75 significant self-disclosures submitted by Texas laboratories.

VIII. Forensic Education and Training for Lawyers, Judges and Law Enforcement

The Commission works with the Court of Criminal Appeals under a grant program to promote education and training of judges and lawyers in the area of forensic science. We also partnered with the Texas Commission on Law Enforcement to enhance the crime scene training provided to peace officers through the Basic Peace Officer Course.

IX. Review and Integration of NIST OSAC Standards and Guidelines in Texas

Finally—and this is a recent development—we are partnering with NIST in two critical areas. The first was discussed in the accreditation section above. The second involves a review of

Organization of Scientific Area Committee standards and guidelines for purposes of assessing their viability for implementation in Texas. In both of these areas, NIST has tremendous expertise, and we look forward to an effective federal-state collaboration.

X. Support for Forensic Science Research

One additional area in which state and local labs could use federal support is foundational research. Though the Texas Legislature has significantly increased funding to our Commission, we do not have the capacity to conduct the types of research activities contemplated by legislation such as the Forensic Science and Standards Act of 2016 (H.R. 5795). Most crime laboratories face tremendous caseload demands, thus leaving precious little time for research. While we strongly believe the oversight of forensic laboratories should be left to the states, increased support from the federal government for forensic science research would be helpful not just for Texas, but for all states.

Finally, we would also like to emphasize the need to reauthorize the Debbie Smith Act before its September expiration date. This legislation dedicates much-needed resources to state and local law enforcement agencies to conduct forensic analyses of crime scenes, especially DNA typing for untested rape kits.

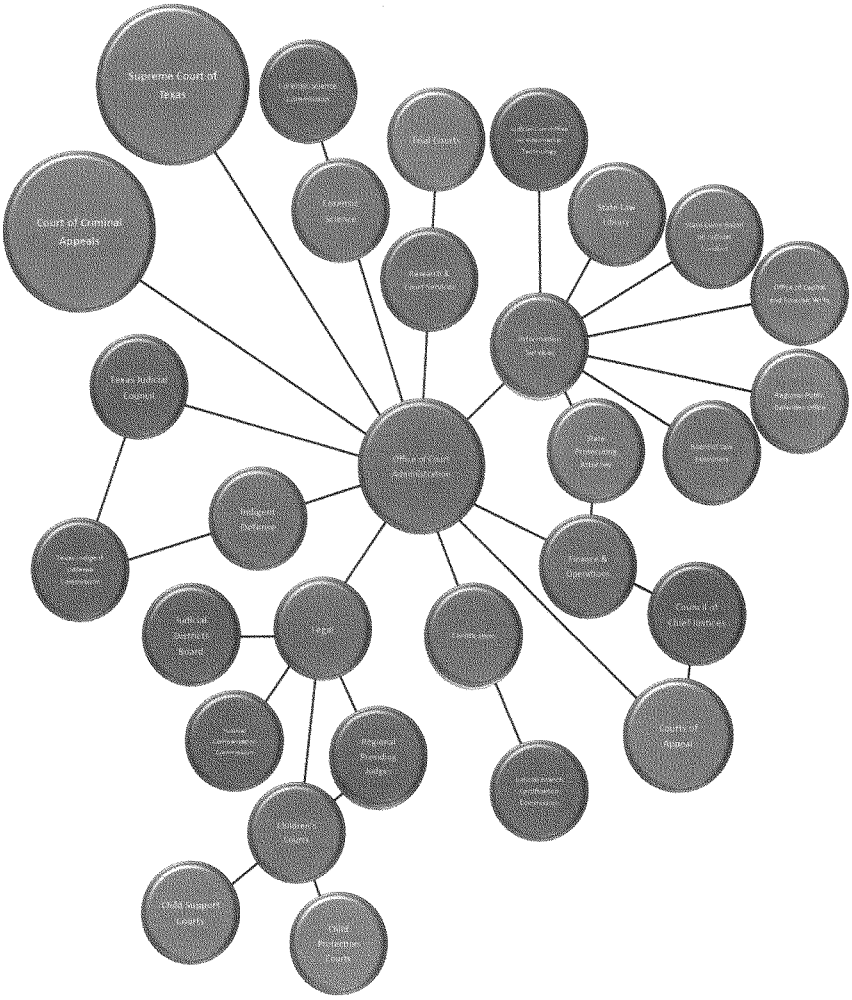
Closing Remarks

Texas is a law and order state, and with that core value comes great responsibility. The Texas Legislature understands this. The Governor of Texas understands this. Individual members of the Legislature from both parties have worked legislative session after session to effect meaningful progress when it comes to the quality of forensic science used in our state.

Is it perfect? No. Do we still have work to do? Absolutely.

But in reflecting upon the last decade, Texas has shown tremendous leadership in forensic science reform. Thank you for letting me share that story with you. I would be happy to answer any questions you may have.

APPENDIX A: ORGANIZATIONAL CHART



APPENDIX B: MEMBERSHIP

Name	Basis for Appointment	Date Appointed	Title
Jeffrey Barnard, MD (Dallas) *Presiding Officer*	University of Texas (Dallas)—Forensic Pathology Art 38.01, Section 3(a)(4)	10/31/11	Chief Medical Examiner, Dallas County; Director, Southwestern Institute of Forensic Sciences; Professor of Pathology, University of Texas Southwestern Medical Center
Bruce Budowle, Ph.D. (Fort Worth)	University of North Texas Health Science Center/Center for Human Identification Article 38.01, Section 3(a)(7)	11/28/16	Director, University of North Texas Center for Human Identification
Mark Daniel, J.D. (Fort Worth)	Texas Criminal Defense Lawyer's Association Article 38.01, Section 3(a)(3)	11/28/16	Criminal Defense Attorney & Partner, Evans, Daniel, Moore, Evans, Biggs and Decker
Nancy Downing, Ph.D. (Bryan/College Station)	Texas A&M University—Forensic Nursing Article 38.01, Section 3(a)(5)	11/28/16	Associate Professor, Texas A&M University College of Nursing; Forensic Nurse, Baylor, Scott & White Hospital; Chair, International Association of Forensic Nurses Campus Sexual Assault Task Force
Jasmine Drake, Ph.D. (Houston)	Texas Southern University—Forensic Chemistry Article 38.01, Section 3(a)(6)	11/28/16	Assistant Professor/Laboratory Coordinator, Texas Southern University Barbara Jordan-Mickey Leland School of Public Affairs, Department of Administration of Justice
Patrick Buzzini, Ph.D (Huntsville)	Sam Houston State University—Materials (Trace Evidence) (Huntsville) Article 38.01. Section 3(a)(8)	4/4/19	Associate Professor, Sam Houston State University, Department of Forensic Science
Pat Johnson, M.S. (Austin)	Forensic Expert (General Seat)—Former Director of Texas Department of Public Safety Crime Lab System—Forensic Chemistry Article 38.01, Section 3(a)(1)	11/28/16	Retired Deputy Assistant Director, Texas Department of Public Safety Crime Laboratory Services
Sarah Kerrigan, Ph.D. (The Woodlands)	Forensic Expert (General)—Forensic Toxicology/Sam Houston State University Article 38.01, Section 3(a)(1)	11/28/16	Chair, Sam Houston State University, Department of Forensic Science; Director, Institute for Forensic Research, Training and Innovation at Sam Houston State University
Jarvis Parsons, J.D. (Bryan/College Station)	Texas District and County Attorney's Association— Article 38.01, Section 3(a)(2).	11/28/16	District Attorney, Brazos County Texas; President, Texas District & County Attorneys Association

APPENDIX C: CODE OF PROFESSIONAL RESPONSIBILITY

Code of Professional Responsibility for Forensic Analysts and Crime Laboratory Management Subject to the Jurisdiction of the Texas Forensic Science Commission

(a) The Code of Professional Responsibility ("Code") for forensic analysts and crime laboratory management defines a framework for promoting integrity and respect for the scientific process and encouraging transparency in forensic analysis in Texas. Because certain components of the Code are best suited to individual forensic analysts while others are best suited to laboratory management, the Code is divided into two sections.

(b) Each forensic analyst shall:

(1) Accurately represent his/her education, training, experience, and areas of expertise.
(2) Commit to continuous learning in the forensic disciplines and stay abreast of new findings, equipment and techniques to maintain professional competency.
(3) Promote validation and incorporation of new technologies, guarding against the use of non-valid methods in casework and the misapplication of validated methods.
(4) Avoid tampering, adulteration, loss, or unnecessary consumption of evidentiary materials.
(5) Avoid participation in any case where there are personal, financial, employment-related or other conflicts of interest.
(6) Conduct thorough, fair and unbiased examinations, leading to independent, impartial, and objective opinions and conclusions.
(7) Make and retain full, contemporaneous, clear and accurate written records of all examinations and tests conducted and conclusions drawn, in sufficient detail to allow meaningful review and assessment by an independent person competent in the field.
(8) Base conclusions on procedures supported by sufficient data, standards and controls, not on political pressure or other outside influence.
(9) Not offer opinions or conclusions that are outside one's expertise.
(10) Prepare reports in clear terms, distinguishing data from interpretations and opinions, and disclosing any relevant limitations to guard against making invalid inferences or misleading the judge or jury.
(11) Not issue reports or other records, or withhold information from reports for strategic or tactical litigation advantage.
(12) Present accurate and complete data in reports, oral and written presentations and testimony based on good scientific practices and valid methods.
(13) Testify in a manner which is clear, straightforward and objective, and avoid phrasing testimony in an ambiguous, biased or misleading manner.
(14) Retain any record, item or object related to a case, such as work notes, data, and peer or technical review information due to potential evidentiary value and pursuant to the laboratory's retention policy.
(15) Communicate honestly and fully with all parties (investigators, prosecutors, defense attorneys, and other expert witnesses), unless prohibited by law.
(16) Document and notify management or quality assurance personnel of adverse events, such as an unintended mistake or a breach of ethical, legal, scientific standards, or questionable conduct.

(17) Ensure reporting, through proper management channels, to all impacted scientific and legal parties of any adverse event that affects a previously issued report or testimony.

(c) Members of crime laboratory management shall:

(1) Encourage a quality-focused culture that embraces transparency, accountability and continuing education while resisting individual blame or scapegoating.
(2) Provide opportunities for forensic analysts to stay abreast of new scientific findings, technology and techniques while guarding against the use of non-valid methods in casework, the misapplication of validated methods or improper testimony regarding a particular analytical method or result.
(3) Maintain case retention and management policies and systems based on the presumption that there is potential evidentiary value for any information related to a case, including work notes, analytical and validation data, and peer or technical review.
(4) Provide clear communication and reporting systems through which forensic analysts may report to management non-conformities in the quality system and other adverse events, such as an unintended mistake or a breach of ethical, legal, scientific standards, or questionable conduct.
(5) Make timely and full disclosure to the Texas Forensic Science Commission of any non-conformance that may rise to the level of professional negligence or professional misconduct.
(6) Provide copies of all substantive communications with the laboratory's national accrediting body to the Commission.
(7) For any laboratory that performs forensic analysis on behalf of the State of Texas, develop and follow a written forensic disclosure compliance policy for the purpose of ensuring the laboratory's compliance with article 39.14 of the Texas Code of Criminal Procedure.
(8) Ensure the laboratory's forensic disclosure policy provides clear instructions for identifying and disclosing any exculpatory, impeachment, or mitigating document, item, or information in the possession, custody, or control of the laboratory. The policy should explicitly address how to inform potentially affected recipients of any non-conformances or breaches of law or ethical standards that may adversely affect either a current case or a previously issued report or testimony.
(9) Inform all forensic analysts working on behalf of the laboratory that they may report allegations of professional negligence or professional misconduct to the Texas Forensic Science Commission without fear of adverse employment consequences.

Lynn R. Garcia

General Counsel | Texas Forensic Science Commission

Lynn Garcia joined the Forensic Science Commission as General Counsel on December 14, 2010. Ms. Garcia assists the Commission with investigations, manages the Commission's laboratory accreditation and analyst licensing programs, provides legal advice, tracks developments in legislation relevant to the FSC's mission, and represents the FSC at various public meetings. In November 2018, Garcia was named an "influential Texan" in Texas Monthly's Power Edition for her role in helping to make the Commission one of the most important forensic science oversight bodies in the country. Ms. Garcia obtained her JD from Georgetown University Law Center in Washington, DC in 2000 and has been practicing law for 19 years.

Chairwoman JOHNSON. Thank you very much. Ms. Behenna.

TESTIMONY OF VICKI ZEMP BEHENNA, EXECUTIVE DIRECTOR, OKLAHOMA INNOCENCE PROJECT

Ms. BEHENNA. Thank you, Chairwoman Johnson and Ranking Member Lucas and distinguished Members of this Committee for the opportunity to discuss with you the intersection of forensic science in criminal trials.

My name is Vicki Behenna, and I became the Executive Director of the Oklahoma Innocence Project in October 2015. Oklahoma City University houses the Oklahoma Innocence Project.

As previously stated, I was a Federal prosecutor for 25 years. As part of my experience as being a Federal prosecutor, I had the opportunity to assist in the prosecution of Timothy McVeigh. That was my first experience with the use of forensic science in a criminal prosecution.

In 2009, I had a personal experience where a close family member of mine was going through a trial where forensic science was hidden. Exculpatory evidence was not provided, leading to his conviction. It was that experience that caused me to retire as a Federal prosecutor after 25 years and to join the Oklahoma City Innocence Project because I understood from personal experience the effect bad forensic science or Brady violations can have on individuals who are accused in our criminal justice system.

The weight that forensic science plays in modern trials cannot be overstated. Lawyers, while we like to think that we know everything about our case, cannot know science as well as the scientists do. As a prosecutor, when a forensic scientist or analyst came into my office and explained to me what this forensic science meant and its value in the prosecution of the case I was trying became increasingly important to me, and I relied upon that expert's opinion.

What we have seen in Oklahoma through an individual by the name of Joyce Gilchrist, who was a chemist with the Oklahoma City Police Department, is that when forensic scientists and analysts overstate the interpretation of forensic science, when they overstate hair analysis, when they overstate and use bite mark evidence and tell the prosecutor that that evidence proves—that bite mark proves that this individual committed—or was there and committed this act, we rely upon that, as I said before, because lawyers can never know the science as well as the scientists and analysts do.

Juries in our criminal justice system are the triers of the facts. That's their role. They listen to the evidence that's presented. They listen to the expert testimony given, and they judge witness demeanor and credibility based upon their role of being the judges of the facts. When experts come into a courtroom and they tell the jury this hair came from this individual or they give a statistical number that this hair could only have come from this many individuals in society, jurors believe that. They rely upon that in making decisions. When bad forensic science is used, the results are devastating for those who are accused of crimes in our criminal justice system.

What I see with the Oklahoma Innocence Project is that many times people serve decades in prison based upon bad forensic

science. Not all individuals and forensic scientists are like Joyce Gilchrist. And I hate to keep coming back and using that as an example, but it's something that happened in Oklahoma's present and as part of what's happened in our modern history. But we need standards. Lawyers need standards. Judges need standards. And we need to rely on the forensic scientists when they're testifying in court are testifying honestly and openly about the science they've been asked to testify about.

The Innocence Project has made numerous recommendations that are part of my written testimony, and I won't go over that here, but our criminal justice system is designed to seek the truth. It is designed to equally protect victims and the accused. Because of the highly persuasive impact of forensic science and forensic experts have on the scales of justice, it's imperative that the science is validated and that forensic experts are supported with the scientific resources they need and that judges are properly educated in their gatekeeping functions. Thank you.

[The prepared statement of Ms. Behenna follows:]

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY:

Raising the Bar: Progress and Future Needs in Forensic Science
September 10, 2019
Testimony of Vicki Zemp Behenna
Executive Director Oklahoma Innocence Project

Thank you Chairwoman Johnson, Ranking Member Lucas, and distinguished members of the Committee, for the opportunity to discuss how we can work collectively to improve forensic science. My name is Vicki Behenna and I became the Executive Director of the Oklahoma Innocence Project (OKIP) in October 2015. OKIP is housed at Oklahoma City University School of Law. OKIP is an organization dedicated to identifying and remedying cases of wrongful convictions in Oklahoma. Our legal clinic brings OCU law students and Oklahoma attorneys together to free people who have been wrongfully convicted. OKIP pursues only cases in which there is credible evidence of factual innocence.

In November 2013, I retired as a federal prosecutor in the Western District of Oklahoma after serving in that capacity for 25 years. During my tenure as a federal prosecutor I was appointed by Attorney General Janet Reno to represent the United States in the case against Timothy McVeigh, the person convicted of detonating a 4,000-pound ANFO bomb in front of the Murrah building in Oklahoma City, killing 168 innocent people. That was in 1995, and was my first real experience in the use of forensic evidence to tie a defendant to criminal activity.

In 2009 I had a personal experience with a close family member wherein forensic evidence that could have been used to exonerate the accused was instead hidden in an attempt to secure his conviction. It was that experience that lead to my retirement as a federal prosecutor, and desire to work with OKIP. Since then I have become familiar with the FBI's February 26, 2016 letter to Oklahoma's Governor on the issues with microscopic hair comparison. OKIP is working with the Oklahoma State Bureau of Investigation to review convictions obtained through exaggerated hair analysis testimony.

The weight forensic evidence plays in modern criminal trials cannot be overstated. It is a powerful tool used to connect an accused person to a crime. In criminal trials, prosecutors use forensic experts to analyze crime scenes, to identify perpetrators of crime, and to corroborate lay witness testimony. Prosecutors and Defense lawyers understand that the testimony of a forensic expert tying a person to a crime is highly persuasive evidence for juries. Evidence such as fingerprints, DNA, hair analysis, bite mark, and blood evidence left behind at a crime scene that a

forensic expert says belongs to a particular defendant is incredibly damning and will likely result in the defendant's conviction if not disproved. Because of the highly persuasive value of this evidence when "bad" forensic "science" is used or when a forensic expert overstates a defendant's connection to the evidence it can likely result in the wrongful conviction of an innocent person.

Prosecutors rely upon forensic experts to guide them through investigations. As lawyers, we rely upon the findings given to us by experts because it is impossible for lawyers to know an expert's discipline – their science – as well as the experts know it. Most forensic experts have gone to school for years, received post-college training, and have years of experience in their specific discipline. Not only do trial lawyers rely upon the advice of experts, but an expert once qualified by the court, is relied upon heavily by juries to understand and decipher the evidence presented at trial.

Juries are an essential part of our criminal justice system. Once empaneled, jurors are told that their role is to "judge the facts." That function includes judging the witness' demeanor and their credibility. When factual conflicts arise between witnesses it is the jury's job to resolve the conflict – to determine which witness or witnesses' observations were most accurate, or who had a better memory of the event, or if a particular witness was bias toward one party or another. During deliberations the jury evaluates the evidence and decide the facts. The Judge instructs the jury on the applicable law. The jurors then apply the law to the facts and render a verdict of "guilty" or "not guilty."

Because of the significance forensic science plays in modern criminal trials, its misuse or exaggeration can have a devastating effect on the life of someone accused of a crime that they did not commit. It is incumbent upon all of us involved in the criminal justice system to: 1) set standards and guidelines for the appropriate application of forensic testing; 2) review the various forensic science disciplines to ensure their accuracy and accurate application; and 3) when deficiencies or inaccuracies are discovered to correct these mistakes, especially when such errors have resulted in a wrongful conviction.

In September 2001, Joyce Gilchrist was fired from the Oklahoma City Police Department after it was revealed that she had egregiously misrepresented forensic conclusions for decades. Ms. Gilchrist was a forensic chemist with OCPD crime laboratory and participated in the forensic evaluation of over 3,000 cases. In January 1987, a police chemist from the Kansas City police crime laboratory filed a complaint against Ms. Gilchrist with the Southwestern Association of Forensic Scientist complaining about Ms. Gilchrist's "scientific opinions" wherein she positively identified defendants based on the slightest bit of evidence. In one case, she "positively" identified a hair as belonging to a particular defendant, without conducting any DNA analysis, a conclusion that is scientifically unsound and

forensically impossible. In August 1999 a federal judge in Oklahoma City labeled Ms. Gilchrist's testimony "untrue" when she testified that semen samples in a rape and murder case were inconclusive, when she knew for a fact that the sperm was not from the defendant. Judge Ralph Thompson found that Ms. Gilchrist intentionally withheld exculpatory evidence. In 2001, the FBI conducted an investigation of Ms. Gilchrist. In their final report the FBI questioned the validity of her work and further recommended that the State of Oklahoma reexamine her cases. In the end, state and federal officials reviewed more than 1,200 felony cases that Ms. Gilchrist was involved in – 165 cases were deserving of further review.

Most forensic experts are not blatantly biased like Ms. Gilchrist. While she left an indelible mark in Oklahoma, it is important to emphasize that most forensic experts understand that they are independent forensic scientists whose job it is to analyze and evaluate the evidence using sound scientific principles and guidelines. But in the rare instance when a scientist feels that their loyalty is to the police department or the prosecutor's office or when a scientist has not implemented the best scientific practices, a case can go incredibly off track simply because of the expert's credentials.

Likewise, when "bad" forensic science is used it is devastating for an accused person. Scientific disciplines that we once thought scientifically sound – such as hair analysis, bite mark, shaken baby, and the origination source for arson investigations – have since been debunked. Yet prosecutors continue to use and judges continue to admit this type of forensic evidence without being properly educated on the proper scope and validity of these disciplines – thereby hampering a judge's gatekeeping function.

The Federal Rules of Evidence, and all state evidence codes, provide guidance for judges regarding the admission and use of expert testimony. Courts allow testimony, in the form of an opinion, by a witness who qualifies "as an expert by knowledge, skill, experience, training, or education . . ." if the expert's scientific, technical, or other specialized knowledge will *help the trier of fact to understand the evidence or to determine a fact in issue. . . "* Fed. R. Evid. 702. An expert is given "wide latitude to offer opinions, including those that are not base upon first-hand knowledge or observation,"[1] because it is presumed "that the expert's opinion will have a reliable basis in the knowledge and experience of his discipline." *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, (1993). A trial court, in evaluating whether to admit expert testimony will evaluate the proffered testimony using the factors enumerated in Rule 702. If the court is satisfied that the witness is an expert in the area for which the expert has been proffered, and the court evaluates the

[1] Rule 601 of the Fed R. of Evid. allow a witness to testify about "a matter only if . . . the witness has personal knowledge of the matter." This rule does not apply to experts testifying under Rule 703 of the Fed. R. Evid.

"theory or technique" and determines that the testimony is reliable under the *Daubert* factors of Rule 702, the witness will be recognized by the court and the jury as an expert. This "recognition" underscores the problem in our criminal justice system in that juries tend to view forensic evidence as more reliable, and more credible than they view a lay witness because juries believe a forensic expert is more objective and their opinion is scientifically sound.

The National Registry of Exonerations has identified a total of 2,486 exonerations in the United States since 1989. Of those exonerations - 570 or 22.9% were the result of false or misleading forensic evidence.[2] In an analysis of 367 post-conviction DNA exonerations, it was determined that 162 or 44.1% of the convictions were obtained from the misapplication of forensic science. Misapplication is defined as "the use of an unreliable or invalid discipline, insufficiently validated method, misleading testimony, mistakes, and misconduct."[3] Of the 162 cases in which the misapplication of forensic science was a contributing factor in the wrongful conviction, the following forensic disciplines were involved:

Forensic Discipline	Total Number of Cases
DNA	9
Serology	89
Bite Marks	7
Fingerprints	3
Hair Comparison	75
Other	17

The following recommendations, which are supported by other stakeholders, including the Innocence Project, can prevent abuse and improve forensic science disciplines: 1) ensure that the National Institute of Standard and Technology (NIST), a preeminent independent science agency, conduct scientific evaluations of the validity of the forensic science disciplines; 2) increase funding for research at science-based agencies and institutions, in accordance with a well-developed strategic plan, to establish or strengthen the fundamental science underlying forensic science disciplines; 3) develop rigorous national standards, recommendations for documentation of forensic sciences, and guidelines for reports and testimony for those forensic science disciplines that have been shown to be based on robust and reliable

[2] Innocence Project, *Overturning Wrongful Convictions Involving Misapplied Forensics,* Innocence Project, https://www.innocenceproject.org/overturning-wrongful-convictions-involving-flawed-forensics/ (last visited Sep 6, 2019).

[3] We know that these problems occurred because DNA testing demonstrated the wrongfully convicted person's innocence

science; and 4) support judicial training and other efforts to ensure that future decisions in admissibility consider the validity of a forensic test in general, and the validity of the test as applied in the specific case at hand.

Our criminal justice system is designed to seek the truth. It is designed to equally protect victims and the accused. Because of the highly persuasive impact forensic science and a forensic expert can have on the scales of justice, it is imperative that the expert and the science is sound. The above referenced reforms will ensure that the science is validated, that forensic experts are supported with the scientific resources they need, and that judges are educated so they can properly preform their gatekeeping function.

VICKI BEHENNA

Vicki Behenna, Esq, now in private practice, is a former Assistant United States Attorney for the Western District of Oklahoma. Her practice focuses on litigation matters with an emphasis on white collar defense, government relations and healthcare.

She has more than 25 years of experience as a federal prosecutor in the U.S. Attorney's Office for the Western District of Oklahoma. During her tenure there, she tried fraud cases including bank, wire, mail, corporate and healthcare and was responsible for the prosecution of complex public corruption cases. Behenna's background and extensive investigative experience with complex investigations resulted in the conviction of many high profile defendants.

Behenna currently serves as Executive Director of the Oklahoma Innocence Project at the Oklahoma City University School of Law. Her tenacious efforts on behalf of the wrongly convicted give her unique insight into the complex issues in this field and the ability to not only manage the Oklahoma Innocence Project, but also the talent and experience to serve as an advocate in court for the organization's clients.

Among her noteworthy prosecutions, Behenna was selected to participate in the Oklahoma City bombing case against Timothy McVeigh as a special attorney to then U.S. Attorney General Janet Reno. Upon completion of the case, Behenna was selected by U.S. Attorney Pat Ryan to serve as senior litigation counsel for the Western District of Oklahoma. Behenna has tried numerous bank fraud cases including a case against State Senator Paul Taliaferro and Dale Mitchell. She was involved in the investigation and prosecution of two high profile public corruption cases involving the Oklahoma State Treasurer's office and the Senate Pro Tempe. She also was involved in an off-label marketing case that resulted in a criminal conviction of Wyeth Pharmaceuticals and a settlement to the government in the amount of $491 million.

Behenna has received several accolades during her 25 year career including the Trial Advocacy Award given by the Association of Government Lawyers in Capital Litigation, Distinguished Service Award from by U.S. Attorney General Janet Reno, Integrity Award presented by the Department of Health and Human Services Office of Inspector General, was recognized by the Western District of Oklahoma as an Outstanding Assistant U.S. Attorney in 2012, and was awarded Distinguished Law Alumna by Oklahoma City University School of Law in 2013.

Behenna is an active speaker and a member of the Oklahoma Bar Association, Federal Bar Association, American Bar Association, Oklahoma Association of Women Lawyers and William J. Holloway, Jr. American Inn of Court. She serves as an adjunct professor at Oklahoma City University School of Law instructing the trial practice and evidence course.

Behenna received her Juris Doctor from the Oklahoma City University School of Law and her bachelor of arts in journalism from the University of Oklahoma.

Chairwoman JOHNSON. Thank you very much. Dr. Kafadar.

TESTIMONY OF DR. KAREN KAFADAR, PROFESSOR AND CHAIR, DEPARTMENT OF STATISTICS, UNIVERSITY OF VIRGINIA, AND PRESIDENT, AMERICAN STATISTICAL ASSOCIATION

Dr. KAFADAR. Madam Chair, Members of the Committee, thank you for inviting me here today. I'm Karen Kafadar, Chair of Statistics at the University of Virginia, also President of the American Statistical Association, which has 18,000 members from 93 countries. I was an author of the 2009 report, which emphasized the need for more collaborative research between forensic scientists and the physical, chemical, biological, and statistical scientists.

At the Committee's request, I'll just talk about the role of the sciences and statistics in advancing forensic science and standards, progress since the report, challenges that remain, and recommendations to continue progress and overcome these challenges, namely centralized leadership, funding for research, and guidance to the courts.

First, forensic science in general progresses through research collaborations. Statistics plays a key role in evaluating proposed methods and interpreting data. The NAS report highlighted these roles and made stronger connections between the forensic science community and other non-forensic scientists and statistical experts, leading to more reliable forensic methods.

What progress has been made since the report? First, Chair Johnson and other Members of Congress raised awareness of this critical issue. Second, DOJ and NIST formed the National Commission on Forensic Science. Commissioners cooperated and issued effective and constructive statements on forensic practice and testimony. DOJ disbanded this commission after only 13 meetings.

Third, NIST created forensic science standards organizations whose mission has been to endorse existing standards for forensic practice. OSAC is comprised primarily of those invested in the current system with only a few researchers who could be considered as being at arm's length to the existing forensic science system; thus, little change can be seen in the standards that OSAC approves.

And fourth, with congressional allocation of funds for competitively selected Center of Excellence to focus on foundational research in pattern and digital evidence. Through a cooperative agreement with NIST, this consortium of five universities has been interacting with forensic practitioners and crime labs and has achieved much practical research in 4 years, but the mandate is limited to research and training in only two disciplines.

Challenges remain. The report from PCAST (President's Council of Advisors on Science and Technology), by the way, in 2016 reinforced the continued shortcomings 7 years after the NAS report. Efforts are being made to address them, but key problems remain: lack of centralized leadership by an agency with the expertise and commitment to develop forensic disciplines and enforce standards grounded in science with proper statistical analyses; a dearth of studies with honest demonstrations of validity and reliability; inadequate funding for these studies to support an independent agency;

and lack of guidance to the courts on how to handle forensic evidence that is relevant but at best inconclusive.

With my colleagues I offer three recommendations. I do not think any of them will be new to NIST. First, an existing agency must take the lead. The NAS report emphasized that this lead agency cannot be law enforcement. NIST has taken the lead in improving forensic science. It can continue to develop mechanisms to support validation and reliability studies for forensic methods, build connections with practitioners, and remain independent of law enforcement. Its agenda should be informed by the forensic community but not be beholden to it.

Second, the OSAC currently is composed of mostly forensic practitioners with few arm's-length researchers. It can improve existing standards but cannot modify them. OSAC approves standards that have been based on past practice. This is not progress. Forensic standards cannot be issued if research underlying them has not been conducted. Real progress is more likely if OSAC units were closer to the 50–50 balance between forensic community representatives and arm's-length scientists who together can identify research needed to improve them.

And finally, more research is needed beyond two disciplines in the present Center of Excellence. Research in other disciplines may require more funded centers whose research agendas are coordinated. Work arising from these centers, especially regarding validation and reliability, should inform OSAC decisions even when they challenge existing practice. If these recommendations are adopted, we can have proper standards on which the courts can rely with confidence.

In short, we have seen some progress but more is needed. Without it, courts remain undirected and we have false convictions and false acquittals. With proper leadership those situations can be reversed. Thank you.

[The prepared statement of Dr. Kafadar follows:]

The Roles of Science and Statistics in Advancing Forensic Science and Standards

Karen Kafadar
Chair and Commonwealth Professor
Dept of Statistics, University of Virginia
President, American Statistical Association
House Committee on Science, Space, and Technology
September 10, 2019

Abstract

The National Academy of Sciences' report, *Strengthening Forensic Science in the United States: A Path Forward* (National Academies Press, 2009), emphasized the need for more collaborative research between forensic scientists and the physical, chemical, biological, and statistical scientists. The costs of *not* doing so are high (false convictions and false acquittals). The scientific method recognizes the transfer of research across multiple domains and the importance of continuing advancement in knowledge with increasing research. Statisticians have advanced knowledge and practice in nearly all aspects of science for centuries, using their expertise to ensure safe medical treatments, quantify uncertainties in scientific measurements, design experiments to validate the effects of interventions and validate claims of error rates. In this testimony I describe: (1) the role of the sciences, including statistics, in advancing forensic science and standards; (2) progress in forensic science since the 2009 NAS report; (3) challenges that remain; (4) recommendations on roles of Federal Agencies to ensure reliable forensic science that is needed to minimize false convictions and false acquittals, namely: centralized leadership, funding for research, and guidance to the Courts.

Key Words: scientific collaborations, analysis of forensic evidence, experimental design, statistical methodology, reliability, validation, error rates

Introduction

Madame Chair and Members of the Committee, thank you for inviting me to appear today. I am Karen Kafadar, Chair and Commonwealth Professor of Statistics at the University of Virginia. I also am 2019 President of the American Statistical Association (ASA), founded in 1839 and is the world's largest professional society of statisticians with 18,000 members from 93 countries.

I am appearing in my capacity as ASA President and as a statistical scientist who has conducted research and taught statistics at the university level to diverse audiences for 26 years. My collaborations have involved scientists in biology, chemistry, physics, medicine, engineering, psychology, anthropology, and sociology. At the Committee's request, I address four topics:

1. the role of scientists and statisticians in advancing forensic science and standards;

2. progress in forensic science since the 2009 report from the National Academy of Sciences, *Strengthening Forensic Science in the United States: A Path Forward*, of which I was a co-author;

3. challenges that remain;

4. recommendations on roles of Federal Agencies in ensuring continued research needed for the fair administration of justice, namely: centralized leadership, funding for research, and guidance to the Courts.

A brief story: Involvement of Statisticians in Forensic Science

In my written testimony here, I will start by explaining my involvement with forensic science. In 2003 I was invited to serve on the National Academy of Sciences' Committee on Scientific Assessment of Bullet Lead Elemental Composition Comparison, which led to the 2004 report, *Weighing the Evidence: Forensic Analysis of Bullet Lead* (National Academies Press, 2004). The FBI asked the NAS to

review its procedures for comparing bullets found at a crime scene with bullets found in the possession of a suspect, based on the concentrations of seven trace elements measured in the lead of the bullets from the two locations. Two of the four aspects of the Committee's charge clearly involved statistical inferences from the measurements, so I was one of two statisticians[1] on the Committee. The shortcomings in the statistical inference procedures were obvious; statisticians advised on statistical analysis of data as well as on data collection and experimental designs, validation, risks of false claims of association and exclusion, and other concepts of statistical thinking. The Committee's report did not recommend the discontinuation of the FBI's Bullet Lead Comparison operation, but it did emphasize that lab reports and courtroom testimony would have to acknowledge that bullets found at a crime scene could not be guaranteed to have come from a specific box (e.g., one found in the possession of a suspect), but rather may have come from one of perhaps thousands of boxes. The FBI recognized that such testimony would greatly limit, or even eliminate, its probative value, and hence discontinued the operation. What surprised me, as a statistician, was the total absence of statisticians in the development inference procedures for data from bullet lead analyses and the value that statisticians could have added. No one would dream of asking a statistician to develop analytical chemical procedures to measure trace element concentrations: if you gave a statistician some manuals, she may have been able to come up with some kind of procedure, but no one would dream of asking a statistician to perform chemistry. But, for some reason, the FBI felt perfectly comfortable asking chemists to develop statistical procedures for drawing inferences from the data they collected on trace element concentrations — and then allowing them to testify in courtrooms on the results of those (improper) statistical procedures. Statistical input could have reduced substantially the number of false accusations based on faulty statistical procedures.

[1]Professor Clifford Spiegelman from Texas A&M University was the other statistician on the Committee.

1 ASA's role in forensic science

The ASA's mission is to promote the profession and practice of statistics to advance science, inform policy, and enhance statistical literacy, to make the world a better place. It is hard to find an area where statistical thinking and methodology does *not* contribute. ASA members participate on committees and sections that interface with many disciplines, including public health, environment, energy, education, law and justice, and forensic science. The ASA Board of Directors issued a statement that endorsed the 2009 NAS report's recommendations for additional research in forensic science, including statistics, and a statement with guidelines for expressing statistical conclusions in forensic science reports and in courtroom testimony.

2 Progress since the 2009 NAS report

The 2009 report (and the Jon Oliver piece on Forensic Science) called the public's attention to the lack of validity and reliability in the analysis and conclusions from forence evidence. Despite well-intentioned employees throughout the forensic science system, the field was relatively isolated from non-forensic scientists in the development of procedures for analyzing, and drawing inferences from, forensic evidence.[2] The acceptance by forensic scientists of their non-forensic counterparts is certainly not complete. But the fact that it has started, notably among the younger generation of forensic scientists, in just 10 years, emphasizes the impact of the 2009 report and the progress it engendered. Three specific projects where funding made possible research collaborations among scientists in different fields that led to progress in the field are: (1) creating a measure of strength in the comparison of two fingerprint images,[3] Use

[2]An exception was DNA evidence, which engaged early with research biologists and geneticists. This collaboration was nicely described in the testimony from Dr. Eric Lander, a world-class molecular biologist, to the Senate Committee on Commerce, Science, and Transportation, 28 March 2012; see `govinfo.gov/content/pkg/CHRG-112shrg77701/html/CHRG-112shrg77701.htm`

[3]H.J. Swofford, A.J. Koertner, F. Zemp, M. Ausdemore, A. Liu, M.J. Salyards, A method for the statistical interpretation of friction ridge skin impression evidence: Method development and validation, *Forensic Science International*, Volume 287, 2018, Pages 113-126, ISSN 0379-0738, `doi.org/10.1016/j.forsciint.2018.03.043`.

of this metric, called *FRstat*, has been limited; (2) a statistical algorithm for matching bullet land impressions,[4] (3) a quantitative approach to blood spatter evidence using fluid dynamics.[5]

This enhanced collaboration, virtually absent ten years ago, was facilitated by several activities; I mention four of them here. First, none of the progress to date would have been possible without the attention to this issue brought by Chair Johnson and other members of Congress. Second, the National Institute of Science and Technology (NIST, where I worked for three years after my doctorate) collaborated with the Department of Justice (DoJ), in forming a National Commission on Forensic Science (NCFS), to "establish and operate a competitively selected Center of Excellence focusing on measurement sciences, technology, and standards in forensic science," and to create a forensic science standards organization. DoJ led the NCFS effort, and the cooperation among forensic scientists, crime lab directors, research scientists, attorneys, and judges resulted in several NCFS statements. That communication barriers were lowered and trust was enhanced among these parties, in just two years, shows the mutual respect and cooperation that can be achieved to advance forensic science.[6] Regrattably, DoJ disbanded this Commission after only 13 meetings.

A third activity was NIST's Organization of Scientific Area Committees (OSAC) to confirm forensic standards.[7] OSAC includes 550+ forensic specialists (about 2/3) and other scientists, judges, and lawyers, on its 25 subcommittees representing forensic disciplines in a triage structure where the final approval of standards occurs at the third level, the Forensic Science Standards Board. Unfortunately, the composition

[4]E. Hare, H. Hofmann, A. Carriquiry (2017), Automatic matching of bullet land impressions, *The Annals of Applied Statistics* 11(4):2332-2358, `projecteuclid.org/euclid.aoas/1514430288`.

[5]P.M. Comiskey, A.L. Yarin, D. Attinger (2019), Hydrodynamics of forward blood spattering caused by a bullet of general shape, *AIP Physics of Fluids* 31, 084103, `doi.org/10.1063/1.5111835`; P.M. Comiskey, A.L. Yarin (2019), Self-similar turbulent vortex rings: interaction of propellant gases with blood backspatter and the transport of gunshot residue, *J. Fluid Mechanics* 876: 859-880, `doi.org/10.1017/jfm.2019.564`. See also `arstechnica.com/science/2019/08/physicists-now-have-even-better-models-for-blood-spatter-from-gunshot-wounds/`

[6]See NCFS products at `www.justice.gov/archives/ncfs`

[7]`https://www.nist.gov/topics/organization-scientific-area-committees-forensic-science`

of the OSAC units remains primarily forensic scientists and practitioners, and the non-regulatory status of NIST requires OSAC to simply approve or reject *existing* standards without allowance for modifications.

A fourth activity is the Congressional allocation of funds to NIST to award a competitively-selected Center of Excellence, housed at Iowa State University and involving Carnegie Mellon, Duke, University of California-Irvine, and University of Virginia.[8] This Center for Statistical Applications in Forensic Evidence (CSAFE) was established in June 2015 and conducts cooperative research among NIST scientists, forensic practitioners in crime labs, and statisticians. Unfortunately, its mandate is limited to research in only *pattern and digital evidence* (which includes fingerprints, shoe and tire track impressions, handwriting, blood spatter patterns, digital signatures) – important areas to be sure, but the mandate does not allow funds to be used for important problems that exist outside those two forensic disciplines. (See Appendix for some of its projects that have yielded important advances.) I currently participate in this Center of Excellence, and formerly was a member of the OSAC's Forensic Science Standards Board and an NCFS subcommittee.

3 Challenges

Shortly after the 2009 NAS report was released, the Honorable Judge Harry T. Edwards, who co-chaired the report's authoring committee, testified before the Senate Judiciary Committee. In that testimony, he said,

> "*There are scores of talented and dedicated people in the forensic science community, and the work that they perform is very important. They are often strapped in their work, however, because of (1) a paucity of strong scientific research, (2) a lack of adequate resources and national support and (3) the absence of unified and meaningful regulation of crime laboratories and practitioners. It is clear that change and advancements, both systemic and scientific, are needed in a number of forensic science*

[8]Center for Statistical Applications in Forensic Evidence; see `forensicstats.org`.

disciplines to ensure the reliability of the disciplines, establish enforceable standards, and promote best practices and their consistent application."

The community has started work in all three areas that Judge Edwards mentions. But challenges remain:

1. Lack of centralized leadership by an agency that has the expertise and commitment to cause forensic disciplines to develop and enforce standards that are grounded in valid and reliable scientific studies and accurate statistical analyses;

2. Lack of studies confirming the validity and reliability of forensic disciplines by domain-specific scientists (versus forensic practitioners) not necessarily tied to a law enforcement agency;

3. Lack of funding to support an independent agency and the studies necessary to confirm the validity and reliability of forensic disciplines;

4. Lack of guidance for the courts on how to handle forensic evidence that is relevant but at best inconclusive. How should a judge instruct a jury in such a case? Until the courts have authoritative guidance, they are likely to continue admitting the evidence because it cannot be declared irrelevant. This would not be a problem if the courts knew how to effectively cabin the testimony of forensic experts: a jury may be inclined to give too much weight to inconclusive evidence merely because an "expert" is testifying to its efficacy.

Non-forensic scientists in chemistry, physics, imaging, statistics, and computer science, can be invaluable in the perspectives that they bring to a given problem (e.g., chemistry and drug toxicology; computer scientists and images of pattern evidence).

4 Recommendations

With my Center of Excellence colleagues and some of my co-authors of the NAS report, I offer the following recommendations. I do not think any of them will be new to NIST.

1. *Charge:* Some agency must take the lead. The 2009 report emphasized that the agency cannot be law enforcement, whose mission has only a small part of what is needed. In fact, since then, the principal law enforcement agency, DoJ, abandoned the National Commission. So another agency must step in. In 2009, NIST was not seen as "a natural leader by the scholars, scientists, and practitioners in the field" (p17) — but that has been true of NIST before, and NIST rose to the challenge to develop that respect and expertise, particularly in measurement science, standards, and technology. NIST can develop mechanisms to support the research in validation and reliability studies needed in forensic science, and remain independent of law enforcement. Its agenda should be informed by the forensic community, but not be beholden to it. Its results need to be communicated to other agencies that have a stake in reliable forensic science, including DoJ (which has NIJ/OIFS), DNI (which has IARPA), DOD (which has DARPA), NIH (which funds biology-related forensics) and presumably others.

2. *OSAC composition:* OSAC, as part of NIST, currently is composed of mostly forensic practitioners with few "arm's length" researchers. It has been directed to approve standards without being allowed into the regulatory space of developing their own. As a result, OSAC primarily approves standards that have been based on past practice. This is not progress. Forensic standards cannot be issued if the research underlying them has not been conducted. Real progress is more likely if OSAC units were closer to 50-50 between forensic community representatives and "arm's length" scientists who together can identify needed studies for validation of existing standards and research to improve them. This balance is especially critical for the top-level OSAC unit, the Forensic Science Standards Board. where presently at most only 3 or 4 members could be considered as "arm's length" from the existing system. "Arm's length" researchers are few, as many are unaware of the scientific challenges involved. Until more of them are made aware, the OSAC units may have to reduce in size, so the balance is 50-50.

3. *Centers of Excellence*: The present NIST-funded Center of Excellence has achieved much in four years, but the work to be done is too extensive to be accomplished by a single Center, which presently is limited to research in only pattern and digital evidence. Research in other disciplines may require more funded Centers whose research agendas are coordinated. Work arising from these Centers, especially regarding validation and reliability, should inform decisions made by the OSAC's Forensic Science Standards Board, not swept aside because it would entail changes to existing practice. (See the OSAC organizational chart for the list of other disciplines outside of pattern and digital evidence.)

   Incidentally, along the lines of promoting research, a policy of transparency — availability of software developed and data collected with federal research grants and agreements — would be sensible. Presently, grantees' data are hard to obtain, even when collected with federal grants. (Research in differential privacy, being conducted for surveys, may apply here, to ensure low risk of identifications from such databases.)

4. *Forensic Science Research and the Courts*: If these recommendations are adopted, then the studies and statistical analysis of validity and reliability of forensic procedures, endorsed by the Forensic Science Standards Board, can be used in judicial challenges to the admission of faulty forensic science evidence and in promoting proper standards on which the Courts can rely with confidence.

The costs of continuing business as usual are too high: Courts remain directed, and the lack of reform leads to both false convictions and false acquittals. But, with proper leadership, the situation can be reversed. Thank you.

Appendix

This Appendix describes four of several projects where forensic scientists collaborated with non-forensic scientists and statisticians to advance research in forensic science.

1. Communication among forensic science stakeholders

   The National Commission for Forensic Science included representatives from areas affected by forensic science: law enforcement, prosecutors, defense attorneys, scientists, judges, and forensic practitioners. In its short 2+ years, commissioners together issued several statements that reflected best practice and recommended new directions. This Commission agreed upon the inappropriateness of definitive conclusions such as "100% match," "match to a reasonable degree of scientific uncertainty," and "zero error rate." Courtroom testimony and lab reports have been successfully discouraged from using such terms.

2. Research in Pattern Evidence

   A cooperative agreement between NIST and Iowa State funds a Center of Excellence in Forensic Science, called CSAFE, for Center for Statistical Applications in Forensic Evidence. NIST limits the Center's funded activities to pattern and digital evidence: latent prints, blood stain pattern analysis, firearms & toolmarks, footwear and tire impressions, handwriting; recovery of material in digital media. Successful projects have included: an improved objective method of comparing ballistic markings, methods for assessing similarity in handwriting samples, and objective metrics of quality in images of pattern evidence (fingerprints, shoe prints, etc.). The Center also studies methods of communicating the strength of forensic evidence to laypersons such as those who sit on juries, to minimize distortion of the information being presented. Researchers affiliated with CSAFE spend far more time on their projects, and in interactions with other CSAFE researchers, than they receive in compensation, so, for the federal government, this investment has had substantial pay-offs.

3. Organization of Scientific Area Committees (OSAC)

   Figure 1 shows a diagram that describes the Organization of Scientific Area Committees (OSAC). Standards are proposed in the subcommittees, and approved by the respective Scientific Area Committees, and finally by the 18-member Forensic Science Standards Board, before being posted on the OSAC

registry of standards. The organization has been useful in introducing researchers to forensic scientists and practitioners. Full trust and collaboration remains elusive for many members, which likely will erode over time and as both sides see the value of such collaboration. Because OSAC lies within the NIST structure, and NIST is not a standards developing organization (SDO), OSAC is limited to posting standards that already exist, not in developing or modifying existing standards. This limitation has significant consequences (e.g., for standards that may be satisfactory in all but a few paragraphs).

4. Fingerprint Community: Efforts to estimate error rates

   The fingerprint community studied the risk of errors in one part of the latent print identification process: volunteer latent print examiners compared two fingerprint images and reported whether they matched or not (or "inconclusive"). While the reported error rate was low, a more thorough study is needed, one that evaluates the risk of errors resulting from the entire process, with latent print examiners who do not know that the case is a "test."[9]

   In addition, researchers at the Defense Forensic Science Center, then under the direction of Dr. Salyards two years ago, published an article on an approach to developing a semi-objective metric for the strength of the association between a latent print found at a crime scene and a suspect's print. Researchers at the Center of Excellence (CSAFE) were invited to comment on this work. That research, like all scientific research, is in the process of being made fully public, so that it can be improved with further study.[10] Use of this metric, called *FRstat*, has been limited; with increased use, we can compare the risks of false positives and false negatives using *FRStat* versus current practice.

[9]Reporting an error rate in latent fingerprint identification based on results obtained by latent print examiners who volunteer for the study and conduct the side-by-side image comparisons in a lab (and hence know they are being tested), without consideration of the full examination process, including image processing of the print, marked features, number of other candidates, etc., is rather like reporting an automobile accident rate based on drivers who come to a simulator and are tested by a video of highway driving.

[10]See footnote 3.

Note: In September 2016, the President's Council of Advisors on Science and Technology (PCAST) issued a Report to the President, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*[11]. Apart from some studies of error rates in fingerprint identification, it largely endorsed the findings of the 2009 NAS report that was issued seven years earlier.

[11] `obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf`

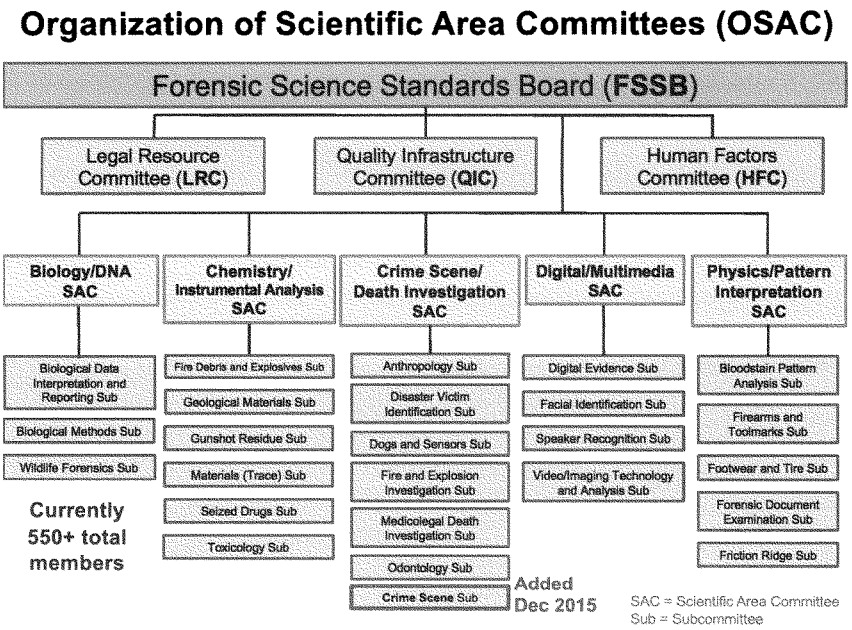


Figure 1: OSAC organizational chart as of October 2018

KAREN KAFADAR

Karen Kafadar is Commonwealth Professor & Chair of Statistics at University of Virginia. She received her B.S. (Mathematics) and M.S. (Statistics) from Stanford University, and her Ph.D. (Statistics) from Princeton University, She previously held positions at National Bureau of Standards (now National Institute of Standards and Technology), Hewlett Packard's RF/Microwave R&D Division, National Cancer Institute, and University of Colorado-Denver. Her research focuses on robust methods, exploratory data analysis, characterization of uncertainty in the physical, chemical, biological, and engineering sciences, and methodology for the analysis of screening trials. She served on the National Academy of Sciences' Committees that led to *Weighing Bullet Lead Evidence* (2004), *Strenthening the Forensic Science System in the United States: A Path Forward* (2009), *Review of the Scientific Approaches Used During the FBI's Investigation of the Anthrax Letters* (2011), *Evaluating Testing, Costs, and Benefits of Advanced Spectroscopic Portals* (2011), and *Identifying the Culprit: Assessing Eyewitness Reliability* (2014). She also served on the governing boards for the American Statistical Association (ASA), Institute of Mathematical Statistics, International Statistical Institute (ISI), and National Institute of Statistical Science. She was a member of NIST's inaugural Forensic Science Standards Board (part of Organization of Scientific Area Committees, or OSAC), and chaired OSAC's Statistical Task Group and ASA's Advisory Committee on Statistics in Forensic Science. She is past Editor of *JASA Reviews* (1996-98) and *Technometrics* (1999-2001), and is current Editor-in-Chief for *The Annals of Applied Statistics*. She is an Elected Fellow of the ASA, ISI, and AAAS, has authored over 100 journal articles and book chapters, and has advised numerous M.S. and Ph.D. students. She is 2019 President of the American Statistical Association.

Chairwoman JOHNSON. Thank you very much. Mr. Gamette.

TESTIMONY OF MATTHEW GAMETTE,
CRIME LAB DIRECTOR,
IDAHO STATE POLICE FORENSIC SERVICES

Mr. GAMETTE. Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, thank you for the opportunity to come on behalf of the American Academy of Forensic Sciences (AAFS) and testify today.

Since 1948, the American Academy has served a distinguished and diverse membership of over 6,000 members divided into 11 sections of physicians, attorneys, dentists, toxicologists, anthropologists, document examiners, digital evidence experts, psychiatrists, physicists, engineers, criminalists, educators, researchers, and others.

I'm also here representing the Consortium of Forensic Science Organizations (CFSO). CFSO was formed in 2000 and is an association of six major forensic science professional organizations with a membership of over 21,000 forensic science professionals.

I am currently the Laboratory System Director for the Idaho State Crime Lab System. And since I started over 17 years ago, forensic science as a profession has evolved and advanced, quality management has intensified, and standards and development has increased.

The National Academy of Sciences' study in 2009 was a significant event in our community. The study supported the forensic science community's ongoing efforts to improve the practice and forensic science as a whole. With support from the Federal Government, we have implemented many of the recommendations from the report. Efforts such as the White House Subcommittee on Forensic Science, the National Commission on Forensic Science, the NIST OSAC, the PCAST report, and discipline-specific research and validation studies have advanced the practice of forensic science. Other Federal efforts have been put in place to advance the science such as the Forensic Laboratory Needs Technology Working Group, the Forensic Science Technology Working Group, and the Council of Federal Forensic Laboratory Directors.

These efforts are addressing currently accreditation and certification, quality assurance, standards development, and implementation, methods and protocols, education and training, ethics, terminology, research, technology transfer, discovery and transparency, statistics, standardized language and reporting, and expert testimony.

Participation has spanned to at least 23 Federal departments and agencies, thousands of Federal, State, and local scientists and stakeholders. Since 95 percent of the forensic science that happens in this country is performed at the State, county, and local level, it is critical to include all forensic, Federal, State, and local partners.

Federal working groups have worked on the accreditation of forensic science service providers, the certification of forensics examiners, and medicolegal personnel, proficiency testing, a national forensic science code of ethics, standards, research and development, and technology transfer.

One particularly helpful initiative has been the NIST OSAC. OSAC works to strengthen the Nation's use of forensic science by facilitating the development of technically sound forensic science standards and promoting their adoption. These standards are written documents that define the minimum requirements, best practices, standard protocols, and other guidance to help ensure that the results of forensic analysis are reliable and reproducible.

The more than 550 members are experts from Federal, State, county, and local government agencies, academic institutions, and private entities with expertise in over 25 forensic science disciplines. OSAC is highly collaborative in their processes. OSAC efforts have expanded into identification and prioritization of research needs that can be accomplished at NIST, NIJ (National Institute of Justice), and other Federal agencies.

The DOJ has developed guidance documents for uniform language and testimony and reports for all Federal laboratories. While research, including black-and-white box studies, is increasing, more resources must be dedicated to bolstering the scientific framework and open access publication of findings.

Findings for research and funding for research has been sparse at best. Data shows that most major forensic science providers are accredited and have quality control programs. Most forensic science practitioners are accountable to one or more codes of professional conduct. Our community has adopted many of the recommendations from a variety of committees, commissions, and boards.

In conclusion, our needs for a successful forensic enterprise are fairly simple. One, we need continued support of the Federal Government to fund efforts to increase forensic laboratory and medical examiner capacity, capability, and training. Two, we need the OSAC codified at NIST with sustainable funding. Three, we need fiscal and operational support for laboratory and medical examiner office accreditation and forensic science providers certification. We need, finally, a coordinated and well-funded Federal research strategy that includes close partnership of practitioners and researchers.

Providers are seeing an unprecedented increase in the work needed to investigate criminal cases. A needs assessment of laboratories and medical examiners is imminent from the Department of Justice, and we understand that there are dollar figures associated with those needs. I would urge this Committee to review those reports while contemplating any new legislation that may affect the operation of forensic science service providers.

It is vitally important to the criminal justice system in the United States to properly resource forensic science in the United States. A healthy and robust forensic science provider network is important for this country to prosecute true perpetrators, exonerate the innocent, and provide closure for victims of crime.

We thank you again for this Committee taking this issue seriously and helping us address this issue, and I would also stand for any questions.

[The prepared statement of Mr. Gamette follows:]

TESTIMONY

Mr. Matthew Gamette
American Academy of Forensic Sciences

Before the House Committee on Science,
Space, and Technology
September 10, 2019
(Updated 9/13/19)

"Raising the Bar: Progress and Future Needs in Forensic Science"

Chairwoman Johnson, Ranking Member Lucas and Members of the committee, thank you for the opportunity to come before you today to testify on behalf of the American Academy of Forensic Sciences (AAFS). Since 1948, the AAFS has served a distinguished and diverse membership. Its over 6,600 members are divided into eleven sections spanning the forensic enterprise. Included among the Academy's members are physicians, attorneys, dentists, toxicologists, anthropologists, document examiners, digital evidence experts, psychiatrists, physicists, engineers, criminalists, educators, and others. As a professional society dedicated to the application of science to the law, the AAFS is committed to the promotion of education and the elevation of accuracy, precision, and specificity in the forensic sciences.[1]

I am also here representing the Consortium of Forensic Science Organizations (CFSO). CFSO was formed in 2000 and is an association of six forensic science professional organizations: American Academy of Forensic Sciences; American Society of Crime Laboratory Directors; International Association for Identification; American Academy of Psychiatry and the Law; National Association of Medical Examiners; and Society of Forensic Toxicologists - American Board of Forensic Toxicology. These professional organizations together represent more than 21,000 forensic science professionals across the United States. One of its primary missions is to speak with a single forensic science voice in matters of mutual interest to its member organizations.[2]

I have worked at a crime lab in some capacity for over 17 years and am currently the Laboratory System Director of the Idaho State crime laboratory system. Since I started my first job as a biology/DNA analyst over 17 years ago the forensic science as a profession has evolved, and the science has advanced through research, implementation of quality management systems, development of standards, and the training of practitioners.

On behalf of the practitioner community, I thank you for hosting this hearing. I look forward to providing you with an overview of the state of forensic science since the National Academy of Sciences study, standards development, our successes since the study was completed, the role of the Federal government and finally our challenges and anticipated needs for the future.

The 2009 National Academy of Sciences report entitled *Strengthening Forensic Science in the United States: A Path Forward*[3] (NAS report) was a significant event in our community. In fact, it is a study the forensic community itself requested. Through its recommendations, the study supported the forensic science community's on-going efforts to improve the practice and forensic science as a whole. With support from the Federal government, we have made important strides in implementing many of the significant

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[1] https://www.aafs.org/about-aafs/#aafs-history.

[2] http://thecfso.org/.

[3] https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf.

recommendations from the report. Subsequent efforts, such as the National Commission on Forensic Science (NCFS), the NIST Organization of Scientific Area Committees (OSAC), the study by the President's Council of Advisors on Science and Technology (PCAST report), and discipline specific studies have greatly informed the forensic science community of areas where needs exist and should be addressed. Other offices have been put in place to assist in advancing the science such as the Forensic Laboratory Needs-Technology Working Group (FLN-TWG), Forensic Science Technology Working Group, and the Council of Federal Forensic Laboratory Directors (CFFLD). Recognizing that our profession is based on the continued development of science and technology, and while improving practices and procedures, we believe it is critical for the Federal government to continue to provide its leadership and resources to the forensic community including its stakeholders.

If you will permit me, I would like to provide you with detail on our progress over the past ten years considering the 2009 National Academy of Sciences report entitled *Strengthening Forensic Science in the United States: A Path Forward.*

THE FEDERAL RESPONSE

The Federal government took immediate action to bring the forensic science community together to consider the findings and recommendations of the NAS report. The White House's Office of Science and Technology Policy (OSTP) created a "Subcommittee on Forensic Science" (SoFS) in July 2009 to assess the issues raised by the NAS report. The SoFS oversaw five interagency working groups (Accreditation and Certification; Standards, Practices, and Protocols; Education, Ethics, and Terminology; Research, Development, Testing, and Evaluation; and Outreach and Communication), which were responsible for most of the work. SoFS participation spanned 23 federal departments and agencies and was comprised of nearly 200 federal subject matter experts and 49 individuals representing state, county, and local forensic scientists, in conjunction with the legal community, a unique process to the NSTC[4] that underscored the recognition that nearly 95 percent of forensic science examinations are performed at the state and local level. This engagement provided a more formal and consistent mechanism for consideration of unique perspectives and input from the broader practitioner, criminal justice, and academic communities.

The purpose of the subcommittee was to "advise and assist the National Science and Technology Council, Committee on Science, and other coordination bodies of the Executive Office of the President on policies, procedures, and plans related to forensic science at the Federal, state, and local levels. The SoFS coordinated a robust effort across Federal, state, and local agencies to identify and address important policy, program, and budget matters, as well as potential activities to

[4] National Science and Technology Council.

enhance and/or amalgamate forensic science initiatives that support research and development; training, education, and ethics; accreditation and certification; and standards of practice. Activities of the SoFS were coordinated through five interagency working groups (IWGs). The IWGs were each chartered with distinct objectives, and their deliberative processes included research and analysis into particular issues of impact that could be incorporated into policy proposals. The subcommittee's findings and work products will inform efforts to enhance future forensic science policy, research, and practice."[5]

This body completed its work in December 2012 and published its report, *Strengthening the Forensic Sciences*, in May 2014..[6] The report recommended, among other things, the accreditation of forensic science service providers, the certification of forensic examiners and medicolegal personnel, proficiency testing for forensic examiners, and a national code of ethics for forensic service providers. Importantly, the Research, Development, Testing, and Evaluation interagency working group pursued the identification of foundational research that can be mapped to specific principles across the various disciplines of forensic science. The group was also responsible for identifying Federal investments in forensic science research. The SoFS was the beginning of efforts by federal, state, county and local practitioners and laboratories to implement the NAS report's recommendations.

Efforts by the co-chairs of the SoFS (one from NIST and one from DOJ) to promote a partnership between NIST and DOJ in the forensic science space lead to the creation of the National Commission on Forensic Science (NCFS) in DOJ and the OSAC in NIST in 2013. This partnership between DOJ and NIST assimilated into a joint effort both a policy and science endeavor to strengthen and enhance forensic science.

NCFS, OSAC, AND STANDARDS DEVELOPMENT

"The NCFS was co-chaired by the Deputy Attorney General and the Director of NIST and consisted of 29 voting commissioners and eight *ex officio* non-voting commissioners. The Commission included federal, state, and local forensic science service providers; research scientists and academics; law enforcement officials; prosecutors, defense attorneys and judges; and other stakeholders from across the country. The work of the commission was supported by several subcommittees: Interim Solutions, Accreditation and Proficiency Testing; Human Factors; Medicolegal Death Investigation; Reporting and Testimony; and Scientific Inquiry and Research."[7]

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[5] See Weedn, V. *Recent Developments in the Forensic Sciences*, The United States Attorneys' Bulletin, Vol. 65, No. 1, January 2017; NAT'L SCI. & TECH. COUNCIL'S SUBCOMM. ON FORENSIC SCI., STRENGTHENING THE FORENSIC SCIENCES (2014), pages iii,1.

[6] NAT'L SCI. & TECH. COUNCIL'S SUBCOMM. ON FORENSIC SCI., STRENGTHENING THE FORENSIC SCIENCES (2014)

[7] Weedn, V. *Recent Developments in the Forensic Sciences*, The United States Attorneys' Bulletin, Vol. 65, No. 1, January 2017, page 5.

The NCFS issued many recommendations and views documents on various subjects related to the enhancement of the intersection between forensic science and the law. Some of these views will be discussed later. In 2017, after NCFS failed to approve a statement in its final report that the commission should continue, the commission expired pursuant to the rules of the Federal Advisory Committee Act, and the Attorney General did not seek to extend it for a third term.

The OSAC is an ongoing effort, providing valuable work products for the forensic science community. "The Organization of Scientific Area Committees (OSAC) for Forensic Science works to strengthen the nation's use of forensic science by facilitating the development of technically sound forensic science standards and promoting their adoption. These standards are written documents that define minimum requirements, best practices, standard protocols, and other guidance to help ensure that the results of forensic analysis are reliable and reproducible. The OSAC is administered by the National Institute of Standards and Technology (NIST), but the great majority of its more than 550 members are experts from federal, state, county, and local government agencies, academic institutions, and the private sector. These members have expertise in twenty-five specific forensic disciplines, as well as general expertise in scientific research, measurement science, statistics, law, and policy. OSAC members work together to develop and evaluate forensic science standards via a transparent, consensus-based process that allows for participation and comment by all stakeholders."[8]

Each OSAC discipline specific subcommittee works by discussing existing standards and best practices in their respective discipline. They discuss matters such as training of practitioners, methods and practice, quality assurance measures, reporting, statistics, and court testimony. When gaps are identified, the subcommittee starts a drafting process to revise an existing standard or create a new one. Consideration is given to issues that must be coordinated among a group of subcommittees (e.g. training or proficiency testing). The OSAC subcommittees are the home of new ideas; they recommend areas of discipline specific research; they vet existing standards, and they draft new proposed standards and guidelines. OSAC subcommittees have access to legal, quality assurance, statistics, and human factors experts that can provide guidance and expertise as they navigate the process.

Once a proposed standard has been developed and vetted through the OSAC subcommittee process, it is then outsourced to a Standards Development Organization (SDO). The most prevalent SDOs used in the forensic workspace are the AAFS Standards Board (ASB), the American Society for Testing and Materials (ASTM), the

[8] https://www.nist.gov/topics/organization-scientific-area-committees-forensic-science. Last accessed 9/6/19. The members also have expertise in standards development, human factors and quality assurance.

American Dental Association (ADA), and the National Fire Protection Association (NFPA). The selection of the SDO is up to the group putting forward the standard proposal. The only stipulation is that the standard cannot compete with an existing standard from any organization.

The AAFS Academy Standards Board (ASB) was launched February 2016 for the purpose of developing forensic-related standards that support forensic professionals and the legal community that rely on forensic science. It is the only SDO that focuses solely on forensic science standards. The ASB oversees 12 Consensus Bodies which review OSAC work products:[9]

- Anthropology
- Bloodstain Pattern Analysis
- Disaster Victim Identification
- DNA
- Dogs and Sensors
- Firearms and Toolmarks
- Footwear and Tire
- Forensic Document Examination
- Friction Ridge
- Medicolegal Death Investigation
- Toxicology
- Wildlife Forensics

As of June 3, 2019, the ASB has received 129 documents drafted by OSAC for development into American National Standards Institute (ANSI). The ASB is currently handling 60% of the OSAC documents.[10]

ASB documents as of June 3, 2019[11]

Consensus Body (OSAC Subcommittee)	Total Received	Published ANS	In process	Submitted for development	Suspended Withdrawn
Anthropology	3	1	2		
Bloodstain Pattern	5	2	3		
DNA/Biology	27	1	18	5	3
Dogs and Sensors	18	1	17		
Disaster Victim	10	4	4	2	
Firearms/Toolmarks	21		15		6
Footwear/Tire	9		8	1	
Forensic Documents	6		6		

[9] Communication from Director of the ASB to Ken Melson, 6/20/19.
[10] Communication from Director of the ASB to Ken Melson, 6/20/19. Other DSOs to which OSAC submits drafts are ASTM (10), ADA (1), and NFPA (1).
[11] Communication from Director of the ASB to Ken Melson, 6/20/19.

Friction Ridge	5		5		
Death Investigation	1		1		
Toxicology	16	2	13		1
Wildlife	8	6	2		
TOTALS	**129**	**17**	**94**	**8**	**10**

The ASB is currently funded by a grant from the Arnold Foundation, which expires in March 2021. It is imperative that the ASB receive additional grants. *The Forensic Science and Standards Act* should provide grant funding to the ASB for purposes of carrying on its work as an ASB adjunct to the OSAC.

An SDO is a consensus-based process where experts and stakeholders can further refine the standard. The SDO must publish the proposed standard for public comment. Each public comment must be adjudicated, a response provided, and an appeal process afforded. Once a standard has been approved through the SDO, the standard goes back to the OSAC for further vetting. At this point in the process, the OSAC proffers the SDO produced standard for entry on the "OSAC Registry."

All OSAC members and the public at large are able to comment on the appropriateness of the standard going on the OSAC Registry. The comments at this point in the process are not for the purpose of changing the standard, but rather for determining if the standard is fit to be placed on the registry and be endorsed by OSAC.

Currently there are nineteen (19) standards on the OSAC Registry. These standards must be reviewed regularly as part of the SDO process. Once an SDO has proffered a standard, the SDO remains responsible for the regular review of that standard. This process has many opportunities for experts, stakeholder groups, and the general public to weigh in on the proposed standard. The hard discussions are happening, and the standards are being thoroughly vetted. It is important to realize that forensic science is following the same process that is used to create standards in all industries. In fact, the OSAC Standard Registry process adds another level of scrutiny beyond the SDO process used by most industries.

It is important to note that currently NIST pays for practitioners and officers of the courts to access the ASTM standards and the ASB provides their standards for free through a generous private foundation. However, free or reasonably priced access for state, county, local and tribal practitioners and officers of the court to these standards must continue to be a high consideration for the federal government.

Another critical mission of the OSAC is to assist NIST, and in collaboration with NIJ, identify and prioritize research needs in the forensic science community. OSAC identified research needs are considered by at least two NIJ working groups as part of the federal granting strategy.

STANDARD TERMINOLOGY, TESTIMONY AND REPORTS

We agree with the NAS report that there should be standard terminology to be used in reporting and testimony, and model laboratory reports. Many efforts are in place to implement these recommendations. Specifically, the terms used to describe findings, conclusions, and degrees of association between evidentiary material and particular people or objects should be reconsidered. In fact, that has been done to a great degree. The NCFS made recommendations for creating consistent and uniform language within disciplines, , including definitions of forensic science and forensic science service providers.[12]

Elsewhere, NIST has completed two expert working group reports. The first was in 2012 by the Expert Working Group on Human Factors in Latent Print Analysis entitled *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach.* Another is pending publication, written by the Expert Working Group for Human Factors in Handwriting Examination entitled *Forensic Handwriting Examination and Human Factors: Improving the Practice Through a Systems Approach.* Both publications discuss the recommended elements reports on the comparison of the known exemplars and unknown evidence samples should have. Those discussions can be used by other forensic disciplines to guide reports in those areas. The report on handwriting examination also contains terminology definitions.

The NIST OSAC has surveyed the terminology landscape and has developed a forensic science definition lexicon. The lexicon was placed online, and I now lead the effort for the OSAC QIC to develop OSAC approved definitions for the most controversial forensic science terms. The OSAC preferred terms task group, comprised of various stakeholder groups, has already agreed on twelve terms with twenty more working through the process.[13] This has been a highly collaborative effort between diverse stakeholders, and OSAC is making significant progress on defining terminology.

Another significant development is the participation of many forensic science organizations in the International Forensic Science ISO Technical Advisory Committee. This group establishes standards at the international level. Most of the major forensic science organizations participate in this relatively new development. This allows the United States to participate heavily in international forensic science standards making, including international forensic science terminology standards.

The Department of Justice is in the process of developing guidance documents governing the testimony and reports of its forensic experts, known as "Uniform Language for Testimony and Reports," or ULTR documents. They are designed to provide guidance on the submission of scientific statements by DOJ forensic examiners when drafting reports

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[12] https://www.justice.gov/archives/ncfs/page/file/1004446/download.

[13] OSAC subcommittees are also addressing terminology at a discipline specific level.

or testifying. These ULTRs are best practice exemplars for state, local and Tribal laboratories, as well as federal laboratories. As of March 19, 2019, the following ULTRs have been completed.[14]

ULTR for General Forensic Chemistry and Seized Drug Examinations
ULTR for the Forensic Anthropology Discipline
ULTR for the Forensic DNA Discipline – Autosomal DNA with Probabilistic Genotyping
ULTR for the Forensic DNA Discipline – Mitochondrial DNA
ULTR for the Forensic DNA Discipline – Y-STR DNA
ULTR for the Forensic Fiber Discipline
ULTR for the Forensic Firearms/Toolmarks Discipline – Fracture Match
ULTR for the Forensic Firearms/Toolmarks Discipline – Pattern Match
ULTR for the Forensic Geology Discipline
ULTR for the Forensic Glass Discipline
ULTR for the Forensic Hair Discipline
ULTR for the Forensic Latent Print Discipline
ULTR for the Forensic Metallurgy Discipline
UTLR for Forensic Serology Discipline

RESEARCH

The NAS report found that as of 2009, "[l]ittle rigorous systematic research has been done to validate the basic premises and techniques in a number of forensic science disciplines. The committee sees no evident reason why conducting such research is not feasible; in fact, some researchers have proposed research agendas to strengthen the foundations of specific forensic disciplines. [footnote omitted] Much more federal funding is needed to support research in forensic science and forensic pathology in universities and in private laboratories committed to such work." [15]

We agree that more federal funding for research and the development of stronger ties between academic research community and the forensic science community is vitally necessary. As the PCAST recognized in its addendum to the main report, "[a] generation of forensic scientists appears ready and eager to embrace a new, empirical approach—including black-box studies, white-box studies, and technology development efforts to transform subjective methods into objective methods."[16] The PCAST report was welcomed as a voice on the issue of scientific validity and reliability, yet funding for research has been sparse at best.

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[14] https://www.justice.gov/olp/uniform-language-testimony-and-reports.
[15] NAS report, p 189.
[16]https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensics_addendum_finalv2.pdf.

In response to the PCAST report, the AAFS noted that it "recognizes the need for improvement, where needed, and view (sic) the findings in the President's Council of Advisors on Science and Technology (PCAST) report as notice of needed validation and improvement. While the Academy does not endorse every statement within the PCAST report, we appreciate the efforts of PCAST to clarify the scientific meaning of validity with respect to feature comparison analysis. The PCAST report is an important start to the discussion of scientific validity and we look forward to continuing that discussion with the larger community of forensic science practitioners." The AAFS went on to highlight that while "PCAST has conducted its work on assessments of scientific validity, the Academy, the National Commission on Forensic Science, the National Institute of Standards and Technology, the National Institute of Justice, and others within the forensic science community have been working to improve standards, training, quality control, oversight, and other necessary components of forensic science services."[17]

NIST and the FBI provide valuable foundational research. The PCAST report, at page 132, recognizes that the FBI Laboratory carries out important research and development activities so much so that the report, in its recommendation #5, endorsed a research budget increase for the FBI to a total of $30 million for its R&D activities, particularly for the intramural research program generally.

NIST is one of the government's research agencies. The PCAST report recommended that NIST be tasked to assess the foundational validity of current and newly developed forensic feature-comparison technologies. NIST has taken on that task by evaluating foundations of DNA mixture interpretation and bitemark evidence. Criteria for these reports have been issued and we anticipate reports being released soon. This tasking could be expanded to include other forensic disciplines, technologies, and methodologies. NIST also reviewed a significant amount of literature that forms the "body of research" supporting forensic science disciplines. That work is critically important to assess what further research needs to be done.

NIST's OSAC makes recommendations for research, as do the NIJ working groups, and the CFFLD. NIST has also funded the Center for Statistics and Applications in Forensic Science (CSAFE)[18] that has a practitioner advisory board, a senior advisory board, and a technical advisory board, all of which are composed of a diverse group of stakeholders, including many who are critical of the forensic sciences. CSAFE conducts research into human factors that create biases in the forensic sciences as well as statistical foundations for various forensic disciplines, including several feature comparison disciplines.

In March 2018, the Office of Justice Programs and Department of Health and Human Services established a Medicolegal Death Investigation (MDI) Federal Interagency

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[17] https://news.aafs.org/policy-statements/presidents-council-of-advisors-on-science-and-technology-pcast-report/.

[18] https://forensicstats.org/.

Working Group (MDI-WG). One of the working group's stated missions is to coordinate MDI research priorities. NIJ is a principal player in establishing the research priorities.[19]

To date, much research has been conducted and published in peer-reviewed publications. Since the NAS report, NIJ has provided over $129 million in forensic science research funds."[20] The PCAST report prepared an extensive compendium of scientific studies and research in the feature comparison disciplines discussed in the report. Responses to the PCAST report were varied, but significant criticism was focused on PCAST's assertion that the Council created its own criteria for scientific validity "without providing scientific support that these criteria are well accepted within the scientific community."[21] The PCAST ignored many studies supporting foundational validity, but in PCAST's opinion, the studies were not "appropriately designed" for their purposes. We believe this was a mistake, and the published research does add to the premise that feature comparison disciplines in general have demonstrated foundational validity. Nevertheless, as with other national reports, the forensic community is striving to conduct black box and white box studies. But these studies require enormous effort and resources, which is where the federal government can assist. We support the PCAST recommendation for increased funding for research, and the increase in funding in the proposed *Forensic Science and Standards Act.*

One criticism of the forensic science community was the lack of access to peer reviewed scientific journals. I report much progress in this area. The AAFS publishes the highly respected Journal of Forensic Science, and many other organizations have raised the bar in this area. ASCLD recently signed agreements with three international peer-reviewed and open-access scientific journals to publish validation studies, research, and other forensic science articles that will be free to everyone to access and utilize. The forensic science community is increasingly self-embracing open-access, peer-reviewed, and indexed scientific journals. Many organizations, such as AAFS and ASCLD, are publishing the proceedings of their scientific meetings.

AUTONOMY OF FORENSIC LABORATORIES

The issue of removing crime laboratories from law enforcement agencies has always been a controversial topic. Many argue that separating crime laboratories from a parent law enforcement agency would reduce possible bias and influence. But the practicalities of accomplishing that is formidable and the matter is a states' rights issue that would face significant resistance from numerous governors. The NAS report recommended laboratories be autonomous from or independent of law enforcement agencies. NAS recommended incentive funds to encourage the disgorgement of crime laboratories from their parent agencies. Many crime laboratories, however, belong in law enforcement

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[19] https://ojp.gov/resources/ojp-hhs-mdi-wg.htm#background.
[20] https://www.forensiccoe.org.
[21] https://www.fbi.gov/file-repository/fbi-pcast-response.pdf/view.

agencies that are overseen by an elected official, making the decision to downsize their departments more than just a financial one. In addition, the cost of removing the laboratory from the parent agency would cost much more than the federal government's incentive payments. Each laboratory would need administrative officers, personnel specialists, budget officers, IT personnel and others to support the functions and employees of the laboratory.

In many states, state law mandates where laboratories are placed within state government and how they are structured. Perhaps an achievable goal would be to ensure that labs have processes to ensure autonomy within their parent agencies, including oversight by a scientific director with decision-making authority. Since approximately 90% of the nations' multi-disciplinary laboratories are accredited, there is already a requirement for them to avoid undue influence.

Currently, there are a number of different reporting models for crime laboratories. Models exist where laboratories report directly to the governor, the state health department, the attorney general, or a city or county counsel. There are important things to be considered no matter what structure exists. Most significant is the senior scientific director having high-level decision-making ability and being insulated from replacement for political reasons. The Washington DC Department of Forensic Sciences (DFS) and Houston Forensic Science Center (HFSC) are held up as "independent" laboratories. While these laboratories do have a higher level of autonomy, they warn about communications being more challenging with customers and budget woes in bad budget years. They note the positive aspect as being that they can lobby directly for their own needs, but the negative aspect is that there is no entity to lessen the blow of mandatory budget cuts in bad budget years.

Arkansas had a lab system that reported directly to the governor's office. They recently moved the lab back under the public safety department because they determined that department was a better reporting structure. Idaho recently created my position as senior scientific director of the laboratory system with autonomy to make major decisions for the laboratory system. The creation of my position was pushed by the Colonel of the State Police because he recognized the need to clearly communicate the lack of undue influence on the lab in our state.[22] It should be recognized that some state labs do very little work for their parent agency. Most of the work comes from other state, county, and local law enforcement. Therefore, the potential undue influence is different for each laboratory based on the customers they serve and their funding structure.

As mentioned earlier, the NAS report does not go so far as to require the physical separation from the parent law enforcement agency. Recommendation #4 calls for

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[22] ATF also created a new Senior Executive Service position of Deputy Assistant Director, Forensic Services, for the head of the ATF forensic laboratory. https://www.officer.com/home/article/10227645/atf-names-forensic-scientist-czarnopys-to-lead-forensic-labs.

"removing all public forensic laboratories and facilities from the administrative control of law enforcement agencies or prosecutors' offices." The goal of the recommendation is to "maximize independence from or autonomy within the law enforcement community." We agree that doing all we can to encourage organizational autonomy to eliminate undue influence would help improve the scientific bases of forensic science examinations by reducing cognitive bias resulting from the laboratory's close association with law enforcement.

Accreditation of laboratories promotes the autonomy of public laboratories from law enforcement agencies and prosecutors' offices. Laboratories are increasingly recognizing the need for firewalls from undue influence by all stakeholders. Laboratories accredited under the general requirements for the competence of testing and calibration laboratories, ISO/IEC 17025:2017, are required to be impartial, giving laboratory personnel the ability to work with scientific independence. For example, Section 4.1.1 states that "Laboratory activities shall be undertaken impartially and structured and managed so as to safeguard impartiality." As noted earlier, according to the BJS report on Publicly Funded Forensic Crime Laboratories: Quality Assurance Practices, 2014, 88% of the nation's 409 crime laboratories were accredited by a professional organization.[23] Since 2014, 89 additional laboratories achieved their initial accreditation.[24]

The ASCLD National Outreach and Priority Agenda states "Forensic Science Service Providers (FSSP's) must be completely autonomous and independent from outside influence on all work products, including analytical methods, reporting, results, conclusions, opinions, etc. Most FSSP's work within parent organizations and governmental structures, and discussions about case priorities, funding, resources, and staffing are common. However, FSSP's should operate with budgeting and operational independence as much as possible while working to accomplish the requests of stakeholders. In all situations, FSSP's should be protected from extraneous pressures that compromise the ideals of independence and objectivity; this includes freedom from undue influence from stakeholders, interest groups, parent agencies, and the judicial system."[25]

ACCREDITATION

Accreditation of crime laboratories began well before the NAS report and has long been recognized as an integral element of quality management within a laboratory. The Department of Justice has recognized the importance of accreditation. Deputy Attorney General Yates has described accreditation as an assessment of a "forensic lab's capacity to generate and interpret results in a particular forensic discipline and helps to ensure an

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[23] https://www.bjs.gov/index.cfm?ty=pbdetail&iid=5828.

[24] Personal communication between ANAB and Ken Melson on 9/9/2019.

[25] https://www.ascld.org/wp-content/uploads/2018/10/2018-2019-ASCLD-NOPA.pdf.

ongoing compliance to industry and applicable international standards. An independent accrediting body assesses and monitors the quality of the lab's management system by examining factors that include staff competence; method validation; appropriateness of test methods; calibration and maintenance of test equipment; testing environment and quality assurance data. Accreditation is one way to increase the quality of work and reducing the likelihood of errors." [26] All DOJ forensic laboratories and other forensic science labs doing work on federal cases are required to be accredited by 2020. Many state, county, and local labs do a significant amount of work requested by federal law enforcement, federal prosecutors, and federal defenders.

Following legislative directive in the Justice for All Reauthorization Act of 2016 the DOJ also revised its grant funding process to help support new accreditations of laboratories. It clarified that both the Coverdell and the Byrne grants may be used to seek accreditation. In addition, DOJ directed that relevant Office of Justice program grants give preferences to laboratories that will use the money to obtain accreditation.[27]

Statistics from the BJS studies indicate a steady rise in the number of new accreditations under ISO/IEC 17025 for publicly funded crime laboratory respondents since 2002 from 71% to 83% in 2009, to 88% in 2014.[28] Since the 2014 BJS report, ASCLD/LAB and its successor ANAB have accredited 89 more publicly funded laboratories under ISO/IEC 17025.[29] It has also accredited 6 calibration laboratories under ISO/IEC 17025 and 33 inspection Bodies under ISO/IEC 17020.[30]

The National Association of Medical Examiners (NAME) accredits Medical Examiner offices and systems. "NAME accreditation is an endorsement indicating that the office or system provides an adequate environment for a medical examiner in which to practice his or her profession and provides reasonable assurances that the office or system well serves its jurisdiction."[31] At the end of 2016 82 medical examiner/coroner officers in 41 states were accredited by NAME.[32] the International Association of Coroners and Medical

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[26] https://www.justice.gov/opa/pr/justice-department-announces-new-accreditation-policies-advance-forensic-science.

[27] https://www.justice.gov/opa/pr/justice-department-announces-new-accreditation-policies-advance-forensic-science.

[28] Presentation by Matthew Durose, BJS statistician, to the NCFS on 2/3/14.

[29] By 2015 all ASCLD/LAB legacy accreditations expired, and all subsequent accreditations were accomplished according to the ISO/IEC 17025 standards.

[30] Personal communication between ANAB and Ken Melson on 9/9/2019.

[31] https://name.memberclicks.net/.

[32] National Science and Technology Council, Committee on Science, Medicolegal Death Investigation Working Group (MDI WG) *Strengthening the Medicolegal-Death-Investigation System: Accreditation and Certification-A Path Forward*, December 2016, p. 3. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/mdi_wg_-_accreditation_and_certification_white_paper_1.6.pdf.

Examiner (IACME) also accredits medical examiner and coroner offices. As of 2016, 21 officers were accredited in 12 states.[33]

The FBI also has an accreditation program for laboratories performing forensic DNA testing or utilizing the Combined DNA Index System (CODIS) to ensure the quality and integrity of the data generated by the laboratory. The accreditation of a laboratory pursuant to the FBI Quality Assurance Standards for DNA Testing Laboratories is often administered by a laboratory accreditation body such as ANAB or A2LA. A2LA also accredits testing laboratories pursuant to ISO/IEC 17025:2017 and is authorized to administer the FBI Quality Assurance Standards.[34]

As of 2013, fourteen states and the District of Columbia had passed legislation mandating accreditation and other oversight requirements for at least some forensic service providers, including: Arkansas California, Hawaii, Indiana, Louisiana, Maryland, Massachusetts, Missouri, Nebraska, New York, North Carolina, Oklahoma, Texas, and Washington, D.C.[35] Accreditation is required only for laboratories conducting forensic DNA analysis in California, Hawaii, Indiana, and Nebraska; the others require accreditation for a broader set of disciplines.[36]

The United States State Department runs one of the most robust and professional programs to help labs become accredited. Unfortunately, the program does not run domestically in our country. This program could be modeled for United States domestic labs to the level of support being offered internationally. While accreditation funds are available through the Coverdell granting program, the available funds are not significant enough to cover the need. The Coverdell grants are stretched thin to provide operational funds to the nation's laboratories and medical examiners

Last year the American Society of Crime Laboratory Directors launched an aggressive mentor-based program to offer help to laboratories seeking accreditation. They partnered with the NIJ Forensic Technology Center of Excellence to initially help six laboratories obtain accreditation in a two-year period. Making tool kits, providing mentors, and supplying initial accreditation funding is essential to seeing even more labs become accredited.

While accreditation funds are available through the Coverdell granting program, the available funds are not significant enough to cover the need. Most large laboratories will

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[33] National Science and Technology Council, Committee on Science, Medicolegal Death Investigation Working Group (MDI WG), *Strengthening the Medicolegal-Death-Investigation System: Accreditation and Certification-A Path Forward*, December 2016, p. 3. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/mdi_wg_-_accreditation_and_certification_white_paper_1.6.pdf.
[34] https://www.a2la.org/accreditation/forensics.
[35] http://www.ncsl.org/Documents/cj/AccreditationOfForensicLaboratories.pdf.
[36] National Science and Technology Council, 2014, p. 5.

spend tens of thousands of dollars each year on accreditation expenses and ancillary requirements such as proficiency testing, security, and quality assurance. Most small labs will pay between five and ten thousand dollars a year for accreditation inspections and fees.

CERTIFICATION

My home state of Idaho was the first laboratory system in the country to require all analysts to be certified. We have required certification for somewhere over twelve years. Other labs have followed suit, and now some states require analysts to be certified or licensed. The requirement for analyst certification is supported by many forensic science organizations[37]

"Analyst certification is recognition by an external organization that an individual has acquired and demonstrated specialized knowledge, skills, and abilities in the standard practices necessary to perform duties and produce valid forensic findings. While accreditation is a quality assessment of a crime lab, certification is a quality assessment of an individual. External certification programs may assess analysts though exams, proficiency testing, evaluation of education, training and practical experience, adherence to codes of ethics, and other standards."[38] Certification compliments accreditation as a means of ensuring the validity and reliability of test results and enhancing public confidence in the judicial system.[39]

In 2014 the SoFS reported that:

> Professional certification bodies focused on the forensic sciences have existed for more than 30 years. Forensic science certification bodies typically focus on one or a few related forensic science disciplines, but there is not a certification body or process for every discipline or category of forensic testing. Those bodies that do exist vary considerably in terms of their eligibility requirements, use of proficiency test and practical exercises, provision of training and continuing education, and requirements for recertification, among other variables. As a result, the certification landscape for the forensic sciences is fragmented, with inconsistencies apparent even among certification programs accredited by the same entity. While many of these differences may be appropriate due to the considerable variability of skill sets required among the different

[37] ASCLD states in their National Outreach Priority Agenda that "ASCLD supports the certification of all forensic science professionals, if appropriate certification programs exist." https://www.ascld.org/wp-content/uploads/2018/10/2018-2019-ASCLD-NOPA.pdf.
[38] https://www.bjs.gov/content/pub/pdf/pffclqap14.pdf.
[39] NAT'L SCI. & TECH. COUNCIL'S SUBCOMM. ON FORENSIC SCI., STRENGTHENING THE FORENSIC SCIENCES (2014) p. 9.

> forensic disciplines, the forensic science field could benefit from a more standardized and comprehensive approach to certification.[40]

Today, however, there are accreditation bodies that accredit certifying organizations. For example,

> The Forensic Specialties Accreditation Board (FSAB) was created in 2000 as a voluntary program to assess, recognize, and monitor such specialty boards/certification bodies. The FSAB reviews and evaluates the operating procedures and standards of applicant forensic certification bodies to ensure that minimum standards are met. FSAB accreditation standards are modeled on ISO/IEC 17024, an international standard designed to ensure the validity, reliability, and quality of certification programs. For example, a certification body accredited under ISO/IEC 17024 must demonstrate a fair and equitable evaluation of all candidates; an organizational structure appropriate to the task of supporting its mission; policies and procedures for handling complaints, appeals, and confidentiality requirements; and a certification and recertification scheme.[41]

FSAB is currently in the process of transitioning to ISO/IEC 17011 and to ISO/IEC 17042 compliance. ANSI is another accreditation program that accredits certifying organizations. It is itself accredited under ISO/IEC 17011. FSAB, which accredits only forensic science certification programs, has accredited the following organizations:

American Board of Criminalistics (ABC)
American Board of Medicolegal Death Investigators (ABMDI)
American Board of Forensic Toxicology (ABFT)
Board of Forensic Document Examiners (BFDE)
American Board of Forensic Document Examiners (ABFDE)
International Board of Forensic Engineering Sciences (IBFES)
American Board of Forensic Odontology (ABFO)
American Board of Forensic Anthropology (ABFA)
International Association of Computer Investigative Specialists (IACIS)
Certified Fire Investigator Board, International Association of Arson Investigators (IAAI)

The International Association for Identification (IAI), which is currently applying for accreditation by ANSI, and the Association of Firearm and Tool Mark Examiners (AFTE) also certify individuals. The chart below lists the areas of certification and the number of certificants for these certifying bodies.

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[40] NAT'L SCI. & TECH. COUNCIL'S SUBCOMM. ON FORENSIC SCI., STRENGTHENING THE FORENSIC SCIENCES (2014) p. 9.
[41] NAT'L SCI. & TECH. COUNCIL'S SUBCOMM. ON FORENSIC SCI., STRENGTHENING THE FORENSIC SCIENCES (2014) pp. 9-10. The FSAB was created by the joint efforts of AAFS and NIJ.

CERTIFYING ENTITY	SUBJECT AREAS	TOTAL NUMBER OF CERTIFICANTS
American Board of Criminalistics (ABC)	Comprehensive Criminalistics Examination Drug Analysis Molecular Biology Fire Debris Analysis Hairs and Fibers Paints and Polymers	1,078[42]
American Board of Medicolegal Death Investigators (ABMDI)	Medicolegal Death Investigation	1,623 Registry Diplomates 243 Board Certified[43]
American Board of Forensic Toxicology (ABFT)	Toxicologist in the measurement of alcohol, drugs and other toxic substances in biological specimens and interpretation of such results in a medicolegal context	465[44]
Board of Forensic Document Examiners (BFDE)	Forensic Document Examiners	10[45]
American Board of Forensic Document Examiners (ABFDE)	Forensic Document Examiners	100[46]
International Board of Forensic Engineering Sciences (IBFES)	Engineering sciences	17[47]
American Board of Forensic Odontology (ABFO)	Forensic dentists	87[48]
American Board of Forensic Anthropology (ABFA)	Forensic anthropology	91[49]

[42] http://www.criminalistics.com/certification.html.
[43] Personal communication between ABMDI and Ken Melson 9/6/19.
[44] abft.org.
[45] Personal communication between BFDE and Ken Melson 9/6/19.
[46] Personal communication between ABFDE and Ken Melson 9/6/19.
[47] https://www.ibfes.org/news-and-publications
[48] Personal communication between ABFO and Ken Melson on 9/6/19.
[49] theabfa.org.

International Association of Computer Investigative Specialists (IACIS)	Certified Forensic Computer Examiner (CFCE)	1832[50]
International Association of Arson Investigators (IAAI)	Certified Fire Investigator	Approximately 2,164[51]
Association of Firearm and Tool Mark Examiners (AFTE)	Firearms Tool marks GSR/Distance examinations	148[52]
International Association for Identification	Bloodstain Pattern Analyst Certification Footwear Certification Forensic Art Certification Forensic Photography Certification Forensic Video Certification Latent Print Certification Tenprint Fingerprint Certification Crime Scene Certification	3,059[53]

Although in 2014, 72% of crime labs employed at least one externally certified analyst,[54] more practitioners need to be certified by a recognized certification body. Universal certification has several monetary and human capital costs. One of those challenges includes the fact that some practitioners perform examinations in different disciplines. To be certified in each testing area would incur significant cost and time concerns for the individual. Forensic science service providers also would have to accommodate the needs for time and resources of its employees to prepare for the certification examinations, and for alternative ways of meeting examination deadlines without employing additional examiners. Other challenges also exist.[55].

COGNITIVE BIAS

The NAS report also recommended research on human observer bias and sources of human error in forensic examinations. Even before the NAS report, there were studies conducted on issues such as confirmation bias and context bias. After 2009 there were numerous studies and peer-reviewed articles on cognitive bias, many by Itiel Dror. His research conducted with other well-known forensic researchers can be found at

[50] https://members.iacis.com/cfce, as of 12/31/18.
[51] https://www.firearson.com/uploads/CFIsforweb04032019.pdf.
[52] https://afte.org/afte-certification/certified-member-roster.
[53] Personal communication between IAI and Ken Melson, 9/13/19.
[54] https://www.bjs.gov/content/pub/pdf/pffclqap14.pdf.
[55] See https://www.bjs.gov/content/pub/pdf/pffclqap14.pdf.

https://www.ucl.ac.uk/~ucjtidr/ . Procedures have been implemented in many laboratories to minimize cognitive bias. For example, sequential unmasking is used to prevent the practitioner from seeing domain irrelevant information, and examinations are conducted in a linear fashion so that the crime scene evidence is examined before the known exemplars from the defendant and others.

Many laboratories, associations, and OJP funded grantees have had training in cognitive bias. OSAC has a Human Factors Committee that provides guidance on the influence of systems design on human performance, ways to minimize cognitive and confirmation bias, and ways to mitigate errors in complex tasks. Itiel Dror spoke at the AAFS Annual Meeting in February 2018 at the plenary session, and the National Clearinghouse for Science Technology and the Law presented a two-hour webinar on cognitive bias by Dr. Dror in 2019. There were 419 registrants for the webinar, and 244 views since the webinar was posted. The concept of cognitive bias is well-known in the forensic laboratories because of internal and external training, the work of the OSAC, and other initiatives. All forensic practitioners need to be trained in this subject, and funding would assist in accomplishing this goal.

PROFICIENCY TESTS

Proficiency testing is almost universally implemented in the publicly funded crime laboratories surveyed by BJS in its 2014 *Publicly Funded Forensic Crime Laboratories: Quality Assurance Practices,* 2014. It reported that 98% of the crime labs conducted proficiency testing in 2014. Proficiency testing is an important quality control process that measures the performance of crime laboratory personnel and the forensic science service provider itself. The tests help determine whether generally accepted practices are used and whether laboratory accreditation protocols are being followed. These proficiency tests are administered through internal or external declared tests, blind tests, random case reanalysis or interlaboratory testing. Blind proficiency testing is preferred, but in 2003 a DOJ panel reported that, after creating blind tests and evaluating them, that it would cost $500,000 to $1 million annually for one test per laboratory.[56]

The proficiency test providers used by laboratories for the accreditation-required proficiency tests are in turn accredited by ANAB pursuant to ISO/IEC 17043:2010.[57] One challenge to using external proficiency tests relates to those instances in which there are few practitioners conducting examinations in a particular discipline. In such cases, proficiency test providers may not see a cost-benefit in developing and disseminating those types of tests to a small group of practitioners. Federal grants for development of proficiency tests in those areas would increase the disciplines in which practitioners can be tested.

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[56] NAS report, p. 207.

[57] https://www.anab.org/forensic-accreditation/proficiency-testing.

QUALITY ASSURANCE AND QUALITY CONTROL

Accredited laboratories have quality assurance and quality control processes in place. As the NAS report stated, accreditation "means that the laboratory adheres to an established set of standards of quality and relies on acceptable practices within these requirements. An accredited laboratory has in place a management system that defines the various processes by which it operates on a daily basis, monitors that activity, and responds to deviations from the acceptable practices using a routine and thoughtful method."[58]

Accreditation requirements include written methods, protocols, validation, calibration, the use of positive and negative controls, corrective actions, among others. Accreditation means the laboratory has a quality management system in place. Most importantly, accredited laboratories require a Quality Assurance Manager (however named) to oversee the quality assurance and quality controls used in the laboratory. Many Quality Assurance Managers belong to the Association of Forensic Quality Assurance Managers (AFQAM). As that association states, its mission is to promote standardized practices and professionalism in quality assurance management for the forensic community.[59]

Quality Assurance Managers have started to network more with colleagues in other industries, especially in the area of risk assessment and management. Training is being regularly offered to laboratory staff on quality management principles and practices. The OSAC has a very active Quality Infrastructure Committee comprised of current or former quality managers and quality management experts. AFQAM partnered with the American Society for Quality (ASQ) to provide more quality assurance resources to laboratories.

CODE OF PROFESSIONAL RESPONSIBILITY

The AAFS and the CFSO agree that all forensic scientists should be subject to a code of professional responsibility. In 2014, 94% of crime laboratories surveyed by BJS maintained a written code of ethics. They either create their own code or adopt a code from their accreditation body or other source.[60] Many forensic scientists are under more than one code — their own code, ANAB's code, and codes of associations to which they belong. ANAB has a code of professional responsibility for all accredited laboratories: Guiding Principles of Professional Responsibility for Forensic Service Providers and Forensic Personnel.[61] In addition, most forensic science associations, to which many practitioners belong, have codes of professional responsibility and ethics.[62]

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[58] NAS report, page 195.
[59] https://www.afqam.org/wp15/.
[60] BJS *Publicly Funded Forensic Crime Laboratories: Quality Assurance Practices,* 2014.
[61] https://anab.qualtraxcloud.com/ShowDocument.aspx?ID=6732.
[62] See Melson, K. *Codes of Ethics in Forensic Science Societies: The Organizational Parameters of Morality and Conduct* in Downs J.C. and Swienton, A. eds. Ethics in Forensic Science, Elsevier, 2012, Chapter 4.

The SoFS also reviewed and studied codes of professional responsibility. It found that the existing codes there were four major categories of ethical assurance usually addressed by them. They were: "the need to (1) work within the parameters of one's professional competence; (2) provide clear and objective testimony; (3) avoid real or perceived conflicts of interests; and (4) avoid real or perceived bias and or susceptibility to outside influences". The Subcommittee on Forensic Science also found that the ASCLD/LAB (now ANAB) Guiding Principles of Professional Responsibility for Crime Laboratory and Forensic Scientists" code addressed all four of the assurances. The NCFS working group on a national code of professional responsibility recommended that the ASCLD/LAB document be adopted as the National Code of Ethics and Professional Responsibility for the Forensic Sciences. The Interim Solutions Subcommittee of the National Commission on Forensic Sciences utilized this code as its starting point for a National Code of Professional Responsibility for all forensic science and forensic medicine service providers and recommended it for adoption by the Attorney General[63]. On September 6, 2016, the Attorney General adopted a code of professional responsibility for DOJ laboratories based on DOJ's Scientific Research and Integrity Policy and the ASCLD/LAB Guiding Principles of Professional Responsibility. ASCLD adopted the Attorney General code of professional responsibility for the membership and encouraged all labs to evaluate their codes of ethics for robustness and enforceability.

A national code has thus been proposed. A code of professional responsibility very similar to the NCFS adopted National Code, is in place in ANAB accredited laboratories that by now includes over 90% of the publicly funded forensic laboratories.

CONCLUSION

I would be remiss if I did not also add that all of these efforts and challenges also affect the medical examiner and coroner community and perhaps more so. The medico-legal death investigation community more than any others has a workforce shortage that has become a national crisis. There are simply very few medical students seeking to become forensic pathologists. As a result, their accreditation is threatened.

As you can see, the community has not only adopted many of the recommendations from a variety of committees, commissions and boards. But the first recommendation of the NAS report, the creation of the National Institute of Forensic Science, has not been formed. The NAS report recognized the creation of this single federal entity would undoubtably pose challenges, not the least of which is budgetary. Creating an entity funded by existing appropriations from various agencies does not solve the budget problem; it merely passes the fiscal burdens downstream to those agencies, creating in effect a mandate without additional funding. I would argue that the solution may be to use the existing frameworks already in place as a result of the original recommendations that currently create a network of federal, state, local and tribal expertise, interaction and

[63] https://www.justice.gov/archives/ncfs/page/file/839711/download.

recommendations for research strategies. Specifically, OSAC and the following entities now participate in the inter-agency development of research needs:

> Forensic Laboratory Needs-Technology Working Group (FLN-TWG):
> This is a new structure created at DOJ to provide recommendations for technology transfer to the forensic science community and evaluate other needs of state, county, tribal, and local practitioners. FLN-TWG focuses heavily on how the federal government can assist state, county, tribal, and local practitioners with technology, policy, and resource needs.
>
> Forensic Science Technology Working Group:
> This NIJ group evaluates and prioritizes the research needs developed by the NIST OSAC and NIJ. It then recommends those programs for funding within the budget constraints of each agency.
>
> Council of Federal Forensic Laboratory Directors (CFFLD):
> DOJ reformed this group as an evaluation tool to consider the needs and direction of the federal forensic science service providers from any federal agency. While DOJ administers the group, they also invite all federal forensic science service providers to participate. The CFFLD is also now coordinating between federal agencies for things like research in measurement science, black box and white box research studies, and database development.

With the leadership of agencies like NIST and NIJ, there has developed an increasingly robust research agenda, without the need for a central office in the White House Executive Office. Indeed, having a National Forensic Science Coordinating Office in OSTP would subject the existence of the office to shifts in political winds depending on administration. Legislation requiring research activity and leadership in agencies like NIST, NIJ, and the National Science Foundation (NSF) would ensure to a greater degree the continued existence of national research.

In conclusion, our needs for a successful forensic enterprise are simple.

1. We need the continued support of the federal government to fund efforts to increase forensic laboratory and medical examiner office capacity, capability, and training. Current funding is minimal best. The majority of funding for the above-mentioned efforts come from the Paul Coverdell Forensic Science Act, which also includes operational needs of forensic laboratories and medical examiners. Its highest funding for the program has been $30 million which covers the entirety of the country's laboratories and medical examiners (See Appendix A);
2. The OSAC was funded by the Department of Commerce only in its initial year. Congress has added the funding each year since then as a pass through from the

Department of Justice. OSAC is not now codified, so the existing structure may or may not exist from year to year. OSAC needs to be codified;

3. Laboratory accreditation for forensic laboratories and medical examiners is costly to obtain and to maintain. Laboratories seeking accreditation need dedicated funding from the government;
4. Certification is important to the reliability of forensic methods but is a burden on laboratories because of personnel costs. The financial support of the federal government to allow laboratories the ability to have their examiners certified would help improve the services of forensic science community.
5. Research and development efforts, at all levels, are funded at best from year-end unexpended resources that the agencies can compile. However, we do not have visibility into those numbers and are only able to comment from the perspective of solicitations that we see from NIJ and NIST. It is clear, however, that research is needed and that the federal government must take a strong leadership role.

It must also be stressed to this committee that the forensic enterprise (laboratories, toxicologists and medical examiners) are also seeing an unprecedented amount of work coming through our doors due to the opioid crisis.[64] We don't know the magnitude of our need for resources, but we do know that it is great. A needs assessment of the laboratories and the medical examiners is imminent from the DOJ and we understand that there are dollar figures that have been associated with those needs. I would urge this committee to review those needs assessments while contemplating any new legislation that may affect the operation of our forensic science practitioners.[65]

It is vitally important to the criminal justice system in the United States to properly resource the nation's forensic science. Resources must be allocated so there is an equal access to valid forensic services in all areas of the country. A healthy and robust forensic science service provider network is important in this country to prosecute true perpetrators, exonerate the innocent, and provide closure for victims of crime. We thank you again for this Committee taking this issue seriously and helping us address these serious issues

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[64] See National Science and Technology Council, Committee on Science, Medicolegal Death Investigation Working Group (MDI WG), *Strengthening the Medicolegal-Death-Investigation System: Accreditation and Certification-A Path Forward*, December 2016. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/mdi_wg_-_accreditation_and_certification_white_paper_1.6.pdf

[65] BJS plans to initiate a new Census of Medical Examiners and Coroners' Offices in 2019. The census will collect information on staffing, budgets, caseloads, resources, policies, and procedures of medical examiner and coroners' offices. https://ojp.gov/resources/ojp-hhs-mdi-wg.htm#bjs-1.

APPENDIX A

HISTORIC FUNDING OF FORENSIC SCIENCE

PROGRAM	**FY20 (note pending, figures are President budget request only)**	**FY19**	**Fy18**	**FY17**	**FY16**
Paul Coverdell Forensic Science Grants	$10 m	$30m	$30m	$13m	$13.5m
DNA Initiative/Debbie Smith DNA Backlog Grants	$105m	$120m	$120m	$117m	$117m
Kirk Bloodsworth Post Conviction DNA Testing Grants	$4m	$6m	$6m	$4m	$4m
Sexual Assault Forensic Exam Program Grants	$4m	$4m	$4m	$4m	$4m
SAKI	$47.5m	$48m	$45m	$45m	$45m
OSAC (note funds are transferred from DOJ and have not been requested by the Department of Commerce in their budget for any of the years indicated on this chart)	0	$4m	$4m	$4m	$3m

Mr. Gamette was born and raised near Salt Lake City, Utah. He attended college at Brigham Young University in Provo, Utah and did undergraduate work in Zoology. He also received a Master's Degree from Brigham Young University in Microbiology where he studied parasitology with an emphasis on *Plasmodium falciparum* malaria. Mr. Gamette completed a certificate program in laboratory management through West Virginia University Forensic Management Academy, holds a certificate in Laboratory Management and Leadership from the University of California at Davis, and graduated as a Certified Public Manager in the Idaho program.

Mr. Gamette interned with the Utah State Crime Lab in Salt Lake City, Utah. He worked in the Spokane Laboratory of the Washington State Patrol from 2002 to 2008 as a biologist/DNA scientist and crime scene responder. He was promoted to Forensic Scientist 4 (Spokane Local DNA Technical Lead) in 2008. He has trained hundreds of detectives, crime scene responders, forensic nurses, and first responders in the collection of biological evidence. Mr. Gamette started his career with the Idaho State Police in late 2008 as the Laboratory Improvement Manager/Quality Manager for the laboratory system. He was promoted to Laboratory System Director over the three laboratories of the Idaho State Police in July 2014.

Mr. Gamette is currently serving as an elected board member of the American Society of Crime Lab Directors (ASCLD) where he is President, Chair of the Advocacy Committee, and a member of many committees and task groups. He serves as the ASCLD representative on the Consortium of Forensic Science Organizations (CFSO) and has served as the Chair of the CFSO Board for several years. He served as a certified assessor with the American Society of Crime Lab Directors-Laboratory Accreditation Board (ASCLD/LAB), and has performed DNA laboratory assessments all over the United States as a certified FBI DNA assessor. He is also an audit panel reviewer for the FBI's National DNA Index System (NDIS). He was selected and currently serves on the NIST Organization of Scientific Area Committees (OSAC) Quality Infrastructure Committee (QIC). He was recently selected as a member of the National Institute of Justice Forensic Laboratory Needs-Technology Working Group (FLN-TWG). He is a member of the American Academy of Forensic Sciences (AAFS), Northwest Association of Forensic Scientists (NWAFS), American Society of Crime Lab Directors (ASCLD), and Association of Forensic Quality Assurance Managers (AFQAM).

Chairwoman JOHNSON. Thank you very much. We now will begin our questions part. And I'll yield myself 5 minutes.

Ms. Garcia, I want to commend you and the Commission for your efforts to date for transparency about the ongoing challenges and for your continued push for improvement. Texas is probably not the first State most people would think about as a model for forensic reform. Yet you have achieved significant improvements over the last several years. Can you offer any recommendations about best practices or core principles for achieving forensic reform that could apply to any State?

Ms. GARCIA. Thank you, Madam Chairwoman. I think one of the reasons we've had success in Texas is because, number one, we have a legislative process, as you well know, that is very up close and personal. And so the members of the legislature in Texas spend a lot of time hearing the stories from exonerees, real-life issues that come up about particular areas of forensic science that may have contributed in some part to a wrongful conviction. Those messages resonate. So that's part of it, our legislative process.

But the main thing I would say is we have tried our best to create a culture in our Commission where we take the adversarial process and set it aside to have a genuine conversation in a transparent manner about what are the issues that are being faced by lawyers, by judges, by the forensic scientists. The labs bring their issues to us in the form of self-disclosure, and we talk about them in a public meeting. And that goes a long way to understanding and resolving some of the hardest issues that we have.

We don't shy away from reviewing things retroactively. If we've identified a problem such as when the FBI came out and said they had all these problems with the hair microscopy analysis, we looked at all those cases. We don't shy away from that, same thing with DNA mixture interpretation. And it takes as long as it takes, and we get the resources we need to address it and we do it together. So hopefully that answered your question.

Chairwoman JOHNSON. Thank you very much. Ms. Behenna, at the risk of inviting the joke of the Texas–Oklahoma rivalry, are there discussions in Oklahoma about studying the Texas model for best practices that might be implemented in your State and others?

Ms. BEHENNA. We are working—and I say we, the Oklahoma Innocence Project is working with the State Bureau of Investigation to review cases in particular where hair analysis was used and possibly could have resulted in a wrongful conviction. It is more of an ad hoc basis right now rather than a collaborative effort, which is what is going on in Texas.

There is much discussion in Oklahoma about criminal justice reform. Part of that discussion is trying to do in a more systematic way review of cases where bad or debunked forensic science has been used and its effect on possibly convicting somebody who was innocent, but not systematically, as I said, as you all have experienced in Texas.

Chairwoman JOHNSON. Thank you. The 2009 National Academy of Sciences report was the first organized voice of scientists, practitioners, and other experts recognizing the limitation of pattern evidence techniques and the urgent need to address these limitations. What are the most important advances in the use of application for

forensic science in the past decade? And this is going to be for everyone. The second question is, what in your view are currently the most significant weaknesses regarding the use of application of forensic science? And I'll start with you, Ms. Ballou.

Ms. BALLOU. NIST realized there were issues with the comparison of fingerprints and bullets, using what we call different techniques of the pattern evidence, and, therefore, establishing more of a measurement process where you would actually have an algorithm that was recognizing the comparison process and giving a numerical value to the examiner would increase the value of what they're seeing between those type of comparisons. And that's what the National Academies addresses, that it was more of a visual comparison by the scientists instead of having a numerical support.

Chairwoman JOHNSON. Thank you.

Ms. GARCIA. I would say in terms of most important, I think there was a recognition that the way it's been done for a long time through apprenticeship, you know, one person teaching the next person who teaches the next person about a technique, recognizing that that is not the best way to go about a scientific analysis, that was important. In Texas what we realized is that is not the fault of those who are doing the teaching or those who are receiving the information. So trying to address those issues in a blame-free way has been very helpful, but we took the lead from the NAS report.

In terms of weaknesses, people are just—they're trying so hard to get through casework they just need more support.

Chairwoman JOHNSON. Thank you. My time has expired. Mr. Lucas.

Mr. LUCAS. Thank you, Madam Chair. Ms. Behenna, we are grateful for your perspective here as a legal practitioner with a long and fruitful career in Oklahoma, including being on the team that prosecuted the Oklahoma City bombing case. But as a former prosecutor and currently a litigator, you've sat on both sides of the courtroom. Can you expand for us with some thoughts about what information would be useful for lawyers and judges to determine the validity of forensic evidence and how to judge the qualifications of the forensic expert witnesses because these are issues you dealt with?

Ms. BEHENNA. So——

Mr. LUCAS. And that's a very open-ended question, and I understand that.

Ms. BEHENNA. It is. With regard to educating lawyers and judges about forensic science and its validity I guess is a better way to phrase it, I think that has to come through education. As I told you before, as a young prosecutor, when an analyst came into my office or forensic scientist came into my office and they said this test means this or this comparison means this, I took that without question. And so I think it's important and I think there started to be discussion amongst lawyers, prosecution and defense lawyers, about sometimes we don't get it right, and sometimes science needs to be validated and it needs to be tested. So I think that's the most important piece as far as educating and talking to practitioners. We have to rely on forensic science, as I said before.

With regard to—you know, I think it's important for judges—judges, as I said in my written testimony, have a gatekeeping func-

tion. Before any expert can testify in a criminal proceeding or a civil matter for that matter, a judge has to evaluate the credentials of the person testifying and evaluate the science. And there are 702, 703, the rules of evidence. But sometimes judges as well are not well-educated on the validation or lack of validation of certain scientific techniques, and so I think in that respect, even though judges will continue to have a gatekeeping function, they need better education.

Mr. LUCAS. Mr. Gamette, let me turn to you. Idaho like Oklahoma is made up of many very rural communities. And there are special challenges in collecting and analyzing forensic evidence in rural communities. I assume Idaho is much like Oklahoma. My county sheriffs and my deputy sheriffs, my local chiefs of police and their patrolmen literally are jacks of all trades. They do everything in these little communities. What recommendations do you have for ensuring that no matter where a crime occurs we can have confidence in the way forensic evidence is handled?

Mr. GAMETTE. Thank you for the question. I do see challenges in our rural agencies that we tried to address first by direct training, so we send out our staff. We send them from the crime lab itself and we educate these officers. We work together in partnerships. We collect evidence alongside of them, which I think is mainly important there. We want to prevent any unequal access to justice, so meaning a small community should not have less access to forensic services than you would have in a major metropolitan community. So we need resources to be able to put into all of these local communities training, education for these officers, early training at post and those sort of things to be able to address these needs that they have.

Mr. LUCAS. Literally in Oklahoma my local law enforcement in many cases on the city, county level depend on the Oklahoma State Bureau of Investigation (OSBI). And by the time you have an event occur that requires that kind of data collection, it can be an hour or two sometimes before their specialist can get to the field to some different part of the State, and this information does deteriorate after all.

In my final moments I'd like to turn to Ms. Ballou and discuss NIST being given the challenge of bringing scientists, law enforcement, and lawyers together to achieve consensus. Tell us how that process is working, putting all these various minds, in the remaining time, together.

Ms. BALLOU. So you can imagine when you set up a new organization that there will be bumps in the road as you progress. And it was a learning experience. We found with the OSAC, with the size of it—550 members, actually was a little larger than when it first started—is that bringing everybody's personalities, expertise together and those who actually indicated that they learned a considerable amount from being part of that organization, as to what they initially thought was an easy task to do. And after listening to the other experts, whether it was in statistics or academia, they realized there was a lot they needed to learn also.

And so at this point NIST has learned that there are some changes that are needed in the OSAC process to make it more fluid and to obtain faster and increased results from it.

Mr. LUCAS. Expired, Madam Chair. I yield back.

Chairwoman JOHNSON. Thank you. Ms. Bonamici.

Ms. BONAMICI. Thank you. This is a fascinating and important topic. I appreciate the expertise of all the witnesses.

The right to a fair trial and the presumption of innocence are real cornerstones of our criminal justice system, and we know that jurors and judges and prosecutors and defense attorneys all rely on the scientific evidence by forensic analysts. It's labeled expert testimony, as Ms. Behenna noted. That gives it a highly persuasive impact. But we know that forensic evidence is not always reliable.

My home State of Oregon there's a lawyer named Brandon Mayfield. He lives not too far for me. I know him because our kids went to school together. After the 2004 train bombing in Madrid, Spain, Brandon was arrested and incarcerated based on fingerprints. His fingerprints were on file because he served as a lieutenant in the U.S. Army. He was incarcerated for a couple of weeks. The FBI broke into his home, tapped his phones, went through his garbage.

Later, a couple weeks after Brandon was incarcerated, the FBI admitted it made a mistake, despite the fact it was later revealed that the Spanish authorities had told the FBI apparently multiple times before his arrest that the fingerprints were a negative match.

Now, the government eventually apologized and paid Brandon and his family a couple million dollars, but I'm not sure that Brandon and his family will ever fully recover from the trauma they went through. It affected the whole community but certainly him, so my point is that this is a really critical topic that comes up in many ways.

I want to follow up on Ranking Member Lucas' question about training for judges and lawyers. And I want to ask about current training models and whether they could be scaled nationwide. The Federal Judicial College provides training for Federal judges. The National Judicial College provides training for State judges. They're already providing forensic science training. Is there anything more that either organization can and should be doing in this area? Ms. Garcia, Ms. Behenna, I think might answer that.

Ms. GARCIA. One thing we're trying to develop in Texas based on feedback from our judges is actually a resource that they can access from the bench because, as Ranking Member Lucas mentioned, some of them are in very rural parts of the State. They cannot physically make it to the judicial conferences and the trainings, so we're trying to bring the resources to them.

Ms. BONAMICI. Interesting. Thank you. Ms. Behenna, do you have any thoughts on that?

Ms. BEHENNA. No, I really don't. And it's—I mean, I wasn't aware—I knew that there was some training that was going on at least on the Federal level, not aware of the State, but, I mean, I would rely upon obviously Ms. Garcia with her——

Ms. BONAMICI. Thank you. I also wanted to talk a little bit about one of the recommendations from the NAS study that—13 recommendations for improvements. One of them is fund research on sources of human bias in forensic science. I wonder if you could talk a little bit about that.

There was a suggestion during Brandon Mayfield's whole event that there was bias because after Brandon married his Egyptian wife, he converted to Islam, so there was some suggestion that his son was taking Spanish, so when they found the computer—there were just a lot of things that were alleged to be caused by bias. So anybody want to address the extent that human bias affects these cases? Mr. Gamette and then Ms. Behenna.

Mr. GAMETTE. I can say that right now practitioners are actively working on this issue. There are several laboratories, including Houston and Phoenix, Arizona, where they're working on human bias with researchers, performing research in the laboratory, putting precautions into place to address this very issue.

Ms. BONAMICI. I think that's something that's fascinating. Maybe we can follow up in another hearing. Ms. Behenna, your thoughts on that or Dr.——

Dr. KAFADAR. Kafadar.

Ms. BONAMICI. Kafadar.

Dr. KAFADAR. Yes, thank you. The Center of Excellence to which I alluded and where I'm working, I participate as well. Some of the projects involve trying to assess the level of bias and how you can modify the presentation of the materials to minimize the bias. There is also, in the OSAC that we mentioned, the three resource committees, and the last page of my testimony shows the organizational chart. There are three resource committees, one of which is human factors, and they try to assess any of the standards that come through to ensure that there is a minimum bias in them.

Ms. BONAMICI. Terrific. Ms. Behenna, do you have a thought on that as well?

Ms. BEHENNA. Just quickly to follow up and that is that I think that a forensic scientist's independence—I'm sorry—and understanding that he is independent or she is independent will be helpful as well in eliminating bias.

Ms. BONAMICI. Absolutely. I see my time is expired. I yield back. Thank you, Madam Chair.

Chairwoman JOHNSON. Thank you. Mr. Posey.

Mr. POSEY. Thank you very much, Madam Chair.

In preparation for this hearing I contacted the sheriff in the county where I live and asked him for his thoughts or anything that I might be able to add to the conversation based on his experiences. And this is a statement that he gave me that I'd like to enter into the record.

Chairwoman JOHNSON. Without objection.

Mr. POSEY. Thank you. "As a career law enforcement officer with over 39 years of public service, I applaud the A.G. Sessions' position to disband those who seek to weaken the criminal justice system with the creation of the National Commission on Forensic Science. Ending a so-called group of advisers made up of attorneys and scientists whose sole purpose was designed to discredit and reject reliable and admissible forensic evidence was the right thing to do then, and it still remains true. What should be discussed is how our Federal law enforcement partners can help with forensic funding to expedite the lab submissions and eliminate untimely evidence backlogs."

And so having submitted that, I'd just like to start with Mr. Gamette, ask what you think we can do in that regard to help eliminate those backlogs. I know I've heard some discussion say it takes so much time, it takes so much time, but, you know, what would be the best way to eliminate the backlogs?

Mr. GAMETTE. I think there's several issues there. One is in funding, and Coverdell is one of the main options that you have for funding in the laboratories. That Coverdell funding goes directly for instrumentation, for personnel, and other things that will directly impact the backlogs significantly.

The other thing is in training. What we need is a bridge training to get people from education directly impacting the crime lab turnaround time. So we need a better transition plan to get those students from college into the laboratory. Sometimes it can take 6 months to 2 years to train those people, and that's not helpful when we need to eliminate the backlogs today.

Mr. POSEY. OK. Now, do you see that we have an adequate crop of aspirants for those positions? With an awful lot of TV programs now dealing with these subjects, I would think there would be a whole lot more public interest.

Mr. GAMETTE. We do have a number of applicants for every position that we advertise. Sometimes we have a problem getting them through the background and polygraph process to be honest, but we do have a number of people that can take those jobs. It's a problem of transitioning them from their college education programs into a very specific niche of science.

Mr. POSEY. Very good. Thank you. Doctor?

Dr. KAFADAR. You were asking what can be done to reduce the backlog?

Mr. POSEY. Yes, just your thoughts on that.

Dr. KAFADAR. So I used it to work at Hewlett-Packard Company and they would continue to, you know, do processes. And what I often found is that when we designed statistical experiments to identify the factors that were affecting the sources of variation and the yield, you know, the percentage of proper products that were being outputted from the process, they actually saved a lot of time.

Mr. POSEY. OK.

Dr. KAFADAR. So it was a matter of process control.

Mr. POSEY. Thank you.

Dr. KAFADAR. Yes.

Mr. POSEY. Ms. Behenna.

Ms. BEHENNA. Yes, I won't profess to know how to clear a backlog. I will tell you that I hear from my friends at the OSBI who complain all the time about their backlog and forensic testing. It's a matter of resources.

Ms. GARCIA. Thank you. The Texas legislature has heard the same complaint that your sheriff made from various members of law enforcement around our State, and I'm very happy to report that this year they've really focused on it. They have funded the transition that Mr. Gamette spoke about. They're funding Sam Houston State University, the University of North Texas Health Science Center to take those students and really get them bench-ready faster and more efficiently. They are also dedicating a lot of money to Texas DPS (Department of Public Safety) to help them

reduce the backlogs. So I think—and they are expecting results, so it will be interesting to see what happens during the interim in the next legislative session.

Mr. POSEY. So the State has taken a lot of responsibility there clearly.

Ms. GARCIA. Yes, sir.

Mr. POSEY. OK. Thank you.

Ms. BALLOU. NIST has the opportunity to look at the actual processes that are in place at the crime labs. Therefore, we hear from the scientists as to where they actually have the difficulty. Do they need a quicker version of a particular methodology to assist in expediting the analysis of whatever the evidence might be? And we had success with that when the DNA was coming on board specifically with 9/11. They needed a method that was quick on determining what possible DNA existed in the dust that was collected at the site, so NIST took it upon themselves to look at a different type of methodology or procedure. We continued to do that and look forward to working with scientists on areas where they need to look at the backlog areas or the logjams that are in the analysis process.

Mr. POSEY. Well, thank you all for your good answers, and my time is expired. I yield back.

Chairwoman JOHNSON. Thank you very much. Mr. Lamb.

Mr. LAMB. Thank you, Madam Chairwoman. And thank you to all the witnesses for being with us today.

I also used to be a prosecutor before I was in Congress, and actually one of the biggest cases in my career I consulted an expert from NIST, which helped us kind of push the case over the line. We had really high-quality fingerprint evidence, the science for which has come under debate, as Ms. Bonamici talked about. But it kind of is what it is.

The issue in our case had more to do with the creation of a digital image of those fingerprints, which is a newer area of science and the law and was like very much under attack, the reliability of those images, whether they're clear enough to really make a match and that kind of thing. And it was somebody from NIST that we talked to and consulted with for months and months and months and got input on that really allowed us to prove the reliability of what the FBI had done in that case.

So it was a real success story and for me kind of shows how, when you have non-traditionally—or I guess scientists that are not traditionally connected to the criminal justice system weighing in on some of these topics, it can really strengthen the underlying practice of forensic science.

So I guess my question is, if the NCFS (National Commission on Forensic Science) has been disbanded for lack of a better word but NIST remains engaged in these subjects and wants to make other contributions, is NIST kind of the home institution for integrating forensic science and traditional and emerging science now to make sure we still get those same kind of results going forward?

Ms. BALLOU. My honest answer would be I'd love to see that, but what actually happens is NIST is so involved with all the Federal agencies and the scientists within them, and we work collaboratively as to where are the difficulties to expand on the research.

But NIST is also a part of the Council of Federal Forensic Laboratory Directors, so we sit at the table with the Directors of all the Federal agencies to listen to what the issues are, what are the concerns, where do they need additional measurement science applied.

And in addition, the National Institute of Justice has held two meetings now, which the sole point of these meetings is for every agency to list the research projects that are taking place so that agencies can see where they can collaborate on a particular project, to stop duplication and to make maximum use of the Federal budget. So in that point I don't say NIST is taking lead. We're more part of the collaboration of agencies within the Federal agencies.

Mr. LAMB. And do you feel like the institutional framework is such that you're getting close enough collaboration particularly with those engaged in criminal investigation and prosecution to be able to continue to play that role?

Ms. BALLOU. We are and I believe the OSAC is doing a wonderful process of updating even NIST with what the State and local needs are, which of course being in the Federal arena we don't always hear. So having them as participants right at our doorstep brings us back to where their concerns are and at that level.

Mr. LAMB. Thank you. Dr. Kafadar, you kind of touched on this a little bit in your testimony as well. Can you just weigh in on the role of NIST as it stands today in the absence of NCFS and maybe where you see things going forward?

Dr. KAFADAR. Yes, I used to work at National Bureau of Standards, which of course became NIST, and I agree it's a very collaborative organization. That's the sense of the scientists that work there. So I think that the kinds of roles that Ms. Ballou was describing are consistent and should be encouraged.

Regarding the interaction with the various disciplines, and I agree that OSAC has been very useful in pulling together a lot of people.

Mr. LAMB. Great. And I just wanted to ask about one last topic, which was the reference, Ms. Ballou, to the work you all are doing on detecting trace amounts of opioids and particularly synthetic opioids. I have a bill that we're circulating now trying to gather support for called the *POWER Act*. It's—there's a companion part in the Senate as well that Senator Sherrod Brown is pushing. And essentially, we're trying to get opioid-detection equipment in the hands of more local first responders and crime labs that can detect fentanyl and the synthetic versions that are coming out because a lot of times the existing equipment might detect heroin but not fentanyl. So I just wanted to flag that for you. If there's anyone at NIST that wants to weigh in on either of our bills or suggest ways that we can make them even more comprehensive or help law enforcement more, particularly as you discover new synthetic analogs, I think this is going to be a problem for us for a while, please contact my office.

Ms. BALLOU. I appreciate that, and we will be in contact.

Mr. LAMB. Thank you. I yield back, Madam Chairwoman.

Chairwoman JOHNSON. Thank you very much. Mr. Weber.

Mr. WEBER. Thank you, Madam Chair. Boy, this is interesting stuff.

Mr. Gamette, I'm going to start with you. Reading through your remarks and stuff, you mentioned that I think the AAFS was founded in 1948. And we've come a long ways because we didn't have a lot of the DNA and the technology that we have now back then.

So it's very interesting to me. And I had to be away from the hearing for a bit, so I apologize if this is redundant. Is there a national crime info system on DNA that everyone can feed into, different States, different counties, different agencies, so that the Nation as a whole knows where that information is located?

Mr. GAMETTE. Yes. There is a very extensive DNA database system in this country run by the FBI through the Department of Justice, and all local and State agencies that qualify, meet the FBI requirements, they have to go through very strict quality assurance categories and other things and be audited. But they can upload data that can be shared between the States both for arrestees and also for case data so that that data can be compared. We do it every day.

Mr. WEBER. So you call it case data. Of course there's all kinds of DNA evidence, right? You could call it a fluid, a hair, I don't know, skin, whatever else—how do you maintain the integrity of those, and do all those other agencies have to go and examine those personally?

Mr. GAMETTE. The profile that you'd be looking at in CODIS or the national DNA index system would be a series of numbers, and so those numbers are compared to each other digitally. All that work is done in the database itself. And so the States generate a DNA profile from whatever type of evidence it is. Whether it's biological, from blood, hair, saliva, anything could be entered. But we developed a profile and then the profile is compared in the index.

Mr. WEBER. So, this might be a legal question. So in a case, does the law enforcement agency have to physically see that evidence or it's just the, Ms. Garcia, you're shaking your head no. So they can go there and they can get the numbers rather, and that's admissible in court and you don't have to actually have that evidence. Is that accurate?

Mr. GAMETTE. So we have the evidence. The evidence would be collected at the scene. It comes into the laboratory. The evidence will be examined. Sometimes you might see the blood. Sometimes you might not. It might——

Mr. WEBER. So that evidence is still maintained in each particular jurisdiction——

Mr. GAMETTE. It is generally.

Mr. WEBER [continuing]. Is what you're saying.

Mr. GAMETTE. It comes into the State to be examined or to the local to be examined, and then it goes back to the agency once it's been examined and a DNA profile has been developed.

Mr. WEBER. OK. Thank you for that. Ms. Garcia, you said that you were hoping to develop a resource for judges they could use from the bench. What's the progress on that?

Ms. GARCIA. So, right now, we don't—we're just starting to outline it. We haven't—we just got funding to do this, so our fiscal year starts September 1. We're developing that, and hopefully, we'll be able to share it with other States when it's done.

Mr. WEBER. Congressman Posey read an interesting statement from his sheriff. What did you think about that sheriff's statement?

Ms. GARCIA. I understand that perspective. There are many members of law enforcement in our State who would share that. For someone who is out in a rural area with not much support, what's going on in Washington is very, very far away from the reality of what they have to contend with day in and day out. So we've made a special effort to work with law enforcement in more rural jurisdictions to make sure that whatever policy initiatives we envision from Austin, which also feels far away for some jurisdictions——

Mr. WEBER. I spent 4 years there.

Ms. GARCIA. Yes. That that—that those are doable, achievable for smaller agencies. And they will tell us when we are off course, and we will do our best to make course corrections.

Mr. WEBER. Is there—and this is a question—and I have about 40 seconds left. Is there one particular entity that sets the standard for—call it whatever you want, forensic—my son's in the FBI. I think he deals with forensic data from financial crimes and stuff, so I know forensic is kind of a broad term I guess. But in forensic data, there's DNA and all those kinds of things, who sets the standards so that forensic people are qualified? Who does that? Ms. Ballou? You're awful quiet.

Ms. BALLOU. It depends on what area of forensic science you're looking at. As you already mentioned, FBI sets the standards for DNA submission of profiles. So everyone looks to them for; what do I have to meet to get that in? But for what each individual has to meet to, say, be certified in the profession or for their agency to be accredited, I would say that everybody's kind of on their own on that one, on deciding what the agency expects to see in their employees and in their divisions and departments.

Mr. WEBER. But Ms. Garcia is putting that together so that she could have that to offer to judges.

Ms. GARCIA. I did want to make a comment. In Texas you must——

Mr. WEBER. You look like you did.

Ms. GARCIA. Yes. So in Texas we're the only State that requires a license to practice, so you must fulfill certain criteria that the legislature has set——

Mr. WEBER. And there's 87 different entities that Texas recognizes and 40-something are outside of Texas and 40-something in Texas?

Ms. GARCIA. Yes, sir.

Mr. WEBER. OK. I'm way over my time. Thank you for your indulgence. Thank you, Madam Chair.

Chairwoman JOHNSON. Thank you. Ms. Horn.

Ms. HORN. Thank you, Madam Chair, and thank you to our panel of witnesses.

And I would be remiss not to say it's good to have a constituent and resident of Oklahoma's 5th District.

So, Ms. Behenna, I'd like to start my questioning with you. I think in your testimony, especially looking at the intersection of forensic science and criminal trials and how we do our best to ensure that the science is good and that we're finding that balance in the

courtroom, it's been touched on in a couple of the other previous questions that we need to train judges, we need to train attorneys. And your transition from prosecutor to head of the Innocence Project is an interesting one. So my question is in what kind of training and way can you overcome the hurdle or the predisposition of accepting the information just as it's given to you or helping prosecutors and judges to understand their role in this process?

Ms. BEHENNA. The greatest resource that I have right now is, quite honestly, the State Bureau of Investigation, the OSBI. We work very closely with the State Bureau of Investigation. If I have a question about a DNA report that came from a smaller county in Oklahoma, I can call the OSBI. I feel that they feel that they are independent scientists, and they're there to help anybody, whether it's a prosecutor, defense lawyer, or somebody at the Innocence Project.

So there is not, again, a system in Oklahoma. I hope to resolve that sometime soon, not as soon as obviously as Texas has gotten on the ball with this. But hopefully that there is a resource like the OSBI that defense lawyers can contact and prosecutors can contact and questions things that they're told by their analysts and their experts.

Ms. HORN. Thank you. And to follow up on that for a moment, you mentioned a system and the progress from the Innocence Project. Have you noticed an impact of organizations like the Innocence Project or other organizations like the work that's being done in Texas informing trials and prosecutors, especially in places like Oklahoma where we have a significant problem with incarceration in clearly and sadly some high-profile cases of misuse of forensic evidence?

Ms. BEHENNA. When I left the U.S. Attorney's Office and explained to people that I was going to go do defense work and be the Executive Director of the Oklahoma Innocence Project, I think my friends on the prosecution side, both Federal and State, thought I had lost my mind. But I constantly engage in conversations with them to help them understand all of us have one goal, and that is to see that justice is done. That's a statement that I learned as a very young prosecutor at the Department of Justice. My role was to do justice. If that meant somebody was acquitted, so be it. Justice was served.

And so we're beginning this conversation in Oklahoma about justice is the most important idea. Because of this personal experience that I have, maybe I have a little more credibility when I tell people we need to make sure we do it right. They seem to listen. So it is my hope that in the future, at least in Oklahoma and around the country, people will understand that it's the importance of justice. That's what we're all working toward.

Ms. HORN. Thank you. And, Ms. Garcia, I wanted to ask a little bit more about effective procedures and how that can translate. Clearly, Texas has put in a lot of work to other States that may not be as far along and what the most effective procedures have been to identify mistakes, fraud, and bias on the front end if States or other places aren't able to fully implement the same type of system that Texas has.

Ms. GARCIA. So Texas took the language in the Paul Coverdell law very literally, and they created an agency that investigates allegations of professional negligence and misconduct. That process and doing that transparently is how we started—and doing it fairly is the single best tool we have. Most States do not do that. They assign the task either to the A.G. or to an Inspector General or something like that. But we have a Commission with dedicated scientists who do that. And so the issues get vetted in a much more thorough way. That's where I would start in any State.

Ms. HORN. Thank you. I yield back.

Chairwoman JOHNSON. Thank you very much. Before we go to the next questioner, let me express my appreciation to you, Ms. Behenna, for being here. I know you're going to have to leave soon to make your connections. You've been a very import witness, and we appreciate you being here.

Dr. Babin.

Mr. BABIN. Yes, ma'am. Thank you, Madam Chair. I appreciate it. And I want to tell all the expert witnesses thank you for your testimony today. It's fascinating.

The use of forensic science has changed the way that we are able to study crimes and prosecute wrongdoers by providing more factual clarity in the evidence that we collect. The accuracy that has been brought to the courtroom since the introduction of forensic science is really pretty astounding.

And I notice in your opening statements in 2016 where the Texas Forensic Science Commission issued a decision recommending a moratorium on the use of bite mark evidence in future criminal prosecutions in Texas, I remember that. I practiced dentistry for 36 years in a rural area in east Texas, and I remember close to 20 years ago our Sheriff's Office brought a container of skeletal remains by my dental office and asked me if I would help in trying to establish an identification. And I did my report, and I told the chief deputy, I said, "well, I've done everything I can do. You know, I have to have some comparisons." And I thought it would be 6 months, and just a few days later he brought me several records, dental records from other dental offices, and we made a positive identification.

And sadly, they were never able to solve that case, but the family did receive some closure about what happened to their young son. He was a U.S. Marine who had been home on leave. So, anyway, I thank you very much. It's certainly an important aspect of our criminal justice system.

And you had mentioned, several of you, about how long it takes to be trained and certified to be a forensic scientist. I know how long it takes to become a dentist, although we do have specialties in forensics and dentistry, and it does take a little while longer. But did I hear one of you say it took about 2 years to get trained up to do this? You said that, Mr. Gamette?

Mr. GAMETTE. Yes, sir. It can take somewhere between 6 months to 2 years is generally a training period that we would quote.

Mr. BABIN. OK. And so the training—do you have just academia, universities and colleges, or is this kind of like a vocation or what type of 2-year training does that entail?

Mr. GAMETTE. We hire scientists to work in our laboratories, so generally they will have a 4-year degree or more advanced degree——

Mr. BABIN. OK.

Mr. GAMETTE [continuing]. Master's degree——

Mr. BABIN. Right.

Mr. GAMETTE [continuing]. Ph.D. in the science that they're working in.

Mr. BABIN. OK. Thank you. And I have the privilege of representing a Houston district that stretches all the way to Louisiana by the way, and I want to just take a minute to commend the Houston Forensic Science Center (HFSC). HFSC was an early adopter of high standards approved by the Organization of Scientific Area Committees of Forensic Sciences, of which many of you know is administered by NIST and strengthen this Nation's use of forensic sciences.

And, Ms. Garcia, you're a Texan. Do you have any recommendations or ideas on how NIST could build off of their ongoing relationship with States to better their systems and make improvements?

Ms. GARCIA. Yes, sir. Actually we've invited NIST to our last two meetings, and we are trying to follow in HFSC's footsteps—as you mentioned, they adopted the standards early—by working with all of our labs so that we take the same position Statewide. And I think what NIST is going to need to do is go State to State and work with the responsible laboratories to make that happen everywhere.

One thing I just wanted to note quickly is with respect to human identification using dental records, we have no issues with that.

Mr. BABIN. Oh, yes, I understand.

Ms. GARCIA. OK. Just to make it clear.

Mr. BABIN. But, you know, I graduated from dental school a while back, and I remember when bite marks were supposed to be positive proof, and that all went out the door at least in the State of Texas in 2016, so I understand.

And, Ms. Ballou, would you care to comment on that as well, with NIST and ongoing relationships with States?

Ms. BALLOU. One of the activities NIST has taken under their wing was to request the NIST scientists to actually visit and take part in crime laboratories. And we've done so with the Maryland State Police and the Montgomery County Crime Lab. Those are both fairly close to the NIST Gaithersburg campus. And we've also visited several agencies in New Jersey and I believe Pennsylvania as well. And it has turned out to be a real eye-opener to our scientists.

When I first arrived at NIST coming from a crime laboratory I was asked to help the research move faster to be applied into the actual workings of the crime laboratory. And when I was shown some of the results of the research I said, well, why are you using those items to test? And they said, well, these are the pure items we always test to determine whether the technology works. I said, well, let me put some spit on it, dirt on it, and some other things, and that would represent what we truly receive from the crime scene. And so it's been a real educational process, and NIST has really expanded the activities that it had taken forth on this.

Mr. BABIN. Thank you very much. It's fascinating. I could ask all of you questions for about an hour, but I'm running out of time, so I'll yield back. Thank you, Madam Chair.

Chairwoman JOHNSON. Thank you very much. Dr. McNerney.

Mr. MCNERNEY. Well, thank you, Chairlady. And I want to thank the witnesses. I mean, this is very informative testimony, and I hope we can sort of change that into Federal law in a positive way and Federal funding, too, so, again, I thank you.

There is an intersection in the discussion with the idea of bias and explainability with artificial intelligence. Ms. Garcia, with the advances in computational forensic science such as probabilistic genotype for DNA analysis and algorithmic firearm analysis, with this replacing human analysis and interpretation of evidence, can we maintain a defendant's constitutional right to cross-examine and challenge evidence against them when the evidence was produced by computers?

Ms. GARCIA. Thank you for the question. I think there's a misunderstanding about probabilistic genotyping in particular that there is no human element there. There actually is. We've been looking at that very closely in Texas. We are an early adopter of probabilistic genotyping. I do think that analysts need to understand what the software is doing. They need to be able to answer questions on cross-examination about what the software is doing. It should not be used as a black box to plug information in and just get out a result. We've actually—we are just now working on a couple of cases where we saw problems in the way the analysis was done, and we're using those as learning tools to help the labs understand that it is not a black box. And there are still human judgment calls that are made. No analyst should testify if he or she does not understand what that software is doing.

Mr. MCNERNEY. Thank you.

Ms. GARCIA. I hope that answers your question.

Mr. MCNERNEY. So that should be a defendant's toolbox is, hey, this stuff comes from a black box, and we don't have any way to cross-examine?

Ms. GARCIA. I would say that at least in Texas the type of software that the labs are adopting there is plenty of room for defendants to ask questions about what's going on underneath that. It's not actually as much of a black box as I think people think it is.

Mr. MCNERNEY. Thank you. Ms. Kafadar, how should forensic standards evolve to address not only advances in the science but implementation of forensic methods and software?

Dr. KAFADAR. Implementation of forensic——

Mr. MCNERNEY. Of forensic methods——

Dr. KAFADAR [continuing]. Methods, yes.

Mr. MCNERNEY [continuing]. And software.

Dr. KAFADAR. So I actually was glad that you asked that question to Ms. Garcia about probabilistic genotyping, and I agree with her answer that there are software programs that could be used to give objective—less subjective output. I think the challenge is in making those algorithms transparent. Right now, I think a number of the algorithms used in Automated Fingerprint Identification Systems remain proprietary.

And then also I think one of the real things that we want to do with those—that output is try to put some characterization as far as how likely is the output. Is it something that could apply to 20 percent of the population or only, you know, one in a million? So it would go a long ways toward making a more objective assessment of what was the output of the software.

Mr. MCNERNEY. Well, do you have concerns about the ascendancy of artificial intelligence in forensic science?

Dr. KAFADAR. In general, I think there's a lot of statistical foundations that needs to be—it needs to be applied to artificial intelligence algorithms. I think there have been a number of articles about that, and I would agree that there—there are a couple of aspects that arise with artificial intelligence algorithms versus the statistical foundations, and I think that stat foundations can enhance artificial intelligence algorithms because right now they're very dependent on the particular data on which they are developed.

Mr. MCNERNEY. Yes. Thank you. Ms. Ballou, in next-generation sequencing algorithms known as probabilistic genome software used to interpret complex DNA mixtures, this technology is widely used in forensic labs across the country. However, it's not nearly as mature as people may think it is. What do you think the current state of maturity is of next-generation sequencing?

Ms. BALLOU. And from NIST's point of view that is still under research. We are taking a look at it. It's a new area that we're investigating, and to find exactly where we are on that particular type of project we'll get back to with further information.

Mr. MCNERNEY. Well, it's—I mean, it sounds a lot of—in the past a lot of opinion has been passed on as science and has put a lot of innocent people in harm's way one way or another. So this is important, and I appreciate the hearing. Thank you.

Chairwoman JOHNSON. Thank you very much. Dr. Baird.

Mr. BAIRD. Thank you, Madam Chair. And thank you, witnesses, for being here today. I appreciate your sharing your information.

Ms. Ballou, I'm going to start with you. My home State of Indiana has made a significant investment in technology-based programs, substance use programs, mental health treatment services for those that are incarcerated. So is NIST able to measure the impacts of State investments like this and incorporate those into your overall program? And I think you've answered some of those, but I'm going to give you another chance because I'd like to see how you feel about that.

Ms. BALLOU. That's an interesting question, and I do not believe I have additional information to provide for you at this time.

Mr. BAIRD. So let's try another one then, OK?

Ms. BALLOU. OK.

Mr. BAIRD. In my community in west central Indiana, and across the country, as we all know, fentanyl and other synthetic drugs are causing a shocking increase in the number of deaths. Could you elaborate on NIST's work on the standards and for detecting these illicit drugs?

Ms. BALLOU. NIST is working on improving the current technology that is used to screen for the presence of certain drugs. Right now, we're trying to make it so that there's the smallest amount of contact between the first responder and the suspicious

material. We're still working to improve the process, and we hope to get that out to the community so that they can apply it as soon as possible.

Mr. BAIRD. Very good. Mr. Gamette, what challenges do you face in your laboratories with analyzing illicit drugs, and what would you like to see us help you to get your work accomplished?

Mr. GAMETTE. The challenges we see are instrumentation, which is very expensive in these disciplines, mainly toxicology and drug chemistry. It's also very expensive to train analysts in this discipline. It's expensive. NIST is providing some help on getting standard reference materials for us. That's been very helpful. So some of that research work to go into identifying panels for doing the validation study of these instruments when they come into the laboratory, that's also very helpful because it takes us a long time. What we haven't mentioned in this hearing is validation has to be done of every scientific discipline and every scientific instrument before we can use it in the laboratory. So all those things take resources to be able to do.

And with the medical examiners, they're also dealing with this opioid crisis and need resources, and they also have severe workforce issues that we need to start dealing with.

Mr. BAIRD. Thank you very much. I appreciate and I recognize the need for standards here and being able to use those as reference materials as you make comparisons, so I think that's extremely critical. And that was more of a comment than a question.

So, Ms. Garcia, can you elaborate on how the Texas Commission is working on the NIST Standards Coordination Office? You've probably answered part of that. And do you have any recommendations for how NIST could better coordinate with other States or with the States?

Ms. GARCIA. Thank you for the question. So when I refer to the Standards Coordination Office, what I'm talking about is actually not the OSAC. It's a separate part of NIST that interacts—helps regulators, both Federal and State, to work with accrediting bodies. So all of our laboratories are accredited, but what we've seen over the last 10 years is that accreditation has great benefit but it also misses some things. And some of those are major things.

So what we are trying to do is work with that body so that they can help us set up a list of—in addition to the ISO program, these are the things that we'd like to see in Texas laboratories. And then we'll work with the accrediting bodies so that they can assess the labs against that extra list. And it could include everything from human factors considerations, all sorts of things. So that's what I meant with that comment.

Mr. BAIRD. Thank you. And one last, I've got about 36 seconds I guess, so Ms. Ballou, can you elaborate on how you prioritize the work in your forensic science and——

Ms. BALLOU. We prioritize our work really by listening to the experts, the forensic scientists themselves to learn where are the issues that they're facing. We also pay attention to what are the latest court issues that are taking place, what concerns actually happened in the courtroom, is there somewhere that we can apply measurement science to address those issues?

Mr. BAIRD. Three seconds. You did very well, thank you. I yield back.

Chairwoman JOHNSON. Thank you very much. Ms. Wexton.

Ms. WEXTON. Thank you, Madam Chair, for yielding, and thank you to the panelists for appearing today.

Before I became an elected official, I served—I'm a recovering lawyer. I served as a prosecutor. I was a criminal defense attorney, and I was even a judge for a while, so I have seen firsthand how incredibly persuasive forensic evidence is. In fact, a lot of times during voir dire certainly in serious felony cases I would inquire of the venire, "How many of you would convict without some sort of forensic evidence, whether it be fingerprints or DNA or a certificate of analysis?" And it was surprising to me, but on just about every panel there would be some people who would say I would not convict without that information. So it works both ways. So, you know, I have seen at all different cases how we have used forensic evidence.

Now, in 2005—my home State is Virginia, and in 2005, we changed the DWI (driving while intoxicated) statute in Virginia. We're all accustomed to the .08, you know, liters percent per—you know, by weight, by volume, or per 2/10 liters of breath. But Virginia changed our statute to have presumptive levels of cocaine, methamphetamine, MDMA, and PCP in blood for presumptive impairment.

Now, that was interesting to me, so when I saw—it was before I served in the State legislature. I went to look up the legislative history, and I saw that there really wasn't any. And when I spoke with Members who were, you know, present when this was passed, I asked them, you know, what kind of scientific evidence was presented about the impairment levels with these various, you know, milligrams of substance in the bloodstream, and there was—nobody had any recollection of anything.

So that got me thinking about—now, I haven't seen any cases, by the way, being prosecuted under this particular section, but that got me thinking, as we have—you know, there are more and more States that have legalized marijuana, it is still presumptively illegal to operate a motor vehicle under the influence of marijuana in those States where it's legal.

So I guess my question is kind of a two-part question. First of all, who makes the determination—you know, how is that determined what that presumptive level of a substance would be to bring up to the level of impairment? And second, are there any—is there anything going on in the area of marijuana intoxication that NIST is involved with or any of the other State labs are involved with?

Ms. BALLOU. Actually, NIH (National Institutes of Health) had done considerable studies. We're working with Dr. Marilyn Huestis, who was lead on that, and she was looking at, what are the effects of marijuana? How does it impair different people? We were hoping to take that information and then start working with other entities that have similar experience on determining a detection process.

So NIST had worked with FIU, Florida International University, who had expertise in determining some of this relative information and trying to devise some type of detection instrument that would

be similar to the breathalyzer that you could take in the field and have somebody breathe into. The difficulty is that the exhalation of the metabolites from the marijuana differ from person to person. So we're still at the stage of trying to figure this out and also working with legislators as to what should that level be for impairment.

Ms. WEXTON. And could the level of impairment for one individual be different from another individual?

Ms. BALLOU. Yes, it could.

Ms. WEXTON. OK. But it's like alcohol in that regard?

Ms. BALLOU. Yes.

Ms. WEXTON. Ok. How about other substances like the cocaine or MDMA or PCP?

Ms. BALLOU. At this time we're not working on those particular substances as that would have to be a blood draw, correct?

Ms. WEXTON. Yes.

Ms. BALLOU. And therefore, further work within the laboratory would take place on that. And at this time I don't recall if NIST is involved in those particular testing procedures.

Ms. WEXTON. OK. Ms. Garcia, do you have anything to add about those processes?

Ms. GARCIA. I would just say that I don't think we have limits or detection levels in Texas on those substances. I think any presence of that in the blood is going to be grounds for potential offense. In Texas marijuana is not legal but we—the legislature just passed something similar to the Federal farm bill. So right now, we're working very closely with the D.A.'s on distinguishing hemp from marijuana.

But in terms of marijuana in the blood and impairment, I know from talking with our toxicologists it's a particularly tricky issue in terms of how you set the line for impairment for operating a motor vehicle.

Ms. WEXTON. Very good.

Ms. GARCIA. So we need help from NIST.

Ms. WEXTON. Thank you very much. I see my time has expired.

Chairwoman JOHNSON. Thank you. Mr. Tonko?

Mr. TONKO. Thank you, Chairwoman, and thank you for holding this hearing on the state of forensic science in America. And thank you to our witnesses for joining us today and your expertise shared. Chairwoman Johnson, thank you for your leadership on this issue.

I fully support efforts to establish scientific standards and protocols across forensic science disciplines. DNA evidence has quickly become one of the cornerstones of justice in America. As our knowledge and technique in using this evidence improves, we need to make certain that our progress relies on credible, rigorous science.

New York's 20th congressional District, which I represent, has established itself as a home to national leaders in forensic science. The Forensic Investigation Center in Albany holds New York's DNA database, a vital resource to all who fight in the name of justice. That DNA data bank has helped with more than 3,000 convictions and has exonerated some 27 innocent New Yorkers.

Professor Igor Lednev at the University of Albany is working to develop new novel methods for forensic and medical diagnosis. With the help of more than a decade of continuous funding from the National Institute of Justice, he was able to develop the first

universal method for characterizing biological stains at the scene of a crime, revealing the time a crime was committed and vital personal details such as age, race, and sex. This novel technology can help investigators analyze a possible crime scene much more quickly, avoid more false positives, and help reduce forensic backlogs that plague every criminal laboratory in America and ultimately speed up lengthy legal proceedings for violent crimes.

Dr. Ray Wickenheiser, Director of the NYSP Crime Laboratory System, together with Dr. Lednev, have proposed creating a first-of-its-kind incubator for the development and validation of such novel technologies in forensic science. This will be the first incubator in the United States based on a State police crime laboratory that brings together researchers and inventors from academia—in this case the University at Albany—with engineers from private industry.

These efforts show how and where forensic science currently excels, but they should also help us address the areas of forensic science where our standards have failed to prevent grave injustices that can result from its misuse. For example, it has been common practice for experts to overstate the reliability and certainty of forensic science methods presented as fact. Juries and judges are sometimes misled into thinking expert testimony is supported by credible science even when the methods used were scientifically unreliable. This practice serves no one and leads to wrongful convictions and injustice for all. The Federal Government has a duty to press forward with the best science to ensure that our justice system employs those methods and eliminates the use of junk science.

So my question is to you, Ms. Ballou. Throughout your career and your work at NIST and your work with the American Association of Forensic Science, you have firsthand understanding of the role of both public and private sectors in ongoing forensic science reform work. Is there a role for these types of public-private partnerships in this field? And what commitments and investments could both sectors make to improving forensic science research and practice?

Ms. BALLOU. I'd say our first activity from NIST and the public-private was the establishment of the OSAC as we were able to pull in some of the private entities to provide their expertise for NIST understanding. We hope to expand upon that to have considerably more information shared between the different variety of groups.

Mr. TONKO. And how can the Federal Government assist in these types of partnerships like that of the New York incubator for the development and validation of novel technologies in forensic science?

Ms. BALLOU. I think you've heard today a lot of examples of different ways of establishing commissions or other institutes that look at the establishments of new technology throughout these States, the local or the Federal areas to expand that. So activity is already taking place. We just need more of them.

Mr. TONKO. Thank you. And, Mr. Gamette, have there been changes in university curricula and general approaches to education of forensic examiners over the last decade to ensure that they have stronger scientific and statistical understanding?

Mr. GAMETTE. Yes, there have been. Several of those changes have been made through FEPAC, which is a forensic education organization that is run by the American Academy of Forensic Sciences. And I think more progress needs to be made in this area, but I think the scientists and the colleges are starting to recognize that to get jobs in a major crime laboratory they're going to have to educate the science—the scientists to those jobs that they're going to go into.

I will also mention just briefly on what Ms. Ballou was talking about, there is a lot of work that's going on by several different groups, the Midwest Forensic Resource Center, the CSAFE (Center for Statistics and Applications in Forensic Science) that exists at NIST, in partnering the practitioners directly with the researchers, funding the research, but then making sure that they have the application of the practitioner there so that it does go into practice once the research is completed.

Mr. TONKO. Thank you very much. And with that, Madam Chair, I yield back.

Chairwoman JOHNSON. Thank you very much. Mr. Perlmutter.

Mr. PERLMUTTER. Thanks, Madam Chair. I'm usually the last one because I always come in last. But I appreciate your testimony.

Mr. Posey's letter from his sheriff made me think about the whole reason for today's hearing. And I appreciated that his sheriff wanted to see more criminal enforcement and all that sort of stuff, but we start with beyond a reasonable doubt. And where does that come from? So I actually looked it up.

So you start with Abraham and Sodom and Gomorrah. The Lord didn't destroy Sodom and Gomorrah till Lot's family had escaped because he was going to favor the innocent over the guilty. Then Muhammad says if there are any doubts in the case, then use them, for it is better for the judge to err toward leniency. Maimonides said let a thousand guilty go free, lest one innocent suffer. William Blackstone at the beginning of English jurisprudence said 10. I don't know why he reduced it from 1,000 to 10, but Benjamin Franklin—and I would refer to Benjamin Franklin and quite frankly John Adams before I refer to the sheriff from whatever county that is in Florida. Benjamin Franklin took it to 100. He said it is better 100 guilty persons should escape than one innocent person should suffer. And John Adams said, it is of more importance to the community that innocence should be protected than it is that the guilty should be punished.

And so that's the reason for today's hearing. That's the reason we need to have our laboratories led by NIST really be as excellent as possible so that we don't convict innocent people. We lean toward allowing the guilty to go free.

So Ms. Ballou, I was at the National Water Quality Lab on Friday in Colorado, so at the Federal center in Colorado where they were talking about trying to detect environmental issues down to one part per trillion. And so from a statistics standpoint, from a scientist standpoint, how do you guys determine if something is beyond a reasonable doubt? Or is that we're just going to leave it up to the jury?

Ms. BALLOU. So—it would help if I hit the button—I received that question when I was testifying once. Do you believe your testi-

mony confirm beyond a reasonable doubt? And at that time I wasn't quite sure what that meant, beyond a reasonable doubt.

And from the National Commission on Forensic Science, our attorney general at the time determined that none of the prosecutors should be using that phrase; beyond a reasonable scientific certainty because it is uncertain exactly what it means. And therefore, at NIST we look more toward, what is the scientific basis of a methodology or procedure? That would be our determination. In looking at the procedures that we put in place, are they scientifically solid? Is there a foundation established? And from that point on, then determine to what degree can we give a response to the jurors, to the officers of the courts as to our findings.

Mr. PERLMUTTER. Anybody else? Good answer, by the way.

Ms. GARCIA. I would say that the importance of teaching our scientists what the limitations are of what they're saying is so critical in response to your question. If someone gets up and says so-and-so left that bite mark to a reasonable degree of scientific certainty and there is no data or science supporting that statement, that's how you get the trier of fact, the jury, to make the wrong conclusion on your question. So we have got to understand what our methods are, are they valid, and NIST has got to help us with that. And what are their limitations, and how can we articulate those in a way that does not lead to an injustice?

Mr. PERLMUTTER. Thank you.

Mr. GAMETTE. I was going to say quality assurance is really important in this discussion because we don't just press for productivity; we press for quality. And that's what we want to do in the laboratory every day. We don't want somebody going to jail that shouldn't be there.

Now, important in that discussion, as it was just being discussed, uniform language in reporting, uniform language in testimony, what can the scientists say? And these standards are being established at OSAC. And it's the practitioners that are working with the researchers, with the statisticians. They all work together to be able to get this right and get it right in the courtroom.

Mr. PERLMUTTER. Thank you. Anything?

Dr. KAFADAR. I'll just say that the average person still has trouble understanding uncertainty, and so statisticians are trying to figure out ways that we can communicate not just the confidence in our results but the limits of the uncertainty.

Mr. PERLMUTTER. OK. Thank you. I yield back.

Chairwoman JOHNSON. That concludes all of our questioners. And let me thank all the witnesses for being here and for your excellent testimony.

The record will remain open for at least 2 weeks for additional statements from Members or any additional material you'd like to submit.

At this time I will say thank you to the witnesses. And you are dismissed, and the meeting is adjourned.

[Whereupon, at 12:37 p.m., the Committee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Ms. Susan Ballou

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

"Raising the Bar: Progress and Future Needs in Forensic Science"

Questions for the Record to:
Ms. Susan Ballou
Program Manager, Office of Special Programs
National Institute of Standards and Technology

Submitted by Chairwoman Eddie Bernice Johnson

1. As you and Ms. Garcia both noted in your testimony, NIST is working with the state of Texas to assist them in developing a general framework for improving the forensic lab accreditation process in Texas. As Ms. Garcia noted, just because a lab is accredited doesn't mean its science and practice are actually meeting current standards. Is NIST considering how to evolve this Texas specific framework into a more generic framework that could be voluntarily adopted across more states?

NIST Response:

The NIST Standards Coordination Office and the Texas Forensic Science Commission (Commission) have agreed to work together to explore the root causes of forensic science laboratory performance issues identified by the Commission but not identified through traditional laboratory accreditation. With NIST's help, the Commission is seeking to identify measures it may take to improve the application of accreditation standards such as ISO 17025 in Texas laboratories. One outcome of this work may be the development of a voluntary consensus standard that addresses key laboratory improvement measures. This type of standard would be adopted formally by the Commission and could also be adopted voluntarily by any other jurisdiction.

2. In your written testimony, you discussed the creation of a process map for Latent Fingerprint Examination that was created in collaboration with DOJ.
   - Can you expand on what this document is and how it might be used by a forensic lab?

NIST Response:

The latent fingerprint examination process map offers a visual description of the conventional procedure used by fingerprint examiners to associate impressions of friction ridge skin with impressions collected as evidence in a crime. The process is commonly referred to as ACE-V - Analysis, Comparison, Evaluation, and Verification. The anticipated uses of this process map include training nonexperts on how latent print examinations are generally conducted, facilitating discussions about key decision points in the ACE-V process, helping researchers and the standards development community pinpoint the activities within the process that will be affected by their research or standards, allowing managers to identify areas in the process where human error risks should be minimized, and enabling laboratory managers to better understand how their protocols compare versus other laboratories.

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This original process map,[1] created by the Expert Working Group on Human Factors in Latent Print Analysis, is well described in Chapter 1 of their 2012 published report titled "Latent Print Examination and Human Factors: Improving the Practice Through a Systems Approach."[2] It has been translated into three languages and is used internationally as a resource to describe the conventional ACE-V process. The process map is currently being updated by NIST and Organization of Scientific Area Committees (OSAC) members to reflect changes in the field that have occurred since it was originally created. The new map will be published in the coming months.

- Could this document serve as a model for similar guides for other forensic discipline?

NIST Response:

NIST has been successful in using this approach in many forensic disciplines and anticipates that that it should be applicable to others. Process maps are routinely created as a part of the Human Factors in Forensic Science Working Group Series (Series). Over the past 5 years, NIST, through the Series and OSAC, has facilitated the development of process maps in the following areas: handwriting examination, speaker recognition analysis, latent print examination (update), DNA analysis, firearms examination, and bloodstain pattern analysis. While many of these process maps are awaiting publication, they have already proved useful internally to OSAC subcommittees as they work to create standards and best practices in their respective disciplines.

- How is the process map disseminated to forensic labs?

NIST Response:

For comments and valuable input, draft documents are sent to a multitude of experts in the related forensic science field as well as the judiciary, academia and private corporations. Presentations on the topic are provided to the American Society of Crime Laboratory Directors (ASCLD), and at annual meetings of the major forensic science associations such as the American Academy of Forensic Sciences (AAFS) and the International Association of Identification (IAI). NIST also maintains this information on its Forensic Science webpage[3] for immediate access. Future process map publications will be added to the site as well.

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[1] https://www.nist.gov/sites/default/files/documents/forensics/latent-print-process-poster2.pdf. The numbers in each of the boxes correspond to "steps" that are more fully described in the full report.
[2] https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=910745#page=15.
[3] https://www.nist.gov/topics/fingerprints-and-pattern-evidence.

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3. In Mr. Gamette's testimony, he noted that NIST pays for practitioners and officers of the courts to access the ASTM standards and that ASB provides their standards for free through a generous private foundation grant, which has an expiration date. What do you see as the Federal role in ensuring that under-resourced crime labs have free or low-cost access to the most current standards so that they can focus their limited resources on actually implementing the standards rather than purchasing them?

NIST Response:

Under OMB Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, Federal agencies that incorporate voluntary consensus standards by reference into regulations are to work with the relevant standards developer to promote the availability of the materials, consistent with applicable law, such as through the use of technological solutions, low-cost-publication, or other appropriate means, while respecting the copyright owner's interest in protecting its intellectual property. The examples noted by Mr. Gamette, while they do not involve incorporation by reference, illustrate ways in which Federal agencies and voluntary consensus standards developers have promoted availability while respecting intellectual property rights.

Submitted by Congressman Troy Balderson

1. Thank you, Chairwoman Johnson, thank you for holding this hearing. One topic I would like to touch on today is the forensic workforce.

   Popular television programs over the last three decades, such as CSI and Law and Order, have increased public awareness of forensic science. Alongside this; have you all seen an uptick in public interest in joining the forensic field?

   I would like the whole panel to weigh in on this, and please let the Committee know what the federal government can do to promote career readiness for this field.

NIST Response:

Following the release of CSI, many colleges and universities with established forensic science curriculum noticed an increase in applications. Many of these applicants were unaware that science coursework was required, and following acceptance transferred out of the program. During the same time, crime laboratories received a rise in the number of individuals responding to job openings. However, those crime laboratories found the respondents educational background

and skill set were not compatible with the vacancy.

In 2016, NIST partnered with the National Academies of Sciences' Board on Human-Systems Integration to provide information to the hiring managers in the pattern evidence disciplines to address the increase in interest in the forensic sciences and provide best practices on workforce development. This workshop convened industrial and organizational (I-O) psychologists, experts in personnel selection and testing, and forensic scientists from the pattern evidence disciplines. Participants reviewed the current status of selection and training in relevant forensic fields. Participants also discussed how tools used in I-O psychology to understand elements of a task and measure aptitude and performance could address challenges in the pattern evidence domain of the forensic sciences, including dealing with the massive increase in responses to job openings, and provide tools to identify the best candidates.

The webpage[4] for the workshop - "Personnel Selection in the Pattern Evidence Domain of Forensic Science" – provides links to the report, report brief, and the archived videos of the workshop sessions. In addition, NIST sponsored the creation of a personnel selection test for fingerprint examiners to assist the hiring manager in identify individuals with the appropriate aptitude. A sample of the questions can be found on the Forensic Science webpage.[5]

2. In the last few decades, have there been any major changes in the way DNA evidence is presented in court?

NIST Response:

When DNA testing was first introduced in the 1980s and for the following two decades or so, analysis was mostly limited to crime samples that contained relatively large amounts of DNA from only one or two people, and the results were presented in the form of a statistic known as the "random match probability" or RMP. In the last 10-15 years, new methods have been introduced for analyzing samples that contain low levels of DNA and/or mixtures of DNA from more than two people. These samples are more complex and more challenging to interpret, and reporting results from them require other statistical methods, including the "combined probability of inclusion" (CPI) or the "likelihood ratio" (LR). Once it was recognized that CPI methods do not work well on samples with low amounts of DNA, there have been additional changes in how laboratories report their DNA test results. In the past five years, with

[4]https://sites.nationalacademies.org/DBASSE/BOHSI/Personnel_Selection_in_the_Pattern_Evidence_Domain_of_Forensic_Science/index.htm.
[5] https://www.nist.gov/node/1203696/take/1.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

"Raising the Bar: Progress and Future Needs in Forensic Science"

Questions for the Record to:
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National Institute of Standards and Technology

the introduction of sophisticated software programs for samples containing DNA from multiple contributors or low levels of DNA, there has been a shift to reporting results as LR values. The likelihood ratio conveys the strength of the evidence under two different possibilities – for example, the possibility that the individual in question contributed to the low level or mixture DNA sample versus the possibility that the individual did not.

3. Specifically, the Department of Defense uses a "probability standard" as opposed to directly stating definitively if the defendant is a DNA match. Does this change reflect a change in the understanding of DNA evidence?

NIST Response:

For the past five years, the Department of Defense's Defense Forensic Science Center located in Forest Park, Georgia, has been using a "probabilistic genotyping software" (PGS) program to report their DNA mixture results in the form of a likelihood ratio (see response to previous question). This likelihood ratio result using PGS is simply another way to report DNA results.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

"Raising the Bar: Progress and Future Needs in Forensic Science"

Questions for the Record to:
Ms. Susan Ballou
Program Manager, Office of Special Programs
National Institute of Standards and Technology

From transcript of testimony:
Line 1589-1590 Representative McNerney

Question: "What do you think the current state of maturity is of next-generation sequencing?"

NIST Response:
Next generation sequencing (NGS) reached maturity in the clinical setting with approval of NGS-based testing by the U.S. Food and Drug Administration (FDA) as an in-vitro diagnostic. Maturity in forensic human identification is demonstrated by the Federal Bureau of Investigation's approval of three NGS-based kits for use in the National DNA Index System (NDIS). Accredited laboratories can now submit NGS-based profiles from these validated kits to the national database. Competition between two U.S. firms which provide instrumentation and chemistry for human identification (HID) has been a driving force for both innovation and acceptance by the forensic community, resulting in improvements in capabilities for HID and an expansion of marker types available as tools to the forensic practitioner.

NIST Standard Reference Materials (SRMs) for forensic DNA typing are now sequenced with NGS, providing laboratories a method of evaluating performance of new kits and marker types. The NIST SRM "Human DNA for Whole-Genome Variant Assessment" played an essential role in the first FDA approval of an NGS-based in-vitro diagnostic.

Responses by Ms. Lynn Garcia

Questions Submitted by Chairwoman Eddie Bernice Johnson

1. **NIST recently released plans for OSAC 2.0. Can you comment on the recently released proposal and whether you think NIST is on the right track?**

Response: Generally speaking, I have no objection to the components of NIST 2.0 that are intended to make the process more efficient, such as consolidating subject areas. Two aspects of the changes contemplated by OSAC 2.0 deserve particular attention, so I will focus on those in this response.

The first is the decision to make resource committee members voting members of subcommittees, and the second is moving the "technical review" phase to the beginning of the process. In theory, these two changes should generate better standards that incorporate human factors, statistics and legal concerns at the initial stages. By incorporating the feedback earlier, the standards and guidelines should improve. However, moving the input earlier in the process is *only helpful* if the input from the resource groups is taken seriously by the majority of the members of the subcommittees.

In our experience, misunderstandings with forensic analysis typically occur when the significance of the observed characteristics is expressed to the trier of fact, whether in a written report or during examination at trial.

A recurring theme with OSAC standards is that the draft documents say nothing about uncertainty of the proposed conclusions. While some disciplines (e.g., toxicology) are accustomed to expressing uncertainty, others simply do not appreciate the need to do so. This is highly problematic if one understands the potentially devastating impact of overstating the strength of evidence in a criminal case.

Some forensic practitioners justify the absence of language regarding uncertainty on the basis that the particular analysis "does not involve measurement." The problem with this assertion is that it views the term "measurement" too narrowly. And because of this, there is ongoing tension between the statisticians, lawyers, and practitioners. More than one statistician has simply quit the OSAC in frustration.

In sum, while I am confident the staff at NIST understands these issues and OSAC 2.0 will endeavor to address them, work still remains to ensure the lawyers, forensic practitioners, statisticians and human resource experts are working together as opposed to talking past each other. I look forward to being a part of that process.

2. **In Mr. Gamette's testimony, he noted that NIST pays for practitioners and officers of the courts to access the ATM standards and that ASB provides their standards for free through a generous private foundation grant. Obviously if we want to see crime labs implement updated standards, they need access, and purchasing standards might not be a high priority in cash-strapped labs. Mr. Gamette recommended a continued Federal role in ensuring free or reasonably priced access to standards, especially as the ASB foundation grant runs out.**

- **Do you agree? Is there any reasonable business model under which the standards development organizations can make these standards available for free or at low cost without grants from a foundation or the government?**

Response: I absolutely agree with Mr. Gamette that access to the standards documents is critical. In issuing the following recommendation: https://www.nist.gov/news-events/news/2019/11/texas-forensic-science-commission-recommends-crime-laboratories-adopt-osac, the very first thing our labs requested was access to the documents. Not all laboratories are even able to afford membership with ASTM. Thankfully, NIST has made the documents available to the laboratories. Without that access, many laboratories located in smaller jurisdictions simply would be unable to afford to access the standards and guidelines.

I am not familiar enough with the way standards development organizations generate revenue to offer a suggestion regarding alternative business models. However, to the extent the federal government, private grant funding or some combination of the two can be made available to promote access to the documents, laboratories throughout the country will benefit.

Questions Submitted by Congressman Troy Balderson

QUESTION: Popular television programs over the last three decades, such as CSI and Law, and Order, have increased public awareness of forensic science. Alongside this; have you all seen an uptick in public interest in joining the forensic field? I would like the whole panel to weigh in on this, and please let the Committee know what the federal government can do to promote career readiness for this field.

Response: More universities now have forensic programs and there is also a growing interest at the high school level. Many schools offer forensic science classes, a clear indication that there is a growing interest in entering the field.

Texas laboratories have seen an increased interest in job postings. One laboratory director mentioned that the clearest indicator of a "CSI effect" in recruitment is when they advertise internships or positions for which they don't require experience or only require minimal experience. Particularly for crime scene investigator positions they will get hundreds of resumes for positions requiring a degree but no experience.

For trainee positions and internships, the Houston Forensic Science Center has started requiring an essay as part of the application. Often they see these essays include descriptions of candidates being inspired by "Abby" or other CSI type shows. Admittedly, laboratory management is a little hesitant to bring on someone who only appears to have that motivation. Often the individual has unrealistic expectations and may not be equipped to handle or fully understand the demands of this kind of work.

Training candidates for forensic analyst positions is a growing conversation on the national and state level. In the last Texas legislative session, lab directors had conversations with numerous legislators about the gap that exists between the education students are receiving in school and the laboratory's needs. The in-house training to ready a new hire for casework typically takes between six months to two years depending on the discipline. Granted, there will always be some in-house training that needs to be done when a hire is made due to differing procedures between labs, and this timeline is also driven by the demands of testimony and the reality that even for an experienced analyst providing effective and appropriate testimony is a daunting task. This impact of this testimony challenge should not be underestimated. Testimony is a massive challenge for analysts demanding that they have ready knowledge of aspects of the laboratory that are well beyond their daily tasks. Getting individuals reliably able to handle the stress and pressure of testimony so they can think clearly and critically under pressure and not mislead the trier of fact regarding complex concepts takes time and repetition.

The lengthy training investment currently being undertaken is difficult for resource-strapped labs to absorb. It often means a more experienced analyst has to be diverted from casework to train a new hire so the loss of capacity is doubled for each new hire. The Texas state legislature did provide money in the last session so that Sam Houston State University could help train chemistry and toxicology analysts, but other efforts to create a similar program for DNA analysis at the University of North Texas were not as successful. Looking nationally, the university

programs that best prepare analysts are those that have close working relationships with an operating crime lab. These relationships allow for internships and research opportunities inside the crime labs so that candidates who complete those programs are better prepared to begin casework after graduation. Programs like this exist at John Jay in New York, Marshall University in West Virginia and Virginia Commonwealth University.

One of the most promising programs is in the US Army and their drug screening toxicology program. They have established a fellowship program for early career officers that places an officer at a partner laboratory for two years. This is a long enough period to actually have the individual potentially complete casework or certainly participate in method validation.

Federal programs to support and extend this concept nationally would be vital. For instance, some laboratories have had success hiring "trainee apprentice" positions that are sent to RS&A for 8-12 weeks. The labs pay a stipend during training and cover housing. costs When the analysts successfully complete the program and return to the lab, they are transitioned from the stipend to a full salary and the lab begins with analysts more prepared for supervised casework than they otherwise would be. The cost of the reduced salary and the course about equals what the labs would invest in training new analysts in-house, plus there is not as much impact on existing bench analysts. If there were more programs such as this, it would be very helpful to the laboratories.

QUESTION: In the past few decades, have there been changes in the way DNA evidence is presented in court?

Response: USACIL was the first lab in the United States to testify and report on STRmix (late 2013) – they were not using likelihood ratios (LRs) before then, so yes, there was/is a change in how DNA is reported now compared to back in the days where the most common statistic in the U.S. for mixtures was the CPI/CPE (combined probability of inclusion/exclusion). Before labs transitioned to LRs, it was common to use "source attribution" statements. Source attribution statements are not amenable to LRs since the LR is not a probability, but a ratio of two conditional probabilities .

Having said this, the use of probabilistic genotyping software (e.g., STRmix, TrueAllele, etc.) does not changes the foundational principles for DNA interpretation that have always existed. The difference is we now have the tools to extend interpretation into areas that were difficult to assess manually before.

Responses by Ms. Vicki Zemp Behenna

October 10, 2019

Chairwoman Eddie Bernice Johnson
Committee on Science, Space, and Technology
2321 Rayburn House Office Building
Washington, DC 20515-6301

Re: Raising the Bar: Progress and Future Needs in Forensic Science follow-up questions

Dear Chairwoman Johnson:

Pursuant to your request, I have reviewed your letter dated September 26, 2019, and offer the following responses to the follow-up questions proposed to me.

Question posed by Chairwoman Eddie Bernice Johnson

1. NIST recently released plans for OSAC 2.0. Can you comment on the recently released proposal and whether you think NIST is on the right track?

I have reviewed OSAC 2.0 released by the NIST regarding their proposal to streamline the production of forensic science standards. It is my understanding that OSAC 2.0 also proposes to engage state and local partnerships, rely on standard developing organizations (SDOs), and establish a steering committee organized to help OSAC prioritize work areas, develop reliable technical standards, and coordinate information on the development validation, and uncertainty of forensic technologies and methods.

With this understanding, I do think NIST is on the right track. It is important for OSAC to be the gatekeeper for validating and establishing standards for forensic science. Additionally, the partnership with state and local legislative bodies to promote uniform standards is extremely important because it is in those local and state courtrooms where forensic science is utilized most. As I mentioned in my comments on September 10th, education for legislative bodies, judges and trial lawyers is, in my opinion, one of the most important tools in protecting against wrongful convictions.

Oklahoma City University School of Law

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Questions posed by Congressman Troy Balderson

1. Popular television programs over the last three decades, such as CSI and Law and Order, have increased public awareness of forensic science. Alongside this; have you all seen an uptick in public interest in joining the forensic field?

As a trial lawyer, I am unaware of an uptick in the general public interest in joining the forensic science field. However, I can tell you as the Executive Director of the Oklahoma Innocence Project, that the project works collaboratively with the Oklahoma State Bureau of Investigation (OSBI), and the University of Central Oklahoma Forensic Science Center, which is located across the street from the OSBI. Several students with UCO, and one who now works for the OSBI, have volunteered with the project and have expressed their interest in making sure that wrongful convictions are minimized through the use of standardized forensic science. It is always energizing to work with young people who want to do the right thing and make a difference.

2. Specifically, the Department of Defense uses a "probability standard" as opposed to directly stating definitively if the defendant is a DNA match. Does this change reflect a change in the understanding of DNA evidence?

I am probably not the best witness to address this question. I am a trial lawyer who relies upon DNA experts to explain the relevance and meaning of DNA analysis. This is the very reason why the science has to be right. The scientist/criminalist who analyze DNA evidence have to approach the discipline with integrity, using approved and vetted standards in evaluating and opining on their findings. I will never know a forensic scientist/criminalist science as well as they do, or how far they can go in opining on matches or probabilities. But I can tell you that scientist/criminalist must be consistent. That is why the NIST and the work they are doing is so very important.

3. There has been tension between the law enforcement community and the Innocence Project over the issue of questioning the validity of forensic science. As someone who has been in both of those worlds, how do we bring these two groups together to improve forensic science while ensuring the preservation of civil liberties?

Discussion and inclusion. From my experience, most prosecutors believe that their job is to do justice, not just obtain a conviction. When I talk to my friends who are prosecutors, they are open to discuss problems with the criminal justice system and ways to fix them. It has been my experience that prosecutors, nor law enforcement, want to

imprison someone who is not guilty of the crime for which they were charged and convicted. The repercussions from such a mistake affect everyone, not just the person wrongfully convicted. If the NIST can bring together the scientist and the stakeholders (judges, prosecutors, and defense lawyers) to discuss how to validate a science, what standards should apply for the testing, and how far a scientist/criminalist can go in opining on the probabilities that the forensic science ties the accused to the crime, then I believe that it will, organically, protect individual liberties.

3a. Are forensic misapplications a systemic problem with how forensic science is conducted nationwide or are mishaps occurring on a case-by-case basis?

In my written testimony, I referenced the case of Joyce Gilchrist, who was a forensic chemist with the Oklahoma City Police Crime Lab. For years, Ms. Gilchrist provided false information and false testimony regarding her analysis of evidence obtained from crime scenes. She was later dismissed after the Oklahoma City Police Department investigated her and found "flawed casework analysis." It is my opinion that this was an isolated incident involving the integrity of one chemist and not a systemic problem with the OCPD Crime Lab. I have had many discussions with the criminalist at the OSBI and, in my opinion, they consider themselves independent scientists, not extensions of the law enforcement agencies for which they work. In short, the misapplication of forensic science is not a nationwide systemic problem. However, once an "accepted" forensic science is challenged and invalidated, it I incumbent on NIST to notify and educate all stakeholders of the problem.

Sincerely,

Vicki Zemp Behenna
Executive Director
Oklahoma Innocence Project

Responses by Dr. Karen Kafadar

Responses to additional questions from House Committee on Science, Space, and Technology (following Committee Hearing on 10 September 2019; Madam Chairwoman Johnson, presiding)

Karen Kafadar, Chair & Commonwealth Professor of Statistics, University of Virginia, and 2019 President, American Statistical Association

1. NIST recently released its plans for OSAC 2.0. Can you comment on the recently released proposal and whether you think NIST is on the right track?

   I applaud NIST's efforts to streamline the approval process. I remain concerned that the OSAC membership remains primarily forensic scientists, with very few "arms-length" scientists from disciplines whose areas of expertise are relevant to the methods used to analyze forensic evidence (e.g., physicists, chemists, engineers) and to draw proper inferences from relevant data collected from such evidence (statisticians). My experience with "OSAC 1.0" was that few of the units included even one such "arm's-length" scientist who had no vested interest in, or had any ties to, the current system; for those few units that did have one such member, (s)he was easily outvoted on all standards proposed for the OSAC Registry. As long as those tied to the current system are making the decisions, no real change can take place.

   Standards should come only after research has been conducted to validate the procedures in proposed standards. Consider the approval onto the OSAC registry of three standards for Forensic Glass:

   a. ASTM E2926-13, Standard Test Method for Forensic Comparison of Glass Using Micro X-ray Fluorescence (μ-XRF) Spectrometry
   b. ASTM E2330-12, Standard Test Method for Determination of Concentrations of Elements in Glass Samples Using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for Forensic Comparisons
   c. ASTM E2927-16, Standard Test Method for Determination of Trace Elements in Soda-Lime Glass Samples Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry for Forensic Comparisons

   The approval of these standards illustrates the point: pre-prints of research articles, showing improved methods of statistical analysis of the measured glass concentrations (with lower chances of "false positives") were made available to OSAC's Forensic Science Standards Board (FSSB); the FSSB chose not to consider this research and instead voted to approve all 3 ASTM glass standards. These approvals are unfortunate and may lead to problems later on (as Bullet Lead evidence did; see NRC report, *Forensic Analysis: Weighing Bullet Lead Evidence*, 2004).

2. What is needed – in investment of resources and/or engagement of scientists and scientific organizations – to ensure sound procedures and proper statistical foundations for forensic science? How can we continue to increase the interest and investment of research scientists across all of the relevant fields of science and engineering in improving forensic science?

Forensic scientists and research scientists need to be shown both the importance and value of collaborating together. Some suggestions for achieving this collaboration:

a. Ensure a 50-50 balance in OSAC units: 50% practicing forensic scientists and 50% arms-length scientists who are not tied to the current system. Presently, when replacing OSAC members, the prevailing attitude is to consider only those who are tightly connected to forensic science and law enforcement. Diversity in disciplines will lead to diversity among members, both professionally and demographically.
b. NSF is well connected to a wide array of scientists from many disciplines. NSF funded a workshop organized by R. Graham Cooks (Purdue) on December 3-4, 2012 (NSF program officer Kelsey Cook) to discuss the potential contributions of analytical chemistry for strengthening the measurement and analysis of forensic evidence (see information at nsf.gov/awardsearch/showaward?AwD_ID=1262145). NSF could significantly advance research in forensic science by holding workshops with both ``arm's-length'' domain-relevant scientists and researchers in forensic science, across several disciplines (e.g., imaging, biology, event reconstruction, fluid dynamics), that would serve to increase the interest and investment of research scientists as well as demonstrate to forensic scientists the value of collaboration with scientists outside their narrow circle.
c. NSF could also jointly fund a report from NAS to evaluate progress and prioritize next steps in strengthening forensic science.

3. The Texas Commission recommended a moratorium on the use of bite mark evidence in the Texas court room because of the dearth of supporting science. Do you believe there are other disciplines of forensic science for which the underlying science is so limited or flawed that any use in the criminal justice system should be similarly questioned?
   I heartily applaud the Texas Commission for taking this step, which surely met with great resistance among forensic odontologists but which, I believe, was long overdue. The subjectivity involved in drawing inferences from arson and blood spatter pattern evidence leads to similar uncertainty, which, as with bite mark evidence, has not been adequately characterized. Subjectivity of this nature also occurs with trace evidence like hair, paint, and tire tracks. The nature of the statements about the evidence should be limited to "points of similarity" until studies with proper measurements and analyses can justify stronger statements of association.
4. In Mr. Gamette's testimony, he noted that NIST pays for practitioners and officers of the courts to access the ASTM standards and that ASB provides their standards for fee through a generous private foundation grant. Obviously if we want to see crime labs implement updated standards, they need access, and purchasing standards might not be a high priority in cash-strapped labs. Mr. Gamette recommended a continued Federal role in ensuring fee or reasonably priced access to standards, especially as the ASB foundation grant runs out.
   a. Do you agree? Is there any reasonable business model under which the standards development organizations can make these standards available for free or at low cost without grants from a foundation or the government?
      This cost issue inhibits research that could be done to improve the ASTM standards. Several industries have developed models that enable customers to access their content

free of charge: Google Search charges for ads, jstor.org charges institutional subscriptions, and professional society journals request page charges of authors whose papers are accepted. Quite possibly a non-profit organization could use a combination of these mechanisms.

1. Popular television programs over the last three decades, such as CSI and Law and Order, have increased public awareness of forensic science. Alongside this, have you all seen an uptick in public interest in joining the forensic field?
   Yes; the 18-minute segment from Jon Oliver (albeit unnecessarily salty) and the articles in the Washington Post (Spencer Hsu on bite marks and hair analysis) provide examples of media that can shed another light on the uncertainties in conclusions from current forensic analyses. These later news items should not merely spur legal appeals; they should be directed to research agencies and foundations who can sponsor workshops and research to improve the field.
2. In the last few decades, have there been any major changes in the way DNA evidence is presented in court? Specifically, the Department of Defense uses a "probability standard" as opposed to directly stating definitively if the defendant is a DNA match. Does this change reflect a change in the understanding of DNA evidence?
   The presentation of DNA Evidence in court has been a success story. It is important to remember that likelihood ratios (LRs; presented to express the strength of DNS evidence) are calculated from observed data – and hence, have uncertainties also. Plausible ranges of LRs should be presented. (For example, a likelihood ratio of 1000 with a plausible range of 800-1200 will convey different levels of evidence strength than a likelihood ratio of 1000 with a plausible range of 10 to 800,000.) It also is important for statisticians to develop ways of expressing the real meaning of likelihood ratios (likelihood of the evidence, given the hypotheses of "same" versus "different" sources), lest they be mis-interpreted as posterior odds (likelihood of "guilt" given the evidence). They are related but the concepts are *not* the same. (Some projects through CSAFE are studying ways of expressing the proper communication of strength of evidence using online participants as "mock jurors.")

Responses by Mr. Matthew Gamette

Question from Chairwoman Eddie Bernice Johnson:

1. NIST recently released plans for OSAC 2.0. Can you comment on the recently released proposal and whether you think NIST is on the right track?

I have been an active participant in the OSAC since the inception. I have experienced first-hand the challenges of setting it up, getting it running, making modifications to the structure, and navigating the difficulties of building the plane while in flight. NIST has been very eager and transparent in seeking comment on OSAC 2.0. NIST has recognized the need for continuous improvement, and engaged to find ways to make the organization more efficient and productive. Four CFSO organizations submitted comments in response to the NIST RFP Solicitation on OSAC 2.0. I have provided those as attachments. We believe those comments were largely considered as NIST formed OSAC 2.0. NIST got a clear message from a number of various stakeholders that their early ideas on OSAC 2.0 were not tenable to the forensic science community. To their credit, they regrouped and refined the model to something that the forensic science community at large will support. The central sticking point on OSAC 2.0, and now plans for 3.0, is the structure remaining at NIST. The forensic science community, and stakeholders at large, are supportive of NIST being the permanent home of OSAC because 1) NIST makes standards for the country, 2) NIST is a neutral and scientific entity that can remain largely uninfluenced by stakeholders in an adversarial legal system, 3) NIST is an entity that is accountable to Congress for the actions of OSAC, 4) NIST has a federal government funding mechanism for Congress to provide sustainable funding for OSAC. NIST remains resistant to being the long-term home of OSAC because they do not believe Congress has put it in their agency mission. It is important for Congress to provide language clarifying that OSAC is in the core mission of NIST. It is also important that Congress provide sustainable funding for OSAC. OSAC funding has never been authorized, and has in fact NOT ever been put in the budget by NIST. Rather, Congress has appropriated $4m each year for its operation. OSAC needs to be codified and consistently appropriated. The OSAC should also not become a center of excellence because the typical models used by NIST are industry funded. Private industry should not control forensic standards making, and state and local forensic science providers do not have sustainable funding to support a center of excellence. These issues must be addressed by Congress in the long-term plan.

The following changes announced by NIST for OSAC 2.0 were requested by members of our organization. We see the following as positive developments in OSAC 2.0:

- The number of subcommittees will decrease from 25 to 17.
- Most Scientific Area Committee (SAC) members will transition to subcommittees.
- Resource committee members will transition to become voting members of subcommittees.
- Interdisciplinary Task Groups will be established.
- The OSAC Registry will remain in place.
- Internal Technical Review Panels will be established per document.
- The open comment period will occur earlier in the process.
- Interim documents will be posted for community use.

The most important part of OSAC is a working group of forensic practitioners and other experts who are charged with developing forensic standards and providing scientific input. Practitioners want to see the advancement of forensic science and have invested in the success of the OSAC process. We appreciate a continuing large practitioner group as part of OSAC 2.0.

Providing an independent scientific location for these current OSAC subcommittees is appropriate and the best practice. NIST continues to provide that home for OSAC 2.0.

The number of committees, the types of committees, the contributions of resource committees, and integration of committee work are improvements.

The consensus based standard development process is wisely preserved in OSAC 2.0, but is also improved by allowing interim documents to be used while waiting for final approval.

Getting comments earlier in the process, more robust adjudication, and other steps to engage stakeholders will improve the process and mitigate frustrations by all parties.

Question from Congressman Troy Balderson:

1. Have you seen an uptick in public interest in joining the forensic field? Please let the Committee know what the federal government can do to promote career readiness for this field.

Television shows have definitely increased the public interest in forensic science. We refer to the increased interest as the "CSI Effect." Jurors expect technology to be used, techniques to be implemented, or speed of analysis that only exists in the imagination of television producers. The side benefit is an increased visibility of the operational needs of laboratories and medical examiner offices and more interest from career seeking individuals.

Colleges and universities have capitalized on degree programs that prepare students for careers in forensic science. However, many of these degrees do not prepare applicants for the educational or experience criteria required by many employers. The advent of the Forensic Science Education Programs Accreditation Commission (FEPAC) has improved the education programs for schools that choose to participate. However, most forensic science jobs do not require that applicants come from FEPAC accredited degree programs. Because many traditional forensic science disciplines are highly applied scientific jobs, the mentorship of a senior scientist is required to train new scientists. Right now, most labs must spend six months to several years training their staff, even after those new hires have completed bachelors, masters, or PhD level education experiences.

The advent of forensic science training standards and standard laboratory methods in the NIST OSAC will help to replace lab specific training programs with centralized training programs. FEPAC and others are already looking at bridging the gap between college and tenure as a fully trained forensic analyst.

Congress can help by increasing federal training programs available to state, county, local, or tribal forensic science practitioners through federal labs and federal programs (e.g. FBI, ATF, DEA). Programs like the ATF program to train firearms examiners are extremely helpful to state and local labs. Congress could also provide grant and other funding to states to partner with educational entities to provide capstone courses that would include employment in a functional crime laboratory. Many laboratories would take on vetted trainees with background checks that could start training in the lab as part of their educational experience. This would minimize the training time needed once these individuals are hired by the forensic science service provider (the lab). The federal government could also implement training centers for specific disciplines to train people newly hired by state and local labs. Public/private partnership centers with instrument vendors, discipline experts, and educators would prove helpful to get scientists up to speed on the technology used by the majority of forensic providers.

It must also mention that one of the biggest workforce issues in the United States is with forensic pathologists. Forensic pathologists must go to school longer than a standard industry pathologist, and will make less money in public service than their colleagues. To solve this issue we must find ways to provide scholarships for these students through medical school, residency, and fellowship programs. Congress could find mechanisms for federal loan forgiveness earlier than ten years, or potentially investigate treating students' medical schooling like the public medical corps. Incentivizing students to pursue this career field by working with educators to open more medical school, residency, and fellowship programs specifically to this field is under discussion. Finding creative ways to condense the medical school educational requirements for forensic pathologists by creating a career track should be investigated. A relatively small investment in forensic pathology education is vital to the success of the nation's medical examiner offices. We are very close to, if not already in, a crisis for pathologists who can perform forensic autopsies in the United States. Medical examiner offices are already losing their accreditation because they do not have enough forensic pathologists to perform all the autopsies needed. Medical examiner offices need more resources overall for operations and training. The Paul Coverdell grants are available to medical examiner offices, but are not sufficient to address all the critical needs.

2. In the last few decades, have there been any major changes in the way DNA evidence is presented in court? Specifically, the Department of Defense uses a "probability standard" as opposed to directly stating definitively if the defendant is a DNA match. Does this change reflect a change in the understanding of DNA evidence?

I started my career with the Washington State Patrol in 2003 as a DNA analyst. The general DNA technology used for most criminal cases in the last couple decades is roughly the same, but the instruments and methodologies have changed a little. I would not say there have been major changes in the way DNA evidence is presented in court, but the type of statistical analysis has definitely changed over time.

DNA analysts have always calculated statistics. Even back to the time when ABO blood typing was used, a statistic was calculated and provided to the courts. The numbers are much larger now, and are more difficult for jurors to comprehend. Forensic scientists have always struggled with communicating the meaning and weight of those statistics to the jury. Originally, statistics were calculated to see if an individual could be "included as a potential contributor" to a crime sample. The method then shifted to more of a "source attribution" statistic being reported. Most laboratories are now shifting the way statistics are calculated and reported to a "likelihood ratio." This evaluates the likelihood of events given a prosecution theory of the case and a defense theory of the case. The "probability standard" referred to in the question is most likely commonly known as a statistical likelihood ratio. The federal government labs were among the first to migrate to the use of a new statistical tool called "probabilistic genotyping." The Idaho State Police Forensic Services that I oversee was among the first of several labs in the country to implement this new software. Our scientists worked hard to validate the software by testing it on all kinds of DNA profiles. We trained our scientists to use the software, trained our officers of the court on the new methods we were using, and have been online for several years. The move to this software suite was critically important for our laboratory. However, it was expensive, and it was difficult to implement. Many labs are still struggling with the resources to implement this technology. Federal grants provided through Congressional funding such as the "Debbie Smith" and "Coverdell" programs are the only way labs can afford to implement these expensive yet essential instrumental and statistical platforms. Congress must continue to appropriate, and even accelerate federal funds that go to these federal grant programs that increase the reliability and advancement of the science being used in labs and courtrooms.

Technology changes have always been communicated with the officers of the courts. As DNA technology has changed over the years, there have been many admissibility hearings. There has also been a significant amount of education provided to state and local stakeholders by the federal government through entities like NIST and DOJ. The COPS program for example provided training to officers of the law and officers of the court regarding DNA technology and statistics. As hard as the federal government has tried, and as good as the scientists have become at explaining the statistics, it is difficult for lay people on a jury to understand complex statistical modeling that often requires a higher education. It is difficult for officers of the court to understand when the statistics are applied correctly, which leads to a battle of conflicting experts and reviews of the wording used by scientists and attorneys in the courtroom. We must do a better job of coming up with mechanisms to help jurors and officers of the court understand the weight and significance of the evidence before them.

SWGDAM has provided an enormous amount of federal leadership to setting good policy and practice for implementation of DNA science. NIST and DOJ are providing extensive training to forensic scientists, officers of the law, and officers of the court regarding the current implementation of likelihood ratios and probabilistic genotyping. The future of DNA testing will likely be Massively Parallel Sequencing (MPS). While the fundamentals of DNA testing are largely the same, the technology will always change, likely get more sensitive, and undoubtedly be used in ways that we cannot now imagine. Federal resources are critical in proper implementation that will be used in the nations' court system.

Appendix II

Additional Material for the Record

STATEMENT SUBMITTED BY REPRESENTATIVE EDDIE BERNICE JOHNSON

ACS Chemistry for Life®

Public Policy Statement
2016-2019

FORENSIC SCIENCE

Forensic science is critical to an effective justice system, which in turn is a pillar of a civil society. It is an interdisciplinary field that includes chemistry as a foundational and integral component. Physical evidence presented in courts is frequently analyzed using forensic science techniques that are often grounded in chemical principles and methods. The credibility of the legal system critically depends on forensic tests that are consistent, accurate, and scientifically valid. Consequently, it is of significant importance to the American Chemical Society (ACS) that best practices from chemistry are part of how forensic science is carried out.

Modern forensic science faces enormous challenges. The 2009 National Academies report, *Strengthening Forensic Science in the United States: A Path Forward,* enumerated the problems of the forensic science community in detail. The report noted that due to its history, its interdisciplinary and applied nature, and its close ties to law enforcement and the legal system, forensic science has not developed a culture that reflects important aspects of how sciences such as chemistry are conducted – the centrality of evidence, the analysis and interpretation of verifiable data, efforts to identify and avoid bias, and clear connection to and building on peer reviewed research. Therefore, the necessary work to establish validity and reliability in analytical methods that are hallmarks of other scientific fields is often weak or absent in forensic science.

Forensic science also plays a critically important role in other areas such as the investigation of domestic and international incidents, U.S. national security, and ensuring public health and safety. Investigating terrorist threats from chemical and biological agents, such as the 2001 anthrax attacks, requires novel methods of evidence collection and innovative forensic techniques. *Nuclear Forensics: A Capability at Risk*, a report released in 2010 by the National Academies, identified areas of concern for nuclear forensics that overlap with concerns raised about forensic science in general. Strengthening the scientific foundations of forensic science will benefit these areas of public concern as well.

ACS applauds the recent formation of the National Commission on Forensic Science (NCFS) and the Organization of Scientific Area Committees for Forensic Science (OSAC) involving the National Institute of Standards and Technology and the Department of Justice, and looks forward to working with this Commission and OSAC as they strive to strengthen and enhance forensic science. The functions performed by these agencies are an important step in forensic science reform and, therefore, these agencies should be maintained as part of the Executive Branch in future administrations. ACS also applauds the policy recommendation by NCFS and subsequent action by the Department of Justice (DoJ) to require all DoJ forensic labs to acquire and maintain accreditation.

ACS asks policymakers to support forensic science reform through the following recommendations:

Strengthen scientific rigor within the forensics culture and expand and integrate forensic science research with the larger scientific community, including ACS

- Consult scientists, law enforcement, and legal professionals to identify and post current forensic science research priorities.
- Expand federal funding opportunities to support forensic science research and graduate education by both senior and junior members of the scientific community.
- Strengthen and expand the federal government's support of forensic science research by coordinating efforts across agencies such as the National Institute of Justice, NIST, NIH, NSF, DOD, DHS, and DOE.

The American Chemical Society (ACS) Board of Directors Committee on Public Affairs and Public Relations adopted this statement on behalf of the Society at the recommendation of the Committee on Science. ACS is a non-profit scientific and educational organization, chartered by Congress, with nearly 157,000 chemical scientists and engineers as members. The world's largest scientific society, ACS advances the chemical enterprise, increases public awareness of chemistry, and brings its expertise to state and national matters.

American Chemical Society, 1155 Sixteenth Street NW, Washington DC 20036, 202-872-4386, www.acs.org/policy

- Support collaboration and communication between scientists performing basic and applied research relevant to forensic science and forensic science practitioners.
- Ensure the independence of the forensic science community from law enforcement.
- Support improvements in the quality of the forums for communication of advances in forensic science, including rigorous peer review in all journals.

Validate and improve the accuracy of forensic analytical methods

- Develop quantitative criteria and standardized procedures as part of validated analytical techniques in forensic science.
- Research and quantify sources and effects of human error and automate forensic tests where appropriate.

Monitor and ensure the quality of forensic science education and practice

- Promote basic and applied forensic science research, as well as translation and deployment of new techniques into forensic laboratories.
- Continue to work towards rigorous accreditation of laboratories at all levels (federal, state, local, tribal), certification of scientists and other forensic science practitioners, and establishment and promotion of ethical standards for forensic scientists.
- Provide education for law practitioners, scholars, and judges in forensic science methods and practice.
- Develop outreach programs for the public that highlight the capabilities, limitations, and potential of forensic science.

STATEMENT SUBMITTED BY REPRESENTATIVE BILL POSEY

Statement by Sheriff Wayne Ivey of the Brevard County Sheriff's Office

Submitted by Rep. Bill Posey

"As a career law enforcement officer with over 39 years of public service, I applauded then AG Session's position to disband those who seek to weaken the criminal justice system with the creation of the National Commission on Forensic Science. Ending a so-called group of advisors made up of attorneys and scientists whose sole purpose was designed to discredit and reject reliable and admissible forensic evidence was the right thing to do then and still remains true. What should be discussed is how our federal law enforcement partners can help with forensic funding to expedite lab submissions and eliminate untimely evidence backlogs."

DOCUMENTS SUBMITTED BY MR. MATTHEW GAMETTE

October 4, 2017

The IAI strongly endorses the OSAC as it did with its predecessor, the SWGS. The OSAC is the primary source for creating standardization throughout all of the forensic sciences. Formed under a working agreement with NIST and the Department of Justice (DOJ), the OSACs operate under a very large level of bureaucracy and have been slow to develop standards and guidelines for the forensic community. The guidelines under which the OSACs operate should be streamlined to create a more efficient process.

Being the primary group tasked with developing standards and guidelines across all the forensic sciences, the OSACs should be primarily comprised of the appropriate subject matter experts including actual practitioners equally represented throughout all OSAC levels. The OSAC is currently housed under and funded through NIST, it is felt that DOJ would be better suited to administer and fund the OSAC. After being placed under DOJ for administrative purposes, the OSAC should be a completely autonomous group. Funding for the OSAC should be insured for at least ten years. With a less cumbersome process and extended funding we would be able to guarantee that the OSAC developed forensic standards would be continually reviewed and kept up to date.

The IAI is committed to playing an active role in assisting with whatever is adopted for OSAC 2.0

Raymond A. Jorz

President

RESPONSE TO OSAC REQUEST FOR INFORMATION

FROM THE NATIONAL ASSOCIATION OF MEDICAL EXAMINERS

Thank you for this opportunity to provide input on the OSAC 2.0.

The National Association of Medical Examiners (NAME) is the national professional organization of physician medical examiners, medicolegal death investigators and death investigation system administrators who perform the official duties of the medicolegal investigation of deaths in the United States.

Many members of NAME have been involved in all levels of the OSAC structure, including on the subcommittees, the SACs, the Resource Committees and the FSSB. We therefore believe we have a good understanding of the current structure and are in a strong position to comment and offer suggestions for improvement.

Specifically, with respect to standards relating to the practice of medicine, as in forensic pathology, the relevant physicians should develop those standards through NAME and not through a more general SDO process. It is important to NAME that the OSAC 2.0:

1) Acknowledge that Forensic Pathology is the practice of medicine.
2) Accept that Forensic Pathologists should set the standards of the medical practice of Forensic Pathology, as is true in all other medical specialties,
3) Support NAME, as the professional organization representing forensic pathologists and medicolegal death investigation, as the appropriate organization for creating the standards.
4) Recognize and institutionally back NAME standards as the standards for the practice of forensic pathology and the medical aspects of medicolegal death investigation.

To answer more directly some of the questions posed in the Request:

(A) *Purpose:*
What is your opinion regarding whether the OSAC is fulfilling these purposes under the current structure?

The OSAC has educated the forensic science community on the process for developing consensus-based standards and guidelines. As noted above, NAME believes that these SDO processes are not applicable to the practice of medicine. Nonetheless, this approach has utility for some subcommittees, especially those that are not so judgment-based, and don't require the integration of medical history (scene investigation), and autopsy examination.

Naturally, adapting to the SDO process has been slow and there were challenges in getting started. Additionally the infrequency of subcommittee in-

person meetings has hampered the necessary face-to-face discussions that are required to create the draft standards and guidelines.

What is your opinion regarding whether these purposes/functions are appropriate for the OSAC and whether the purposes should be modified in any way?

To reiterate, the OSAC process must recognize that Forensic Pathologists practice medicine and undergo a rigorous training and certification process to do so. There is no precedent or rational justification for an outside body of non-practitioners to create medical practice standards.

The challenge in the OSAC process is that disciplines that depend on experience and judgment do not translate as well to the SDO process. The National Commission on Forensic Sciences reinforced that courtroom opinions based on experience and judgment are valid.

What is your opinion regarding what role, if any, the OSAC should be playing in addressing the recommendations of the 2009 National Academies of Sciences report, "Strengthening Forensic Science in the United States: A Path Forward" (https://www.nap.edu/read/12589/chapter/1)?

The OSAC is the first organization that has included members from all the forensic sciences, as well as outside experts. The NAS emphasized collaboration and OSAC has provided an opportunity for this. The OSAC subcommittees assist SDOs in determining what standards are needed.

Specifically, with respect to standards relating to the practice of medicine, as in forensic pathology, development of those standards should be set by the physicians involved through NAME and not through a more general SDO process. The OSAC MDI should not be a replacement for NAME's medical practice standards setting, but should be an adjunct that can focus on the non-medical aspects of medicolegal death investigation.

The OSAC 2.0 should, when it comes to medicolegal death investigation, work to address the recommendations of the NAS report by promoting further accreditation of medical examiner/coroner (ME/C) systems, by working to ensure certification of practitioners, and by working to guarantee that ME/C systems are free of undue influence of law enforcement, prosecutors, politicians and others. The OSAC 2.0 should explicitly take the position that medical standards are the province of medical specialties and the OSAC will support and promote standards that have been developed for Forensic Pathologists by Forensic Pathologists for 25 years. Medical guidelines and standards are created outside the federal framework, as standards bodies for physicians should be composed only of physicians, and this does not meet the SDO notion of "balance". No other area of medical practice in this country is governed by practice standards made by non-medical practitioners or anything like the SDO process.

One of the primary criticisms of disciplines other than forensic pathology in the NAS report was the perceived lack of a scientific basis for some of the activities considered "forensic science". A corollary to this is that any standards promulgated

by an organization dedicated to increasing that scientific validity should themselves have a validated basis. Accordingly, the OSAC should demand that standards not merely be "consensus" standards, but that they reflect valid scientific principles rather than common wisdom. The OSAC should thus identify areas of uncertain validity to direct investigations not only in forensic science, but also in consensus standards themselves.

(B) *Oversight and independence:*

Please provide your views regarding what type of entity should host the OSAC (e.g., governmental, professional association, etc.).

The entity that hosts the OSAC should support the OSAC financially, administratively and organizationally but without attempting to control the operation and output. It is critical that the OSAC be free from political and other influences.

Ideally, the organization should be as recommended by the NAS report: an independent stand-alone National Institute of Forensic Sciences – not in NIST or DOJ or any other government agency.

If there is not a stand-alone Institute, then NIST is a competent and appropriate group to assist in standards-setting, in fact the best place for this. They are not only the arbiters for federal standards policy, but they also have a large community of applied scientists (to be contrasted with NSF and NIH)--to include an excellent set of forensic scientists. They also sometimes overemphasize their own scientists and science over others and other work done outside NIST or not funded by NIST. However, their location within the Department of Commerce (DOC) gives them a commercial perspective that is not well-suited to the government-basic forensic science enterprise. Lastly, their record of technology transfer to the larger forensic science community, particularly the state and local forensic scientists and non-governmental forensic scientists has not been strong or perhaps at best has been hit or miss. On the other hand, the power of NIST's measurement science and statistical prowess has not been fully harnessed by the OSAC and should become more engaged in figures of merit and ensuring standards are science-based and statistically sound. The independence of this standards-setting process from law enforcement is a strength and should be continued, but the fact that the OSAC is funded by DOJ subverts this independence.

What is your opinion about the preferred characteristics of a host organization for an effective OSAC?

See above.

What are your views as to the type of organization that should provide oversight to the OSAC?

The organization has to have the financial stability and staff to support the OSAC. The organization should be neutral regarding the direction the OSAC takes in determining standards, rather than attempting to direct implementation of standards to advance an agenda created outside of the OSAC.

The organization should transcend elections, and political parties, or it will move from one short-lived structure to another, and have no impact.

Do you believe that the OSAC should have more/less independence from a host organization?

The OSAC should be completely independent with respect to function and output.

(C) *Work products and aims:*

What is your opinion regarding whether the OSAC is fulfilling these aims as structured?

The primary work products of the OSAC are the Registry and the putative standards that are referred to SDOs. Several of the standards placed on the registry have already been used and accepted by the forensic community for years, so bring no real change. The OSAC has also produced a terminology list and a list of research priorities. The availability of forensic standards to those that need them is incomplete, despite attempts to fund their availability--because some SDOs charge for their standards, which is beyond the control of NIST; this will be a continued tension. There is no marketing effort of the Registry. There will be growing pains as the set of national standards is first established--as was witnessed by the very first issued standard. In fact, it appears that standards are being written with insufficient scrutiny and attention to form, harmonization, or even scientific basis. There is a real concern that standards are being developed beyond the capability of smaller labs and practitioners--despite their ability to provide input during windows of opportunity--because it is the large labs that are represented. There is also too little input of the international community or even the consideration of their existing standards.

What are your views as to the type of work products the OSAC should produce?

The OSAC should develop standards, guidelines, and best practices and advocate for the funding necessary for their implementation.

The OSAC should identify areas of research and development and advocate for their support.

The OSAC should not produce standards for the practice of medicine.

What do you believe are the essential elements of work products?

Initial drafts of standards and guidelines, which can then be sent to an ANSI accredited SDO organization.

Identify areas of needed research to strengthen the scientific foundation of forensic science practice.

Identify areas for training and education.

Create standards that are scientifically valid, not merely the result of consensus thinking.

Please provide your opinion as to whether there should be implementation/enforcement of the work products.

Implementation can be done through the appropriate discipline-specific accreditation and certification organizations. Funding can be used as a "carrot" for implementation and likewise a "stick" with compliance a condition for funding.

Do you believe that the OSAC should develop "best practices" and other materials that are not formal "standards"?

The OSAC should develop the appropriate level of document and in many situations those may well be best practices or guidelines and not standards.

General comment: A study should be commissioned on the actual implementation and use of Registry standards by practitioners, accreditation bodies and the courts.

(D) *Structure:*

What are your views as to whether the current the OSAC structure works efficiently?

The subcommittee structure works for drafting standards and guidelines, although the infrequency of in-person subcommittee meetings has hampered this effort. The SAC oversight is useful in avoiding redundancy, but adds a layer of bureaucracy that delays the process.

Overall the current structure is far too complicated. The resource committees in particular bring little obvious value to the process. The QIC has done most of the work for the organization in creating processes, but when this is done, the committee could probably be replaced by a single organization employee, or a smaller committee. The LRC and HF resource committees often collaborate, and seem to have positioned themselves to be oppositional to the rest of the organization.

There will no doubt be pressure to create further subcommittees, but any new subcommittees should be science-based. There is arguably too great a presence of and control by federal practitioners.

Do you believe that another structure should be utilized?

The OSAC Resource Committees (HFC, LC and QIC) add unnecessarily to the complexity of the OSAC and result in delays for subcommittees producing documents.

In an independent Institute with a more simple structure, there would be a section for each discipline that would report to a board comprised of section chairs with the appropriate administrative support. Each section would include practitioners and researchers in that discipline. The role of professional organizations, such as NAME, should be formally recognized and integrated into the process.

Please provide your opinion about whether there are any issues in the current work product development process that should be addressed structurally.

Documents coming from the subcommittees should not have to go through so many layers of approval before they can be submitted to a SDO. This has resulted in significant delays.

In your view, does the reliance on standards development organizations function as intended (please include the reasons for your opinion)?

Yes, an outside SDO allows review by all the appropriate external stakeholders.

(E) *Participation:*

What are your views as to the community the OSAC should serve?

Everyone who is in any way affected by forensic science will ultimately be served by the OSAC, but the OSAC should support the forensic science disciplines.

In your opinion, what stakeholders must be a part of the OSAC (e.g. practitioners, researchers, forensic science societies, accreditation bodies, scientific societies, human factors experts, metrologists, standards development organizations, legal practitioners)?

These are all appropriate stakeholders, but practitioners, forensic science and other scientific societies, and accreditation bodies should develop draft standards for forensic science practice. The others are appropriate for giving feedback, but should not themselves be setting standards. Non-licensed persons should not be telling licensed professionals how to do their job. This is especially true for Forensic Pathologist Physicians.

It is important to recognize that there are different goals involved when integrating nonprofessional stakeholders into a standards-making process, and those goals may be at cross purposes. It is the experience of the forensic pathology community that nonprofessional stakeholders often have specific agendas that are important to their work, but which are destructive to the practice of ethical forensic pathology. Prosecutors want to aid in the prosecution of cases, and often make suggestions that will increase the rate of false positive results. Defense attorneys

have proposed interventions that will greatly increase the rate of false negative results. Funeral home directors have suggested changes in some jurisdictions that inhibit investigation but make processing the body for a funeral more convenient. Social scientists have argued from numerous agendas that we should classify cases according to various theoretic and social criteria. While all of these interests are important, all of them work to sacrifice the scientific validity of forensic pathology for the sake of these disparate, essentially non-scientific needs. In fact, NAME has devoted a great deal of energy to protect forensic pathologists from this kind of corruption and influence; it would be unfortunate for such inappropriate influences to become formalized at the federal level.

If the goal of this process is, as stated, to increase the scientific validity of our work, then that goal is not served by integrating these anti-scientific agendas into the standards process. A consensus process that inserts these disparate goals into what is supposed to be a scientific process will fail.

If you think that any of these entities should be excluded, please explain why and identify other venues for the views of the excluded entities to be incorporated into forensic practice, if appropriate. In your view, should some stakeholders serve more limited roles and, if so, how and why?

At the OSAC level it is critical to have greater representation by practitioners and subject matter experts. The strength of the OSAC is the participation of the community and this should be continued. At the SDO level is where others can have input.

It is appropriate to have stakeholders who are not subject matter experts play an advisory role in the standards process, but not as voting members.

(F) *Funding:*

What is your opinion as to the funding model that the OSAC should employ—Entirely funded by the Federal government, by non-Federal funds, or a combination of funding sources? (Please include your thoughts on the role of funding sources such as membership fees, certification fees, and meeting registration fees.)

NAME believes the OSAC should be entirely funded by the Federal government, codified though legislation, and receive a direct line item. No other organization has the resources to support the OSAC and without a consistent reliable funding source, the OSAC is not sustainable. Only the Federal government has adequate funding to maintain the necessary structure, organization, administration, in-person meetings, and travel costs. It is particularly necessary for the OSAC subcommittees to have in-person meetings in order to develop the draft documents to submit to the SDOs for further development into standards.

While membership fees, certification fees, and meeting registration fees may work in other industries to support standards development projects, these would be entirely inappropriate in the forensic science realm. The vast majority of forensic science practitioners are public employees and most forensic science laboratories are NOT for-profit corporations, but rather city, county or state publically funded entities, with barely enough financial support to perform their daily duties. They do not have the ability to support an OSAC structure through fees. Reliance upon donations, fees, and non-Federal sources will not provide the necessary stability.

What are your views about the implications of funding models for the other traits, particularly oversight and independence?

Funding models other than the Federal government seriously risk diminishing the independence of the OSAC; in a "pay-to-play" model, only those entities and organizations with sufficient resources to send people to in-person meetings will have their views represented. Charging members or participants is likely to result in drawing people with extreme perspectives and not those with a more balanced view.

Independence is paramount.

Concept 1: Current Framework and Function

Overview

In this concept, OSAC would continue to function within its current structure and with its current core mission—the development, review, approval and placement of industry-leading standards and best practices to the OSAC Registry. OSAC would continue to operate and be funded as it is currently, but may be overseen/funded by NIST, by another federal agency, or by another appropriate organization.

Management

NIST or another agency/organization would manage the overall structure and continue to fund OSAC as it is currently formulated (see OSAC Organizational Structure).

Work Products

OSAC would develop a registry of standards and related documents such as best practices and guides.

Standards

OSAC would facilitate the development of standards and best practices for the OSAC Registry. OSAC would ensure that standards have a high degree of technical merit and are developed via an appropriate process. OSAC would also ensure a balance of interests and transparency. In general, OSAC would rely on standards developing organizations (SDOs), but provide a mechanism for public comment, as many SDOs do not perform this function.

Key Differences from Current OSAC

OSAC would continue to function as is within the currently formulated organizational chart, subject to future revisions by the parent agency/organization. Oversight and financial support of OSAC may continue to reside within NIST or be transferred to another federal agency or appropriate non-federal organization.

NAME Thoughts and Concerns

NAME prefers this concept, #1.

The current structure was established this way with the four purposes of the OSAC in mind (providing technical leadership necessary to:
1) facilitate the development and promulgation of consensus-based documentary standards and guidelines for forensic science;
2) promoting standards and guidelines that are fit-for-purpose and based on sound scientific principles;
3) promoting the use of the OSAC standards and guidelines by accreditation and certification bodies;
4) and establishing and maintaining working relationships with other similar organizations.)

There is value in independence of the standards-setting function and thus the OSAC should be outside the DOJ. NIST has expertise in metrology, statistics, and standards-setting and so it is particularly useful to have their involvement and engagement. NAME believes that the OSAC should either be an independent Institute or stay at NIST and be directly funded, not through the DOJ.

Whatever host organization is chosen, it must be able to provide the financial, organizational and administrative needs of the OSAC.

Concept 2: Community-based Standards
Overview
In this concept, OSAC would consist of two primary structures: Scientific Area Committees (SACs) and a Forensic Science Standards Board (FSSB). The SACs would be staffed by forensic science practitioners who would identify needed standards, advocate for research and development to support needed standards, and find standards that meet forensic needs. The FSSB would be staffed with scientific experts who would address issues of scientific merit. Standards would be placed on a registry based on SAC and FSSB concurrence. Lab managers, accreditors, regulators and others would use the registry as a source for vetted standards.

Management
NIST or another federal agency would manage the overall structure by awarding grants to forensic science organizations to staff the SACs and to scientific and professional organizations to staff the FSSB.

Work Products
OSAC's only work product would be a registry of standards and related documents such as best practices and guides.

Standards
Standards would be developed by any organization that chooses to engage in this area. OSAC would ensure that standards have a high degree of technical merit and are developed via an appropriate process. OSAC would also ensure a balance of interests and transparency. In general, OSAC would rely on standards developing organizations (SDOs), but provide a mechanism for public comment, as many SDOs do not perform this function.

Key Differences from Current OSAC
The subcommittees would be replaced with standards developing organizations. The FSSB would be composed of experts from outside the forensic science community.

> **NAME Thoughts and Concerns**
>
> NAME does not support this concept.
>
> It is useful to have the interactions between the OSAC subcommittees and the outside SDOs, as in the current structure. Having a FSSB composed of experts from outside the forensic science community is viewed by NAME as completely inappropriate. The current balanced membership in the consensus bodies of the SDOs provides enough outside expertise in this process. This scenario has the potential of degenerating into a political process, reacting to "emergencies".

Concept 3: Federal/State/Local Partnership
Overview
In this concept, OSAC would develop model laws for use by regulators and state/local legislative bodies. The goal would be to promote uniformity across forensic laboratories. This is especially important given that most forensic practice happens at the state and local level, rather than the federal level. Model laws would cover issues of forensic laboratory quality, and would extend to the entire legal system, including matters of accreditation, certification, training, and requirements for standards and best practices. OSAC would consist of legislative, legal, forensic, and other experts serving as representatives of federal, state and local governments. (This concept is based on the National Conference on Weights and Measures (link is external).)

Management
NIST or another federal agency would establish a new organization and would fund its startup. The organization could become financially self-sustaining by charging fees for training and credentialing.

Work Products
The primary work products would be model laws specifying licensing and proficiency requirements, rules of evidence, accreditation and other performance requirements. Products would also include educational material.

Standards
OSAC would develop minimum requirements for standards and best practices including evaluation criteria. The development of specific standards would happen outside of OSAC.

Key Differences from Current OSAC
Instead of focusing on populating a registry of standards, OSAC would mainly focus on producing model legislation. In this scenario, instead of accrediting bodies monitoring for compliance with standards, legal requirements would mandate an infrastructure that supports and improves forensic science.

> **NAME Thoughts and Concerns**
>
> NAME does not support this concept.
>
> NAME prefers to have standards implemented through accreditation. Professional standards need to allow variance for exceptional circumstances, as long as the variance is explained and justified; model legislation and legal standards do not allow this necessary degree of flexibility.

Concept 4: Standards Readiness Assessment and Improvement Program
Overview
In this concept, OSAC would assess standards, identify research needs, and coordinate the development, testing and evaluation of forensic methods, protocols and technologies. This function is critically important because standards have diminished value when the underlying scientific basis in not well understood. OSAC would look at all forensic science disciplines from established to novel. For example, single source DNA analysis is mature and has established protocols, large validation studies, and well understood uncertainties. Other areas in forensic science may lack established protocols, large scale validation studies, or a sufficient understanding of uncertainties. OSAC would publish reports assessing whether forensic methods have a sufficient basis of research to support the development of technically-sound standards. These reports would also identify the research needed for developing standards or improving them.

Management
NIST or another federal agency would lead the work and may establish partnerships with additional federal and private sector entities.

Work Products

OSAC would produce peer reviewed publications based on results from literature surveys and from OSAC-coordinated studies on standards readiness, method development, validation, inter-laboratory comparison, and reference data and materials. The resulting reports would be used to understand the correct use and limitations of evidence and supply standards developing organizations (SDOs) with the data and materials they need to implement new documentary standards or improve existing ones. OSAC would also produce gap assessments.

Standards
OSAC would produce reports that SDOs would use to understand whether existing documents should be revised, and to know what technology is ready for standardization. SDOs would be responsible for writing, correcting, and distributing documentary standards

Key Differences from Current OSAC
A library of resulting scientific studies would replace the registry. The committee structure would be replaced by a steering committee that assists OSAC in prioritizing work areas. OSAC would support the development of reliable technical documentary standards by functioning as a clearinghouse and coordinator of information on the development, validation, and uncertainty of forensic technologies and methods. Emphasis would be placed on both existing and new technologies. This will enable a path to implementation for existing methods as well as new approaches developed in the field by federal, state, and local agencies, in academia, and in other research organizations.

NAME Thoughts and Concerns

NAME does not support this concept.

NIST and the forensic community have invested an enormous amount of time and money developing the current OSAC structure and procedures. It appears that this Concept would completely replace the work done to develop the OSAC and would be a waste of the resources previously committed. The proposed review of scientific studies should be part of the OSAC subcommittees' work plans. Also, this scenario has great potential for excluding forensic pathologists from research funding.

AMERICAN SOCIETY OF
CRIME LABORATORY DIRECTORS, INC.

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The American Society of Crime Laboratory Directors (ASCLD) represents a membership of more than 600 crime laboratory directors and forensic science managers dedicated to providing excellence in forensic science through leadership and innovation. The ASCLD membership represents both public and private institutions from all 50 states in the U.S. and eighteen countries worldwide. Our mission is to promote the effectiveness of crime laboratory leaders throughout the world by facilitating communication among members, sharing critical information, providing relevant training, promoting crime laboratory accreditation, and encouraging scientific and managerial excellence in the global forensic science community.

ASCLD is dedicated to advancing forensic science through a multitude of initiatives including the Organization of Scientific Area Committees (OSAC). ASCLD has remained a fervent advocate and supporter of the mission of the OSAC since its inception in 2013. ASCLD believes that the goals and work products of OSAC are critical to the forensic community and could have a significant impact for the entire criminal justice community and the administration of justice.

As a result, the ASCLD Board of Directors offers the following comments for consideration by the National Institute of Standards and Technology (NIST) on the recently released "Request for Information on the Development of the Organization of Scientific Area Committees (OSAC) for Forensic Science 2.0."

ASCLD remains ready to be a resource to NIST to support OSAC's goal of developing consensus based documentary standards underlined by strong technical merit and to encourage their implementation into practice.

Respectfully,
ASCLD Board of Directors

Phone: 919.773.2044 | *Website: www.ascld.org*

ASCLD Board Comments

Request for Information on the Development of the Organization of Scientific Area Committees (OSAC) for Forensic Science 2.0.

ASCLD has invested heavily into OSAC over the last three years. ASCLD has promoted the OSAC to our membership with weekly postings of current information in our Crime Lab Minute newsletter and by scheduling OSAC updates at every ASCLD symposium since OSAC's inception. ASCLD maintains five positions on the Quality Infrastructure Committee (QIC), one position on the Forensic Science Standards Board (FSSB), and chaired the FSSB for the first three years of OSAC's work. The ASCLD Board of Directors has directly engaged with NIST on multiple occasions to provide feedback on improving the structure and function of the OSAC and has advocated for dedicated funding for the OSAC. ASCLD managers allow and fund their employees to participate in OSAC activities. To that end, ASCLD is invested in the success and future work of OSAC and offers the following comments to the Request for Information.

(A) Purpose

ASCLD believes the current purposes presented in the OSAC charter are appropriate and necessary within the scope of the OSAC's work to support and continually improve forensic science practice. Further, ASCLD believes that OSAC is the best organization to perform the function of developing consensus-based documentary standards that are fit for purpose and have technical merit.

While ASCLD strongly supports the original OSAC purpose, we would note the mission of OSAC seems to have shifted from direct development to "facilitating the development..." of documentary standards from the time OSAC was announced and today. ASCLD believes OSAC, itself, contains all the necessary components of a proper standards developing organization and suggests those participating in the OSAC may find the development process more straightforward if OSAC were to return to the vision of "developing" documentary standards and posting them directly to the OSAC Registry. Should this not be possible, one potential solution would be to create an "Interim Registry" or "Registry of Best Practices" that would publish all documents developed within OSAC at the time they are sent to a Standards Developing Organization for further action. In this iteration, OSAC-developed work products would be available to forensic science practitioners for use more quickly. OSAC work products advance the field of practice and incorporation into the work process should be as timely as possible. Developing an "Interim Registry" or "Registry of Best Practices" would allow for rapid incorporation into practice. Once a standard has been approved by an SDO, OSAC could vote to move it to the "OSAC Registry of Approved Standards."

ASCLD strongly disagrees with the proffered Models 2, 3, and 4. We believe these models would fundamentally change the purpose of the OSAC and dismantle three years of work by hundreds of dedicated NIST employees, forensic science practitioners, and criminal justice stakeholders. ASCLD confirms the mission of OSAC and its origin as provided in Model 1.

(B) Oversight and independence

ASCLD believes that the NIST should maintain oversight of OSAC with appropriate deference to the organization for standards-based decisions. ASCLD supports the administration of OSAC to-date. NIST should be commended for how well OSAC has been administered. The OSAC Affairs staff has done a laudable job of launching a new organization with hundreds of participants and such an important mission.

ASCLD believes that NIST is the appropriate neutral, scientific body to organize such an effort and lends significant credibility to the OSAC initiative. Further, a government body with sustainable funding would provide a steadying confidence that the organization will continue well into the future.

ASCLD believes while NIST is the preferred entity to host the OSAC, one critical element to the organization's credibility is to ensure the complete autonomy on standards and Registry decision making should remain entirely within the OSAC and end with the Forensic Science Standards Board. ASCLD recognizes that the scientific, metrological, and statistical input provided by NIST scientists balanced by the practical understanding provided by forensic scientists represents a strong partnership which requires continued nurturing. ASCLD recommends that OSAC consider staffing their team with communication specialists with facilitation skills in order to enhance communication and execution of initiatives among OSAC members.

(C) Work products and aims

ASCLD believes OSAC is making progress toward achieving the aims set forth in the OSAC Charter; however, enough time has not passed to see significant progress on every aim listed. While only a few standards have been posted to the OSAC Registry, there are currently more than 200 standards at some point within the OSAC development or approval processes.

The OSAC is largely staffed with volunteer members who have full-time jobs and the standards development process, by nature, takes time. ASCLD recognizes these factors contribute to a slow roll-out of standards on the Registry.

ASCLD supports the release of OSAC work products to the broader community in as timely a manner as possible. Work products would find more widespread and rapid adoption if they were posted to an "Interim Registry" or a "Registry of Best Practices" once they are sent out of OSAC to an SDO.

ASCLD also supports the addition of a public comment period while documents are still in development at the subcommittee level, in order to obtain public input at a stage where it is most effectively incorporated.

Finally, ASCLD believes that OSAC should provide access to documentary standards published on the Registry to forensic laboratories and relevant criminal justice stakeholders.

(D) Structure

ASCLD believes the current structure of OSAC is effective; however, ASCLD believes each Scientific Area Committee (SAC) should also be staffed with someone with an appropriate skill set to act as a project lead/facilitator to enhance communication. ASCLD supports the majority composition of OSAC to be forensic science practitioners who understand the concrete needs of the community, as well as the operational considerations necessary for implementation, and who represent the ultimate end users of the work products. ASCLD also appreciates the constructive contributions provided by the inclusion of research scientists, educators, statisticians, and metrologists to OSAC.

ASCLD supports embedding individual members of the OSAC Resource committees as members of OSAC subcommittees and Scientific Area Committees. Rather than the primary focus and membership of those individuals residing within the Resource Committees, their participation would be in the subcommittee or SAC. In this iteration, the valuable input of stakeholders on the LRC, QIC, and HFC would be better heard at the subcommittee level while standards are still in progress and where the subcommittee is better able to incorporate that feedback. To that end, the Resource Committees would be modified to OSAC-wide task groups that report to the Forensic Science Standards Board with the collective discussion among legal, human factors, and quality-focused stakeholders maintained similarly to the currently functioning OSAC-wide Statisticians Task Group. This would shift the valuable input of these stakeholders down into the day-to-day discussions on standards which would allow for more efficient incorporation rather than delaying the input to comment periods or after-the-fact input.

ASCLD also believes the Forensic Science Standards Board should maintain the existing role to evaluate subcommittees and forensic disciplines represented in OSAC for their effectiveness in accordance with the current goals.

Finally, as discussed previously, ASCLD believes OSAC work products that move forensic science forward should be publicized earlier rather than later to allow for incorporation into laboratory procedures. ASCLD believes OSAC is staffed appropriately and more than capable of publishing its own "standards;" however, if this is not possible, ASCLD believes that an "Interim Registry" or "Registry of Best Practices" should be created in order to disseminate the documents in production as in as timely a manner as possible. The ultimate goal of OSAC should be to provide documentary materials which improve forensic practice. To date, reliance on SDOs as the sole purveyor of materials suitable for the OSAC Registry has created unnecessary duplication, confusion, and most significantly delays in improving the practice of forensic science.

(E) Participation

ASCLD believes the primary end-user of OSAC work products are forensic science practitioners. If OSAC consensus documentary standards that are fit-for-purpose and have strong technical merit are published/posted to the Registry with the express goal of improving forensic science and written/approved with an audience of forensic science practitioners in mind, the entire criminal justice

system will become the beneficiary. ASCLD believes this should be the guiding principle of the OSAC organization.

To that end, ASCLD strongly believes that OSAC should maintain a substantial composition of forensic science practitioners. Through the first three years of OSAC, practitioners have demonstrated a transparent willingness to engage with stakeholders to improve forensic science, including the posting of "research needs" which practitioners recognize as areas needing funding and research for improvement. ASCLD agrees, however, that the entire list of stakeholders offered in the Request For Information are important perspectives to have represented in OSAC ("*e.g.,* practitioners, researchers, forensic science societies, accreditation bodies, scientific societies, human factors experts, metrologists, standards development organizations, legal practitioners"). ASCLD does not believe that any of the named participants should be excluded; rather we believe that this diversity and their participation is the principle reason why a NIST-sponsored OSAC is the most appropriate place for this critical work to occur.

(F) Funding

ASCLD believes the OSAC should be funded by the Federal government. Professional organizations or public-private partnerships are unlikely to financially sustain this initiative long-term at an effective level. A pay-to-play model precludes an equitable distribution of participation. Further, ASCLD believes OSAC should be funded with a sustainable, multi-year authorization. NIST should request this budget appropriation annually. One of the principle reasons OSAC has been able to achieve its results to date is due to the consistent funding from year-to-year for all disciplines. OSAC bridged a previous funding disparity which existed among different disciplines previously represented by the SWGs. The opportunity for all disciplines to rely upon consistent funding has allowed them to dedicate a significant amount of work to standards development. ASCLD believes that only through multi-year Federal authorization, will the OSAC continue to be effective.

> ***ASCLD believes that OSAC should be Federally authorized in the NIST budget at a minimum of $5 million per year.***

This funding would allow all disciplines to hold two in-person technical, collaborative work sessions per year. In-person work sessions are key to producing technically-sound documentary standards in a timely manner and in-person work session models are currently used by other successful standards bodies such as the technical committees in the International Organization for Standardization. A key OSAC success has been the ability for subcommittees to interface with legal, academic, statistician, and human factors scientists in real-time at in-person meetings during the deliberation of work products. The ability for a subcommittee to directly and immediately get feedback from relevant stakeholders has been lauded as a significant achievement and dramatic improvement over the former Scientific Working Groups (SWGs). This success will be maintained with additional, sustained funding.