

**TURNING THE INVESTIGATION ON THE
SCIENCE OF FORENSICS**

HEARING

BEFORE THE

**COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION**

UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

DECEMBER 7, 2011

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

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TURNING THE INVESTIGATION ON THE SCIENCE OF FORENSICS

WEDNESDAY, DECEMBER 7, 2011

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 2:35 p.m. in Room SR-253, Russell Senate Office Building, Hon. John D. Rockefeller IV, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. JOHN D. ROCKEFELLER IV, U.S. SENATOR FROM WEST VIRGINIA

The CHAIRMAN. Good afternoon. We're here today to investigate the science of forensics. This has been done before by the National Academy of Science Committee, which Dr. Gatsonis and Mr. Mearns served on.

It's a huge subject and so I'm going to ask forbearance, because I want to explain it a little bit to give it a little context. And if one of you collapses in a sound sleep, I'll know that I've gone too long. And it isn't going to be long, but it's just going to be a little longer than I should have.

OK. The criminal justice system is intimately tied to the practice of forensic science. Attorneys, judges, and juries all rely on forensic evidence presented in the courtroom to determine the guilt or innocence of the accused.

For many in the public, their understanding of forensic science comes from the world of entertainment exclusively. Popular shows like CSI, NCIS give the impression that forensic science is nearly infallible, and not only that, but it can be done in 12 minutes or three, always conclusive, very high-tech.

However, the reality is very far from the depiction. Today, we learn about the state of science in forensic disciplines. We will see that some fields, like DNA analysis, use reliable methods and techniques rooted in scientific research. Others, for the most part, arise from the law enforcement community. And you know, they have their place, but not backed up by science.

We will also see that other fields of forensics such as ballistics, bite marks, fingerprints, hair follicles, all that kind of thing where the scientific foundation simply is not there, leaving the results of some analysis in doubt. Particularly telling in this conception about the practice of forensic science concerns the availability of DNA, which actually turns out to be only somewhere between 5 and 10 percent, I think, of what can be used as evidence in any event. But

as you watch some of these shows, it sounds like everything, that and fingerprints.

The other 90 percent of cases, the criminal justice system relies on other types of analysis, including those that may not be scientifically sound. At the request of Congress, the National Academy of Sciences reviewed the state of forensic science in the United States. The review committee included members from the legal, forensic, and scientific community. And what they found surprised me, as we will hear in today's testimony, surprised some of them as well. The Committee's report highlighted many challenges that the forensic science community has. These problems were not the forensic practitioners themselves, a majority of whom are dedicated, ethical professionals doing their best possible work. Rather, the problem involves the science itself. For example, forensic analysis is often used to try to establish a direct link between the evidence and a specific individual. With the exception of DNA analysis, no forensic method has been demonstrated with any high degree of certainty to be able to establish that link, thus, I would think, putting juries at risk and decisions at risk.

There are also no national standards for the language used in reporting outcomes and interpretation of forensic analysis. When an expert testifies in court that a fingerprint from a crime scene is, quote, consistent with the fingerprint of the defendant, what does that mean?

One thing to one person and another thing to another person on the other side, and therefore, not so hot.

Many disciplines in forensic science were homegrown exclusively for law enforcement and by law enforcement because they needed to bring things together, the famous match with fingerprints.

Now, this is not inherently damaging. It has led to a symbiotic relationship between forensics and law enforcement.

When crime labs are subject to funding and oversight through law enforcement, there is potential for conflicts of interest. It is critical that we separate the science from the prosecutorial jurisdiction to address both the perception and the reality of bias in the analysis of evidence used at trials.

As for those working in the crime labs, the Bureau of Labor Statistics projects a 20 percent increase. I mean, this is huge in the next five or 6 years in the need for forensic specialists.

But they have to be certified. Everybody else gets—before they can go before a courtroom, I believe Mr. Grisham has to be certified, if you're a nurse or if you're whatever. You have to be stamped official, approved.

This is not true in forensic science. It's not true. You don't have to be stamped as anything, and therefore, raising those questions.

But on the other hand, there's going to be this enormous need for forensic scientists. And we need them to be well trained. Forensic science students need a strong background in the fundamentals of science, technology, engineering, and math, STEM, my four favorite letters, a supply already taxed by the Nation's urgent need to reassert its global competitiveness in all kinds of other areas, so a lot of competition.

It's both a lack of resources and expertise that makes educating a new generation of forensic scientists very difficult. Within my

own state of West Virginia, we have many problems, but one we don't have is that we've seen firsthand the growth in the forensic science industry. And it didn't happen because we started it.

It happened because the FBI Criminal Justice System Information, a division of Department of Defense, Biometrics Identity Management Agency. Biometrics, forensics sort of joined there, just a huge infusion because we're close to Washington and the FBI moved out. Tremendous interest developed in our two major universities about that.

So their close collaborations are helping to make significant advances in biometrics technologies and they will be working even closer side by side on a daily basis once the new joint Biometric Technology Center is completed.

As I say, we have two universities. They both do this and they do it very, very well. And that's to our advantage, which we need.

This afternoon, we will hear from a panel of witnesses on how we can advance the science of forensics and address the field's most critical challenges. I think this is an absolutely fascinating hearing. I love it.

I absolutely love it because it involves STEM. It involves the excitement. It involves the media presentation, how our heads are worked on, and how, when you get the famous funny-looking person who finds on computers the match, there it is, match. And the person is virtually on their way to a cell or at least a trial.

First off, we have Mr. John Grisham, a very renowned author and former defense attorney. Mr. Grisham serves on the Board of Directors of the Innocence Project, and is Chairman of the Mississippi Innocence Project itself, and who is very well acquainted, I'm sure, with the famous Fred Zane problem in West Virginia, where 12 people who had been in prison for a number of years, some of them up to 12 years, they found out that the forensics were incorrectly done and they were all freed.

It's a heck of a price to pay for insufficient forensics.

Second, we have with us the Co-chair of the National Academies' Committee on Identifying the Needs of the Forensic Science Community, Dr. Constantine Gatsonis. Dr. Gatsonis is a biostatistician at Brown University.

Our third witness, Mr. Geoffrey Mearns, is the Provost of Cleveland State University. He's a former prosecutor and also a member of the National Academies' Committee on Forensic Science.

Finally, we have Dr. Terry Fenger, who is Director of the Forensic Science Center at Marshall University in West Virginia. Marshall has a master of science degree program in forensic science. It's one of the very few in the country, as a matter of fact.

And that's good for us, but not good for the country in this effort to meet the rigorous standards required for accreditation by the Forensic Science Education Program Accreditation Commission, which turns out to be very, very important.

So that said, the—and again, you know, if you're a nurse and you go in to testify, you've got to be certified. You've got to be a stamped, reliable source of information, or any other type of person. Forensics? No.

And what are we going to do about it? So I'd like to thank you all for being here today. I apologize to my colleagues for my lengthy

statement, but I don't really, and I call upon my good colleague, Mr. Boozman.

**STATEMENT OF HON. JOHN BOOZMAN,
U.S. SENATOR FROM ARKANSAS**

Senator BOOZMAN. Thank you, Mr. Chairman, very much. And again, thank you for holding this afternoon's hearing. This really is a very important issue, not only because the field of forensic science is critically important to upholding our nation's criminal justice system, but also because the forensic sciences are vital in supporting homeland security, and counterterrorism missions, and protecting the safety of the public.

I am very pleased that we are having the discussion today. Over the last two decades, many advances have been made in the field of forensic science, which has led to the prevalence of forensic evidence in our judicial system and courtrooms.

These advances are particularly seen in the realm of DNA technology and medical identifiers, but also exist in the form of the many other forensic evidence identifiers.

These types of forensic evidence are widely relied upon by investigators as a search for the perpetrators of crimes, attorneys, and judges, then in turn, juries, when assessing the guilt or the innocence of those suspected of crimes.

Our courtrooms, however, are not the only venue or experience in the increase of forensic science. Many popular television shows, as the Chairman alluded to, CSI, Law and Order, to name a few, portray state-of-the-art forensic laboratories and the use of forensic evidence often as a central factor in their ability to solve crimes in a 60-minute segment.

But in reality, crimes labs and forensic testing processes are substantially different from what we see on the Hollywood sets. In reality, from forensic botany, chemistry, and even anthropology, the many various fields within the broader field of forensics are extremely complex and unique in nature.

Law enforcement, prosecutors, and crime labs would all benefit from greater research efforts. In the absence of greater peer review research, there are too many unknown variables, leaving room for error in a system on which our judicial integrity, national security, and public safety community rely so heavily.

And while there is no doubt that we need more research and training to increase crime lab capacity and improve accuracy, precision, and reality, the purpose of this hearing is to discuss how best to strengthen forensic science to ensure reliable findings and protect the public, and how to best build upon existing expertise within the science and public safety community to ensure that we can improve forensic science in the most efficient and effective manner possible.

I am looking forward to hearing from panelist Dr. Gatsonis and I'm also interested in hearing from Mr. Mearns on the impact of forensic science on the judicial system. I'm eager to hear from Dr. Fenger on his knowledge of forensic education, as well as from Mr. Grisham, a fellow Arkansan, on the tragedy of the wrongful convictions based on faulty forensic evidence.

I'm also hoping to hear how we could potentially leverage existing initiatives within the forensic community in moving forward with advancing forensics. I'm hoping to explore how to use Federal resources to foster improvements in forensic sciences without reinventing the wheel.

I once again thank all of you for being here and I echo the Chairman in the sense that this truly is a very important thing. And again, thank you for bringing it to our attention.

The CHAIRMAN. Thank you, Senator Boozman, very much. Senator Klobuchar?

**STATEMENT OF HON. AMY KLOBUCHAR,
U.S. SENATOR FROM MINNESOTA**

Senator KLOBUCHAR. Thank you very much, Mr. Chairman, for holding this important hearing. I want to welcome all the witnesses. And as a former prosecutor for 8 years, I have been intimately involved in these issues.

I was smiling when I heard you talk about the CSI effect. When those shows came on, we actually would have several jurors who would acquit in cases. And afterwards, we'd ask them—a simple hand case, where someone had touched someone. "Well, you didn't have the DNA evidence." We didn't have the DNA evidence.

So we learned quickly to adjust and to anticipate those issues. But most importantly, I've worked extensively with the Innocent Project, Mr. Grisham, on both witness ID issues and we did some novel things in our county, as well as videotaping interrogations, which I think has been an incredibly positive development in our state, on both the prosecutor, police, and defense side.

The issue of forensic science—if we don't have reliable forensic science, we can't make a case. A defense lawyer's job is to protect the innocent. And a prosecutor's job should also be to protect the innocent, as well as to prosecute the guilty.

And so I think it's incredibly important that we have the most updated science and it's a vital part of our criminal justice system.

In Minnesota, we created a forensic laboratory advisory board in 2006. We've been working to develop, among other things, a mandatory accreditation project for—a process for individual labs and certification requirements.

But there remain great disparities and inconsistent practices among crime labs in the country. As the National Academy of Sciences report from 2009 highlights, there's a pressing need to improve the overall quality of forensic evidence across the board.

So I am looking very forward to hearing the evidence today because this is about science. We shouldn't be afraid of science. We should embrace science. And if we have evidence that is flawed in some way, that doesn't meet the top scientific standards, then we need to change that. Otherwise, it calls our entire judicial system's integrity into question.

So thank you, Mr. Chairman, for holding the hearing.

The CHAIRMAN. Thank you very much, Senator Klobuchar and Senator Udall, to be followed by Senator Lautenberg.

**STATEMENT OF HON. TOM UDALL,
U.S. SENATOR FROM NEW MEXICO**

Senator UDALL. Thank you, Chairman Rockefeller, and I want to thank you for your leadership on this issue today. I think it's a very important one for our committee to be addressing.

Forensic science is a powerful tool with great potential to help law enforcement quickly and effectively identify who has committed a crime and who is innocent.

But I'm very aware that many of the forensic tests we use today lack scientific validity. Our citizens, courtrooms, and law enforcement personnel rely on these tests. And it's imperative that we improve the research regarding forensic science and make sure we know about its limitations.

I know, from my days as Attorney General, that it's imperative to have scientifically valid evidence to identify criminal offenders and to protect the truly innocent. And I look forward to hearing from our panel today on how to improve on the scientific validity of this important field.

I also, again, want to thank Chairman Rockefeller and the witnesses who are here today. You all have done very valuable work for the safety and justice in our communities and I'm very grateful for your efforts to improve upon our criminal justice system.

One of the issues that I think Senator Klobuchar mentioned that's very important—and I know this as a Federal prosecutor and then as a State Attorney General—is, with these crime shows, which are so prevalent in that the general public watches, they have an impact on juries.

And juries view the criminal justice system in a different light, based on these crime shows that are out there, that are running on a regular basis.

And I'm just wondering—and I hope, when we get to the questioning, that I'll be able to ask you about it—is, is there a danger there? Is there anything we can do there? Is there a problem? And what are the challenges?

So with that, thank you again, Chairman Rockefeller, and I yield back.

The CHAIRMAN. Yes. Absolutely. Senator Lautenberg and then Senator Wicker.

**STATEMENT OF HON. FRANK LAUTENBERG,
U.S. SENATOR FROM NEW JERSEY**

Senator LAUTENBERG. Yes. Mr. Chairman, thanks very much for holding this hearing. And though I am not a lawyer, I am very conscious of what we have to do to make sure that the law provides the kind of exacting evidence that is required in cases.

And I'm fortunate to have had a court house in Newark bear my name. And I worked hard to get an inscription on the plaque identifying the building. And my inscription said, "The full measure of democracy is its dispensation of justice."

And—but we all know there can be no true justice if police and prosecutors do not have the tools that they need to fairly enforce our laws. And that includes tools provided by science, which has played an important role in our criminal justice system since the FBI opened its first crime lab in the 1930s.

But the fact is, sometimes forensic science isn't really scientific. DNA testing is a proven method to determine a suspect's guilt or innocence, but the same thing cannot be said of other crime-solving techniques.

And I said proven method, but we have challenged it to that in many instances. Scientists tell us that many forms of commonly-used forensics, including fingerprints, ballistics, firearms identification, fail to meet the most basic scientific standards.

The scientific community also has expressed serious concerns about the quality of our country's crime labs. Now, there are no national standards for forensics labs or for the people who work in them.

Many crime labs are forced to deal with inadequate funding, outdated equipment, and lengthy backlogs. In addition, these labs are not required to coordinate their efforts, which could undermine homeland security.

And if terrorists were to attack locations in several states at once, there would be no guidelines for local labs to work together and with national homeland security experts to examine the evidence and share their findings. This is unacceptable.

The United States must be tough on crime and terror, but our efforts are meaningless if shoddy science and ineffective crime labs hinder our ability to enforce our laws and protect people.

Make no mistake. We have a lot at stake here. And as Americans, we take pride in having the world's fairest criminal justice system. But we've all heard horror stories about how faulty forensic evidence has sent people to jail or, worse, to death row.

And every time an innocent person is put behind bars, a guilty person is let free to walk the streets. The bottom line is that we've got to do everything in our power to make sure only sound science is used in our criminal justice system.

So Mr. Chairman, I look forward to hearing from today's witnesses about how we can do a better job protecting the American people, making sure wrongful convictions are the exception not the rule.

And Mr. Grisham, I'm particularly pleased to welcome you because I was a member of the board of Cardozo Law School for so many years. So thank you all, however, for your work. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Lautenberg. Senator Wicker?

**STATEMENT OF HON. ROGER WICKER,
U.S. SENATOR FROM MISSISSIPPI**

Senator WICKER. Thank you, Mr. Chairman. I want to welcome the panel, thank them for their participation today. I know they're wondering if they will ever get a chance to begin speaking. And so I will not prolong this. I do want to thank the Chair for bringing this important subject matter to the attention of the Committee today.

I particularly want to welcome my long-time friend, John Grisham. In 1987, I had the opportunity to be elected to the State Legislature from Mississippi. There was, in the House of Representa-

tives at that time, someone who had been elected the term before, from DeSoto County.

And I got to be a friend of John Grisham during my service in the Legislature. It is true that oftentimes, he's sat closer to the left side of the room and I sat closer to the right side of the room.

But we had a friendship then, and maintain one today, and I was glad to serve with him until he had decided to go ahead and leave and pursue full-time writing, but at the same time, to speak out for issues which advanced the cause of justice.

I've been on both sides of a criminal courtroom. I was an Air Force judge advocate. I have prosecuted cases. I have defended cases in the Air Force and also in the State courts back home.

This is not a matter of left or right. It's not a matter of Republican or Democrat. It's not a matter of prosecution and defense. This is a matter, in a nation where we have an absolute presumption of innocence for our citizens, of getting it right.

And that's what I think we're all interested in doing. And I think that's what this panel is all about today, so I thank you all, and I particularly welcome John here, and I thank you again, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Wicker. And Mr. Grisham, the floor is yours.

**STATEMENT OF JOHN GRISHAM, MEMBER, BOARD OF
DIRECTORS, INNOCENCE PROJECT; CHAIRMAN, BOARD OF
DIRECTORS, MISSISSIPPI INNOCENCE PROJECT**

Mr. GRISHAM. Thank you, Chairman Rockefeller, Ranking Member Boozman, my good buddy, Roger Wicker. We used to call him Roger. Now, of course, it's Senator Wicker. And other members of the Committee, I'm John Grisham. I'm with the Innocence Project. It's still at Cardozo Law School in New York. I'm a member of the Board of Directors of the Innocence Project.

I'm also an author who has written about wrongful convictions in both fiction or in non-fictional settings. I am not a researcher, a scientist, or a doctor. I used to be a lawyer for 10 years and I spent a lot of time in the courtroom, primarily in criminal defense.

I now get to create stories about lawyers, and law firms, and courtroom dramas, and stuff like that. My adventures as a writer have taken me to some interesting places, but none as fascinating and heartbreaking as wrongful convictions.

When I was a law student, we were taught that the basis of our judicial system is the right to a fair trial. I still believe that and I'm sure we all do.

But in this country, many trials are simply not fair. Innocent people are convicted and sent to prison, some to death row. At the Innocence Project in New York, in the past 20 years, we have worked to exonerate, using exclusively DNA evidence, 280 inmates, innocent people, who were in prison. 17 were on death row.

If you take the other Innocence projects around the country—and they're always 44, 45, 50; they come and go—in the past 20 years, the total number of exonerations is somewhere around 850.

Those of us who work in Innocence all believe that this is the tip of the iceberg. This is a small fraction of the innocent people who are in prison right now.

Wrongful convictions are caused by a number of factors, all of which could be avoided. The most common problem is improper eyewitness identification. Bad forensics is number two. False confessions, false testimony from jailhouse snitches and informants, bad defense lawyering, misconduct by police and prosecutors, judges who are asleep at the switch.

And these causes overlap. And you can take any wrongful conviction case, study it, and find four or five of these factors at play. In half of our exonerations, 50—a little over 50 percent—the trials were contaminated by bad forensic science such as microscopic hair, bite mark analysis, fiber analysis, soil analysis, voice analysis, forensic practices that have not—not been scientifically tested.

Witnesses present themselves to—to the court, to the jury, as experts in these fields and they give detailed testimony with scientific principles that are untested and not validated. It's still happening today. It happened. It's happening somewhere today, with tragic results.

Faulty science is rampant in American courtrooms. It's procured by prosecutors, often well-meaning. It's tolerated by judges, offered by experts, and consumed and believed by jurors, in good faith.

And in—in all fairness to the system, the courtroom is not the place to distinguish good science from bad. I sort of stumbled into this world a few years ago, when I heard the story of a guy named Ron Williamson.

Ron had just died. He was my age. He lived in Oklahoma. We had very similar backgrounds. And he had been convicted of a rape and murder he did not commit. He went to death row in Oklahoma. He went completely insane. He came within 5 days of being executed.

He got a miracle stay in 1994 and, 5 years later, working with the Innocence Project in New York, his DNA was tested. He was completely exonerated and found not guilty, walked out of prison in 1999.

At the time of his trial, though, in 1988, the police and prosecution had virtually no physical evidence against him, evidence against him, because he was innocent. With the use of a couple of jailhouse snitches, a half-baked jailhouse confession, and some bad science, they got a conviction. They convicted Ron.

The most damaging witness against Ron at trial was an expert from the state crime lab, who took the stand and, with a great deal of authority, explained to the jury that there were 17 scalp and pubic hairs taken from the crime scene, 17.

And he used all the right terms. He said that these hairs were microscopically consistent with the samples taken from Ron. Even went so far as to say there was a match, which is a bad word, but that word was used. Got a match.

Prosecutor picked up on it and used it for the rest of the trial.

This type of—the impact of this testimony on jurors cannot be overstated. These experts come in. They've got education, the experience, resumes, nice suits, big vocabularies, and they are really, really impressive to jurors who are not that sophisticated.

Eleven years after this guy testified, 11 years later, those 17 hairs were—underwent DNA testing. Not a single one came from Ron Williamson.

In researching and writing *The Innocent Man*, I sort of came aware of the scope of this problem. I joined the Board of the Innocence Project. And for the past 5 years, I've gone around the country, raising money, making speeches, raising money for various projects, trying to raise awareness.

I've met a lot of exonerees, guys who spent 10, 15, 20 years in prison for somebody else's crime. Every story is fascinating. Every story is compelling. Every story is heartbreaking.

Every wrongful conviction goes back to the courtroom. It goes back to the trial and back to the testimony. And if we can't ensure that the testimony is accurate, then the trials are not going to be fair.

Thank you. I look forward to your questions.

[The prepared statement of Mr. Grisham follows:]

PREPARED STATEMENT OF JOHN GRISHAM, MEMBER, BOARD OF DIRECTORS, INNOCENCE PROJECT; CHAIRMAN, BOARD OF DIRECTORS, MISSISSIPPI INNOCENCE PROJECT

Thank you Chairman Rockefeller, Ranking Member Hutchison, and members of the Committee. My name is John Grisham and I am a Member of the Board of Directors of the Innocence Project in New York. The Innocence Project is a national litigation and public policy organization dedicated to exonerating wrongfully convicted people through post-conviction DNA testing and reforming the criminal justice system to prevent future miscarriages of justice. I am also the Chairman of the Board of Directors at the Mississippi Innocence Project, an organization that is a member of the Innocence Network, an affiliation of organizations dedicated to providing pro bono legal and investigative services to individuals seeking to prove innocence of crimes for which they have been convicted and working to redress the causes of wrongful convictions. Today there are 57 of these projects based in the United States and nine international projects.

I am also an author and I have written about wrongful convictions in both fictional and non-fictional settings. In fact, it was the pursuit of a good story that has led me to the world of wrongful convictions. Almost seven years ago, I was reading *The New York Times* and saw the obituary of Ron Williamson. Ron was a man much like me. We were the same age, we both dreamed of being Major League baseball players, we both grew up in small towns in the Bible Belt, and we both came from the same religious backgrounds. However, Ron was convicted of a rape and a murder he did not commit, was sent to death row, went insane, and came within five days of being executed before receiving a miracle reprieve.

Ron Williamson was the second-round draft pick of the Oakland A's in 1972. He signed for \$50,000, left his small town of Ada, Oklahoma, and went away in search of major league glory. Injuries soon derailed a promising career, as did drugs, alcohol, and women. By the time Ron was twenty-eight, he was showing signs of mental instability. He would later be diagnosed as bipolar. His drinking increased, and he found it difficult to keep a job. A man who had once been a local sports hero became a misfit around town. He had a few brushes with law enforcement and spent time in jail.

In 1981, an attractive young cocktail waitress was brutally raped and murdered in Ada, not far from where Ron was living with his mother. The victim's name was Debra Carter, and she was last seen outside a bar, late at night, engaged in some type of confrontation with a thug named Glen Gore. Though Gore was well-known to the police, and the last person seen with the victim, the authorities in Ada failed to pursue him as a suspect.

Eighteen years later, Gore's DNA would link him to the rape and murder of Debra Carter, and he is now serving a life sentence in Oklahoma.

Five years passed after the murder and the Ada police could not solve the crime. Finally their investigation mistakenly led them to conclude that Williamson and his friend Dennis Fritz were the perpetrators, and arrested them, charged them with capital murder, and proceeded to trial.

Since Ron Williamson was innocent, there was virtually no physical evidence presented against him in court. However, using false testimony from jailhouse snitches, a half-baked jailhouse confession, and unvalidated science, the prosecutor got a conviction and a death sentence. The most damaging testimony against Ron came from

an expert—an analyst with the Oklahoma Bureau of Investigation. This expert testified that there were seventeen scalp and pubic hairs taken from the crime scene, and that his analysis revealed that these hairs were “microscopically consistent” with the samples taken from Ron Williamson and his co-defendant, Dennis Fritz. Specifically, two scalp hairs and two pubic hairs were “microscopically consistent” with Ron’s samples and, he incorrectly testified, therefore there was a positive “match.”

Jurors typically give great weight to such testimony. They want to believe the authorities—the prosecutors, police, and experts called by the State—and when a veteran analyst who boasts of investigating hundreds or thousands of cases testified with great confidence about his or her findings, jurors believe the testimony.

Eleven years after Ron’s trial, all seventeen hairs were subjected to DNA testing. Not a single one came from Ron Williamson or Dennis Fritz.

To this day, there are no scientifically accepted population statistics for the frequency of hair characteristics; thus there is no data proving what is rare or common. There are no uniform standards on the number of features on which hairs must agree before an examiner may declare a “match.”¹ His wrongful conviction can be blamed primarily on the use of unreliable, unproven, untested, and unregulated use of hair analysis testimony.

Fortunately, Ron was exonerated and released from prison in 1999. Needless to say, his mental health had not improved during his ordeal in prison and on death row, and he soon returned to his old habits. He died in 2004 of liver failure.

While researching his story, I spent time with other innocent men, some out of prison, some still behind bars. I slowly came to realize that there are likely thousands of innocent people in prison, most sent there by the same mistakes that convicted Ron Williamson and Dennis Fritz. Every wrongful conviction I’ve studied could have been prevented. They are caused by a number of factors—bad eyewitness identification; bad defense lawyering; false confessions; false testimony by jailhouse snitches and informants; misconduct by the police and prosecutors; judges who can be either incompetent or afraid to make tough rulings; and bad science. These causes overlap and several are present in every wrongful conviction.

Once I realized the enormity of the problem—the sheer number of wrongful convictions—I decided to get involved. I joined the Board of the Innocence Project in New York, and I helped organize the Mississippi Innocence Project.

The first major case undertaken by the Mississippi Innocence Project involved the killings of two little girls. In the span of two years, the girls were abducted from their homes, raped, murdered, and their bodies were tossed into creeks. Their homes were in the same rural neighborhood. The cases were reviewed by a forensic pathologist, an expert witness essential in every homicide case, and by a forensic dentist. In addition to identifying the cause of death, forensic pathologists are trained to identify pattern injuries and to determine whether marks on the skin are injuries sustained in a struggle before death as opposed to the normal artifacts occasioned by decomposition of skin after death. If the pathologist believes he sees pattern injuries on the deceased consistent with bite marks, he enlists a forensic dentist to determine whether there is sufficient detail to include or exclude a suspect’s dentition.

In the autopsy report of Courtney Smith, the first victim, the prosecution’s pathologist, who was not board certified in forensic pathology, incorrectly diagnosed post-mortem marks on the body as adult bite marks occurring at or before the time of death. He also neglected to personally conduct the biopsy on the marks to determine whether they were inflicted anti-mortem or post-mortem, improperly delegating that responsibility to the forensic dentist. And when the results of the biopsy strongly indicated that the marks occurred after death, he testified to just the opposite. The dentist also miscalled the post mortem artifacts as human bite marks and erroneously claimed that the source of the bite marks “could be no one but Levon Brooks.” In the second case two years later, the same pathologist erroneously called post mortem artifacts human bite marks and claimed the marks were made at or before the time of death without anyone doing the necessary biopsy. And the same dentist, who wrongly identified Brooks as the source of the bite in the first case, testified that “indeed and without a doubt” the bite marks on Christine Jackson were inflicted by a man named Kennedy Brewer. In the first case, Levon Brooks was sentenced to life in prison; in the second, Kennedy Brewer was sentenced to death. Post-conviction DNA testing identified Justin Albert Johnson as the source of the semen in three-year-old Christine. Johnson volunteered a detailed confession to both murders leading to Brooks’ and Brewer’s exonerations.

¹ Strengthening Forensic Science in the United States: A Path Forward, Committee on Identifying the Needs of the Forensic Science Community, The National Academies Press (2009), p. 160. (Hereinafter NAS report)

Although no scientific studies support the use of bite marks to demonstrate the positive identification of the biter,² this method was applied to connect Levon and Kennedy to the deaths of these young girls. Tragically, one of those girl's lives could have been spared: after Levon Brooks was convicted, the real perpetrator of both murders, Justin Albert Johnson, remained free to kill Christine Jackson—the crime for which Kennedy Brewer was convicted.

These cases illustrate the consequences of a very real shortcoming of our criminal justice system that should concern all of us. Granted, these cases have some of the dramatic human elements of misconduct and malfeasance that also contribute to bad convictions; though in that sense they are the exception, not the rule. Instead, in most cases, people who are uninformed about the reliability of a technique make assertions that are, unbeknownst to them, not based on rigorous scientific research. They do not benefit from the educational benefits of a robust academic field. And they do not know that the techniques they rely on have never been comprehensively studied and standardized, and that no evaluation ever quantified their probative value.

The development of DNA testing has allowed us to demonstrate this. We now know about the factual innocence of 280 Americans, 17 of who were sentenced to death and waiting to be executed. Research into the causes of wrongful conviction has revealed that the reliance on unvalidated and/or improper forensics is the second-greatest contributing factor to wrongful convictions, contributing to approximately 50 percent of those cases overturned by DNA testing.

In those exonerations alone, we have had wrongful convictions based on unvalidated or misapplied serological (or blood type) analysis, microscopic hair comparisons, bite mark comparisons, shoe print comparisons, fingerprint comparisons, forensic geology (soil comparisons), fiber comparisons, voice comparisons, and fingernail comparisons among the many forensic disciplines that have produced wrongful conditions.³ It comes as no surprise that the National Academy of Science concluded: “With the exception of nuclear DNA analysis, however, no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source.”⁴ The overarching problem has been that all too frequently, non-DNA forensic disciplines have been improperly relied upon to connect our innocent clients to crime scene evidence.

Just as DNA exonerations reveal inherent shortcomings in other forensic disciplines, the evolution and regulation of DNA as a forensic technique (from basic research to crime lab and to casework) contrast starkly with many other forensic technologies. Long before there was a national forensic DNA testing program, the National Institutes of Health and others funded and conducted extensive and relevant basic research and followed it with applied research. Scientists appreciated the challenge of transferring the technology from research lab to clinical lab and from clinical lab to crime lab. The forensic methods were validated for case work, and individual crime labs further test the kits and protocols for use in their own laboratory settings.

Many non-DNA forensic practices have not been scientifically validated, and there is no formal scientific apparatus in place to scrutinize developing forensic technology. Most of the forensic practices used in law enforcement have no other application; they were developed for the purpose of investigation, prosecution and conviction and, because they were not developed in a scientific setting, they took on a life of their own without being subjected to the rigors of the scientific process. Essentially, the forensic practices were simply accepted as valid; they went online with little or no assessment of their robustness and reliability. No entity comparable to the Food and Drug Administration ever scrutinized the forensic devices and assays, unlike many of the devices and assays that are used in a clinical laboratory. And unlike clinical laboratories, no Federal statute requires, and no single entity sets standards for, accreditation and certification, so not all crime laboratories and forensic units are accredited, and practitioners are not required to be certified. Enforceable parameters for interpretation of data, report writing, and courtroom testimony have also never been developed.

Unfortunately, this is a national problem. An exhaustive review of the Nation's DNA exonerations showed that 72 forensic analysts from 52 different labs across 25 states had provided testimony that was inappropriate or that exaggerated the probative value of the evidence in either reports or live courtroom testimony.⁵ Again,

²*Supra* note 1, at p. 176.

³Garrett and Neufeld, *Virginia Law Review*, Vol. 95, No. 1, March 2009, p. 14–15.

⁴*Supra* note 1, at p. 7.

⁵*Supra* note 1, at p. 9.

this is not necessarily because they were bad actors or had any ill intention. Instead, look to the NAS report, which noted extensively that our national forensic science system does not sufficiently support education, training, certification, and standards for testing and testifying.⁶

While there is research and work that establishes what needs to be done to improve various forensic practices, the fact is that no one has been able to sufficiently muster the resources nor focus the attention necessary to use the existing information as a launching pad to comprehensively improve the integrity of non-DNA forensic evidence. The NAS Report is the first step—and a tremendous one—toward fully establishing and acting upon what we already know.

Many people believe that, at trial, a good defense lawyer and an effective cross-examination will enable the jury to properly assess the strength of forensic evidence. However, as the NAS report states and the post-conviction DNA exoneration cases clearly demonstrate, the scientific understanding of judges, juries, defense lawyers and prosecutors is wholly insufficient to substitute for true scientific evaluation and methodology. It is beyond the capability of judges and juries to accurately assess the minutiae of the fundamentals of science behind each of the various specific forensic assays in order to determine the truth in various cases, and it is an unfair and dangerous burden for us to place on their shoulders. The NAS says that “judicial review, by itself, will not cure the infirmities of the forensic science community.”

It is absolutely clear—and essential—that the validity of forensic techniques be established “upstream” of the court, before any particular piece of evidence is considered in the adjudicative process. For our justice system to work properly, standards must be developed and quality must be assured before the evidence is presented to the courts—or even before police seek to consider the probative value of such testing for determining the course of their investigations. There is simply no substitute for requiring the application of the scientific method to each forensic practice or technology, as well as parameters for report writing and proper testimony, as part of the formal system of vetting the scientific evidence we allow in the courtroom.

A Federal effort is needed to ensure that the best standard and a single standard is implemented so that we don’t have 50 states operating under 50 definitions of “science.” Forensic science in America needs one standard of science so we can have one standard for justice. It is time for a serious commitment to provide a scientific system of support for forensic science in order to ensure ongoing evaluation and review of current and developing forensic science techniques, technologies, practices, and devices. Likewise, we need both public and private industry to support the research and development of improved technology with an eye toward future economic investments that benefit the public good and the administration of justice. The impact of rigorous scientific research will be enormous.

The investment of time, effort and resources necessary to deliver us from our false reliance on some forensic practices will pay tremendous dividends in terms of time, effort and resources not wasted by virtue of this false reliance. In short, it will make criminal investigations, prosecutions and convictions more accurate, and our public more safe—and perhaps most importantly, justice more assured.

The CHAIRMAN. I thank you, sir, and now, we turn to Dr. Gatsonis, who is part of this National Academy.

**STATEMENT OF CONSTANTINE GATSONIS, HENRY LEDYARD
GODDARD UNIVERSITY PROFESSOR AND CHAIR,
DEPARTMENT OF BIOSTATISTICS, PROGRAM IN PUBLIC
HEALTH, BROWN UNIVERSITY AND CO-CHAIR, COMMITTEE ON
IDENTIFYING THE NEEDS OF THE FORENSIC SCIENCE
COMMUNITY, NATIONAL RESEARCH COUNCIL,
THE NATIONAL ACADEMIES**

Dr. GATSONIS. Senator Rockefeller, Ranking Member Boozman, and members of the Committee, thank you very much for this opportunity to summarize and discuss the findings of the report. This was prepared by the Committee on Identifying the Needs of the Forensic Science Community in the United States and it was done at

⁶*Ibid.*, at p. 14–16.

Congressional request. I was the Co-Chair of the Committee, together with Judge Edwards.

The Committee's report was issued in February 2009 and is titled *Strengthening Forensic Science in the United States, a Path Forward*. It's available to download from the website of the Academy.

The report has generated a lot of interest. I've given a lot of speeches as has Judge Edwards and many members of the Committee. And so far, it has generated zero action.

So this is where we are. Now, the report, as you know, examined both the science and the practice of the forensic disciplines across the country. It covered a broad range of issues in the forensic disciplines, from disparities in resources, facilities, training across the various jurisdictions, to lack of mandatory standardization, certification, and accreditation, to uneven development of the broad range of forensic disciplines, to various political realities, and so on.

As we went through the work of this committee, we heard one consistent message and I'll spell it out in the report: the forensic science system encompassing both the research and the practice of the forensics has serious problems.

The problems can be addressed only by national commitment to overhaul the current structure that supports the forensic science community in the country.

This can only be done with effective leadership at the highest levels of both Federal and state Governments, pursuant to national standards, and with a significant infusion of Federal funds.

The first recommendation in our report was the creation of a National Institution of Forensic Science.

In the rest of my time today I will focus on the scientific underpinning of the culture and the practice of science in the forensic disciplines.

So, forensic science is inherently multi-disciplinary. The more advanced forensic disciplines derive methods and expertise from across a very broad spectrum of scientific disciplines. For instance, nuclear DNA and mitochondrial DNA analysis came from molecular biology. Substance identification came from analytical chemistry.

These kinds of forensic disciplines generally are based on solid, scientific ground because they were developed elsewhere. They have been validated through extensive research and they continue to be developed.

Analyses based on these disciplines, if they're executed according to scientifically sound scientific principles, they can be reliable. Going beyond DNA and chemical analysis, a good number of forensic disciplines are trying to link patterns in samples from a crime scene to particular sources.

For instance, a latent fingerprint impression, a marking on a bullet, a pattern of fire, a blood spatter pattern—they want to link those with an analogous pattern on a weapon, on a tool, on a finger, and so on, and so forth.

Most of these methods of pattern analysis have been developed within the forensic science community over the years, with little input from the broader world of science. Many of them have been around for decades, even longer.

That doesn't necessarily mean that they are accurate or they do their job right. As we state in the report, the level of scientific development and evaluation varies substantially across the forensic science disciplines. There is wide variability across disciplines, with regard to techniques, methodologies, reliability, error rates, reporting, underlying research, general acceptability, and the educational background of its practitioners.

Addressing these problems is a very tall order. So to illustrate points about the scientific issues, let me just first discuss the case of nuclear DNA, which is being held up as one of the main examples of what could be scientifically strong, good forensics.

DNA analysis has been developed and refined over decades in molecular biology. When the sample from a crime scene is matched to an individual using DNA analysis, we can also state the probability that somebody else's DNA would match that one.

This is the so-called "probability of random matching." Typically that probability is miniscule. And importantly, studies have been done to assess and quantify this probability.

There are many reasons why the science of DNA rests on solid ground including the extensive peer-reviewed literature, the continuing research behind it, the knowledge about probabilities of random match, and other kinds of false-positives. The laboratory procedures are well-specified and subject to validation and proficiency. And the clear and repeatable standards for analysis, interpretation, and reporting are there.

Now DNA analysis addresses the so-called individualization questions, That is, "Does a particular piece of a specimen come from a specific individual?" That's the individualization.

Other forensic modalities address the question of classification. For instance, does this piece of hair come from an individual from a certain background? Does this piece of paint come from a car of a particular make? These are the classification questions.

In terms of their reliability and the accuracy in making individualization conclusions, it's fair to say that, with the exception of nuclear DNA analysis, there is a lot that we do not know about the other forensic disciplines.

That doesn't mean that these other methods may never get there, but we don't know it at this point. The scientific work has not been done.

A considerable amount of research and development is needed to provide rigorous evaluation of the capacity of forensic analysis methods to consistently and with a high degree of certainty demonstrate a connection between the evidence and the specific individual source.

Such conclusions may be possible, but at present, we simply don't have the supporting evidence. I will finish in one second.

In terms of reliability and accuracy of making classification conclusions, a number of forensic analyses show promise. However, even for those analyses, we don't know many of the facts.

Let me just say that the research on the accuracy of the forensic disciplines is not rocket science. There are several areas of science where we do that kind of research.

I do research in diagnostic medicine, where we evaluate diagnostic techniques, like imaging for lung cancer screening and so on.

Well, diagnostic medicine has developed a research infrastructure and diagnostic procedures are being evaluated routinely. For instance, we know how accurate colonoscopy generally is. We know how accurate is digital mammography in identifying breast cancer. We have assessed how accurate is MRI to determine how extensive is a prostate cancer. We've done and continue to do this kind of research.

This research has also addressed the influence of various factors on diagnostic accuracy and how this accuracy may vary across radiologists.

Although the context of the forensic sciences is complex and there are substantial differences from diagnostic medicine, forensic science can still profit from learning from other disciplines and diagnostic medicine is one of them.

I will stop here. I had several more pages, but I will stop here. [The prepared statement of Dr. Gatsonis follows:]

PREPARED STATEMENT OF CONSTANTINE GATSONIS, HENRY LEDYARD GODDARD UNIVERSITY PROFESSOR AND CHAIR, DEPARTMENT OF BIostatISTICS, PROGRAM IN PUBLIC HEALTH, BROWN UNIVERSITY AND CO-CHAIR, COMMITTEE ON IDENTIFYING THE NEEDS OF THE FORENSIC SCIENCE COMMUNITY, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Chairman Rockefeller, Ranking Member Hutchison and Members of the Committee, thank you for the opportunity to submit written comments.

The NAS Committee on Identifying the Needs of the Forensic Science Community examined both the science and the practice in the forensic disciplines across the country. The Committee's report, titled *Strengthening Forensic Science in the United States*, covered a broad range of challenges for forensic science, from disparities in resources, facilities and training across the country's jurisdictions; to lack of mandatory standardization, certification, and accreditation; to the uneven development of the broad range of forensic disciplines; to political realities and evidence admissibility issues.

In my comments below I will concentrate on the state of the forensic science, which is characterized by the report as one of variable development across the forensic disciplines and low or non-existent research activity and infrastructure in many disciplines. Much research is needed not only to evaluate the reliability and accuracy of current forensic methods but also to innovate and develop them further. In order to achieve these goals on a national scale, an *organized and well supported forensic science research enterprise* is a key requirement.

Forensic science is an inherently multidisciplinary endeavor, utilizing methods and techniques from other scientific areas, such as molecular biology and analytic chemistry, as well as methods developed within the forensic communities, such as the analysis of patterns from fingerprints and handwriting. The forensic science disciplines conduct analyses and are asked to provide information for a variety of purposes in the criminal justice process. Broadly speaking, the questions they address can be divided in two categories:

- a. Can a piece of evidence be associated with a particular class of sources? For example, can a hair specimen collected at the crime scene be reliably said to come from an individual of a particular ethnic group? Is a paint mark left at a crime scene consistent with the paint used in type of car defined by model and production year? Does a powder cargo contain cocaine?
- b. Can a piece of evidence be associated with an individual source? For example, can a particular DNA sample be reliably said to belong to individual X?

The first category of questions leads to *classification* conclusions. The second leads to *individualization* conclusions. Although the goal of criminal investigations and trials is typically to assess the innocence or guilt of specific individuals, answers to both categories of questions are valuable. For example, classifying a piece of evidence may lead to decisions to exclude individuals from further consideration in the particular investigation. Moreover, the accuracy and overall performance of a forensic method should be judged only against the question it is called to address. Thus, analyses that can lead to classification should be evaluated on the basis of how cor-

rectly they classify and not on the basis of whether they can match a piece of evidence to a specific individual. This point may seem straightforward but lies at the root of many common misconceptions about the proper role of specific forensic analyses.

As with all scientific methods, it is important to assess the probability of various errors that can be made in the course of a forensic analysis. In particular, we need to study the frequency of how often the analysis can identify the source of the information correctly and how often errors will be made. Borrowing terminology from diagnostic medicine, we need to know the sensitivity of an analysis (probability that the analysis will identify a trait when it is actually present) and the specificity (probability that the analysis will declare the trait is absent when it is actually absent). The complements of these two quantities represent the rates of two common types of errors. Other measures of performance such as the positive and the negative predictive value can also be useful to analysts. A more detailed discussion is presented in Chapter 4 of the report.

A broad array of forensic disciplines is called upon to provide evidence in support of one or the other, or sometimes both categories of conclusions (classification and individualization). In Chapter 5 of the report the Committee presents a précis of each of the main disciplines, intended to summarize the state of their scientific underpinning and development, the way in which evidence is reported and used in investigations and court proceedings, and an assessment of current research and educational activity and needs for further development.

A key finding of the Committee was the wide variability across forensic science disciplines with regard to the techniques and methodologies used, the reliability of results, the types and frequencies of errors that occur, the soundness of the research base, the general acceptability of the discipline, and the availability of published peer reviewed research. Some of the forensic disciplines are rooted in traditional science. For example, DNA was developed in molecular biology and substance identification uses techniques from analytic chemistry. Such methods are generally on solid ground because the validity of those methods has been established scientifically through past and ongoing research, there is good understanding of uncertainties in their conclusions, and there is continuing development of their methodology. If they are executed according to the principles of science, they can be very reliable.

A number of other disciplines have been developed within forensic science, often with little input from the broader world of science. The goal of these analyses is to link a pattern from a crime scene—which may be a latent fingerprint impression, markings on a spent bullet, patterns from a fire, blood-spatter patterns, and so on—with analogous patterns from a weapon, tool, finger, etc., associated with a suspect.

In terms of the reliability and accuracy in making individualization conclusions, it is fair to say that, with the exception of nuclear DNA analysis, there is a lot we do not know about other forensic disciplines. Considerably more research and development is needed to provide a rigorous evaluation of the capacity of a method to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source. Such conclusions may be possible, but at present we simply do not have enough basic understanding to know. In terms of the reliability and accuracy in making classification conclusions, a number of forensic analysis methods show promise. However, even for classification analyses, there is only a modest amount of available research and systematic evaluation.

An unfortunate corollary of the low level of research and evaluation in many of the forensic disciplines is a tendency to consider and present the results of analyses as free from error. Such a disposition would be unthinkable in the context of scientific research and practice. It is therefore imperative to foster, encourage, and ultimately require the adoption and continued development of scientific methods and practices across the forensic disciplines. A body of research is required to assess the accuracy and reliability of analyses in many of the forensic disciplines and to address the impact of sources of variability and potential bias. These disciplines need to develop rigorous protocols to guide subjective interpretations and pursue equally rigorous research and evaluation programs.

The development of scientific research and a scientific culture in the forensic disciplines is not needed to evaluate *currently used* methods and practices. It is indeed a precondition for the evolution of these disciplines and for the development of *new* methods that address the evolving needs of the legal system.

In parallel to an analysis of the science of the forensic disciplines, the Committee undertook an examination of the practice in such disciplines across the country. As described in the report, there are great disparities among existing forensic science operations in Federal, state, and local law enforcement jurisdictions and agencies. This is true with respect to funding, access to analytical instrumentation, the availability of skilled and well-trained personnel, and certification, accreditation, and

oversight. As a result, it is not easy to generalize about current practices within the forensic sciences community. It is clear, however, that any approach to overhauling the existing forensic science system needs to address and help minimize the community's current fragmentation and inconsistent practices.

The fragmentation problem is compounded because operational principles and procedures for many forensic disciplines are not standardized or embraced, either between or within jurisdictions. There is no uniformity in the certification of forensic practitioners or in the accreditation of crime laboratories. Indeed, many jurisdictions do not require forensic practitioners to be certified, and many forensic science disciplines have no mandatory certification programs. Moreover, the accreditation of crime laboratories is not required in most jurisdictions. Often, there are no standard protocols governing forensic practice in a given discipline. And, even when protocols are in place, they may be vague and not enforced in any meaningful way. In short, the quality of forensic practice in most disciplines varies greatly because of the absence of adequate training and continuing education, rigorous mandatory certification and accreditation programs, adherence to robust performance standards, and effective oversight. These shortcomings obviously pose a continuing and serious threat to the quality and credibility of forensic science practice.

I will close with a review of the Committee's recommendations. The Committee's major recommendation is that Congress should establish and appropriate funds for an independent Federal entity, the National Institute of Forensic Sciences, or NIFS. Such a Federal body will: (1) bolster our ability to more accurately identify true perpetrators and exclude those who are falsely accused; (2) improve our ability to effectively respond to, attribute, and prosecute threats to homeland security; and (3) reduce the likelihood of convictions resting on inaccurate data.

In addition to this major recommendation, the Committee offers several additional specific recommendations regarding the separation of forensic science from law enforcement, addressing training and educational needs, improving certification and accreditation requirements, reforming the medicolegal death investigation system, creating interoperable fingerprint databases, and enhancing the role and quality of the forensic sciences in homeland security.

In particular

- *Recommendation #2 highlights the need for standardized terminology and reporting of the results of forensic analyses.*

The National Institute of Forensic Science (NIFS), after reviewing established standards such as ISO 17025, and in consultation with its advisory board, should establish standard terminology to be used in reporting on and testifying about the results of forensic science investigations. Similarly, it should establish model laboratory reports for different forensic science disciplines and specify the minimum information that should be included. As part of the accreditation and certification processes, laboratories and forensic scientists should be required to utilize model laboratory reports when summarizing the results of their analyses.

- *Recommendation #3 addresses research needs in the forensic sciences.*

Research is needed to address issues of accuracy, reliability, and validity in the forensic science disciplines. The National Institute of Forensic Science (NIFS) should competitively fund peer-reviewed research in the following areas:

- (a) Studies establishing the scientific bases demonstrating the validity of forensic methods.
- (b) The development and establishment of quantifiable measures of the reliability and accuracy of forensic analyses. Studies of the reliability and accuracy of forensic techniques should reflect actual practice on realistic case scenarios, averaged across a representative sample of forensic scientists and laboratories. Studies also should establish the limits of reliability and accuracy that analytic methods can be expected to achieve as the conditions of forensic evidence vary. The research by which measures of reliability and accuracy are determined should be peer reviewed and published in respected scientific journals.
- (c) The development of quantifiable measures of uncertainty in the conclusions of forensic analyses.
- (d) Automated techniques capable of enhancing forensic technologies.

- *Recommendation #4 urges independence of forensic laboratories from law enforcement and prosecutorial offices.*

To improve the scientific bases of forensic science examinations and to maximize independence from or autonomy within the law enforcement community, Congress should authorize and appropriate incentive funds to the National Institute of Foren-

sic Science (NIFS) for allocation to state and local jurisdictions for the purpose of removing all public forensic laboratories and facilities from the administrative control of law enforcement agencies or prosecutors' offices.

- *Recommendation #5 emphasizes the need for assessing and minimizing bias and human error.*

The National Institute of Forensic Science (NIFS) should encourage research programs on human observer bias and sources of human error in forensic examinations. Such programs might include studies to determine the effects of contextual bias in forensic practice (*e.g.*, studies to determine whether and to what extent the results of forensic analyses are influenced by knowledge regarding the background of the suspect and the investigator's theory of the case). In addition, research on sources of human error should be closely linked with research conducted to quantify and characterize the amount of error. Based on the results of these studies, and in consultation with its advisory board, NIFS should develop standard operating procedures (that will lay the foundation for model protocols) to minimize, to the greatest extent reasonably possible, potential bias and sources of human error in forensic practice. These standard operating procedures should apply to all forensic analyses that may be used in litigation.

- *Recommendation #6 addresses the need for uniform standards and adoption of best practices in forensic laboratories across the country.*

To facilitate the work of the National Institute of Forensic Science (NIFS), Congress should authorize and appropriate funds to NIFS to work with the National Institute of Standards and Technology (NIST), in conjunction with government laboratories, universities, and private laboratories, and in consultation with Scientific Working Groups, to develop tools for advancing measurement, validation, reliability, information sharing, and proficiency testing in forensic science and to establish protocols for forensic examinations, methods, and practices. Standards should reflect best practices and serve as accreditation tools for laboratories and as guides for the education, training, and certification of professionals. Upon completion of its work, NIST and its partners should report findings and recommendations to NIFS for further dissemination and implementation.

- *Recommendation #7 stresses the need for mandatory accreditation and certification.*

Laboratory accreditation and individual certification of forensic science professionals should be mandatory, and all forensic science professionals should have access to a certification process. In determining appropriate standards for accreditation and certification, the National Institute of Forensic Science (NIFS) should take into account established and recognized international standards, such as those published by the International Organization for Standardization (ISO). No person (public or private) should be allowed to practice in a forensic science discipline or testify as a forensic science professional without certification. Certification requirements should include, at a minimum, written examinations, supervised practice, proficiency testing, continuing education, recertification procedures, adherence to a code of ethics, and effective disciplinary procedures. All laboratories and facilities (public or private) should be accredited, and all forensic science professionals should be certified, when eligible, within a time period established by NIFS.

- *Recommendation #8 calls for uniform quality control and quality assurance programs.*

Forensic laboratories should establish routine quality assurance and quality control procedures to ensure the accuracy of forensic analyses and the work of forensic practitioners. Quality control procedures should be designed to identify mistakes, fraud, and bias; confirm the continued validity and reliability of standard operating procedures and protocols; ensure that best practices are being followed; and correct procedures and protocols that are found to need improvement.

- *Recommendation #9 calls for a national code of ethics for forensic scientists*

The National Institute of Forensic Science (NIFS), in consultation with its advisory board, should establish a national code of ethics for all forensic science disciplines and encourage individual societies to incorporate this national code as part of their professional code of ethics. Additionally, NIFS should explore mechanisms of enforcement for those forensic scientists who commit serious ethical violations. Such a code could be enforced through a certification process for forensic scientists.

- *Recommendation #10 calls for major emphasis on graduate education in the forensic sciences.*

To attract students in the physical and life sciences to pursue graduate studies in multidisciplinary fields critical to forensic science practice, Congress should authorize and appropriate funds to the National Institute of Forensic Science (NIFS) to work with appropriate organizations and educational institutions to improve and develop graduate education programs designed to cut across organizational, programmatic, and disciplinary boundaries. To make these programs appealing to potential students, they must include attractive scholarship and fellowship offerings. Emphasis should be placed on developing and improving research methods and methodologies applicable to forensic science practice and on funding research programs to attract research universities and students in fields relevant to forensic science. NIFS should also support law school administrators and judicial education organizations in establishing continuing legal education programs for law students, practitioners, and judges.

- *Recommendation #11 calls for the establishment of medical examiner offices across the country and the eventual elimination of existing coroner offices.*

To improve medicolegal death investigation:

- (a) Congress should authorize and appropriate incentive funds to the National Institute of Forensic Science (NIFS) for allocation to states and jurisdictions to establish medical examiner systems, with the goal of replacing and eventually eliminating existing coroner systems. Funds are needed to build regional medical examiner offices, secure necessary equipment, improve administration, and ensure the education, training, and staffing of medical examiner offices. Funding could also be used to help current medical examiner systems modernize their facilities to meet current Centers for Disease Control and Prevention recommended autopsy safety requirements.
- (b) Congress should appropriate resources to the National Institutes of Health (NIH) and NIFS, jointly, to support research, education, and training in forensic pathology. NIH, with NIFS participation, or NIFS in collaboration with content experts, should establish a study section to establish goals, to review and evaluate proposals in these areas, and to allocate funding for collaborative research to be conducted by medical examiner offices and medical universities. In addition, funding, in the form of medical student loan forgiveness and/or fellowship support, should be made available to pathology residents who choose forensic pathology as their specialty.
- (c) NIFS, in collaboration with NIH, the National Association of Medical Examiners, the American Board of Medicolegal Death Investigators, and other appropriate professional organizations, should establish a Scientific Working Group (SWG) for forensic pathology and medicolegal death investigation. The SWG should develop and promote standards for best practices, administration, staffing, education, training, and continuing education for competent death scene investigation and postmortem examinations. Best practices should include the utilization of new technologies such as laboratory testing for the molecular basis of diseases and the implementation of specialized imaging techniques.
- (d) All medical examiner offices should be accredited pursuant to NIFS-endorsed standards within a time-frame to be established by NIFS.
- (e) All Federal funding should be restricted to accredited offices that meet NIFS-endorsed standards or that demonstrate significant and measurable progress in achieving accreditation within prescribed deadlines.
- (f) All medicolegal autopsies should be performed or supervised by a board certified forensic pathologist. This requirement should take effect within a time-frame to be established by NIFS, following consultation with governing state institutions.

- *Recommendation #12 stresses the need to achieve interoperability of fingerprint data systems across the country.*

Congress should authorize and appropriate funds for the National Institute of Forensic Science (NIFS) to launch a new broad-based effort to achieve nationwide fingerprint data interoperability. To that end, NIFS should convene a task force comprising relevant experts from the National Institute of Standards and Technology and the major law enforcement agencies (including representatives from the local, state, Federal, and, perhaps, international levels) and industry, as appropriate, to develop:

- (a) standards for representing and communicating image and minutiae data among Automated Fingerprint Identification Systems. Common data standards would facilitate the sharing of fingerprint data among law enforcement agencies at the local, state, Federal, and even international levels, which could result in more solved crimes, fewer wrongful identifications, and greater efficiency with respect to fingerprint searches; and
 - (b) baseline standards—to be used with computer algorithms—to map, record, and recognize features in fingerprint images, and a research agenda for the continued improvement, refinement, and characterization of the accuracy of these algorithms (including quantification of error rates).
- *Finally, Recommendation #13 calls for preparedness of forensic scientists and laboratories to address homeland security needs.*

Congress should provide funding to the National Institute of Forensic Science (NIFS) to prepare, in conjunction with the Centers for Disease Control and Prevention and the Federal Bureau of Investigation, forensic scientists and crime scene investigators for their potential roles in managing and analyzing evidence from events that affect homeland security, so that maximum evidentiary value is preserved from these unusual circumstances and the safety of these personnel is guarded. This preparation also should include planning and preparedness (to include exercises) for the interoperability of local forensic personnel with Federal counterterrorism organizations.

In the two years since the release of the report I have seen a lot of interest in its content and recommendations. However I have not seen major progress in implementing any of them. Specifically with respect to the first and most central recommendation, I understand that the current fiscal environment makes the establishment and funding of a new Federal agency challenging. Short of this, I think there is much Congress could still do and I urge you not to allow the current fiscal environment to be a reason to undertake any forensic science reform. As one example, I believe that the National Institute of Standards and Technology (NIST) could serve as an incubator for NIFS as long as Congress acts in several years to make NIFS a fully independent agency. I note that this is the position of the American Statistical Association (ASA), of which I am a fellow: <http://www.amstat.org/outreach/pdfs/RockefellerForensicScience.pdf>. I also note the ASA Board of Directors approved a statement endorsing the *Strengthening Forensic Science* report: http://www.amstat.org/outreach/pdfs/Forensic_Science_Endorsement.pdf.

In closing, I would summarize the Committee's work by saying that the Committee studied the science and practice of the forensic disciplines in the country and decided that a major buildup of the scientific enterprise and a massive overhaul of the forensic system are needed in order to meet the needs of the country, current and future.

The CHAIRMAN. I wish you to go on. You were fascinating. We will get back. Mr. Geoffrey Mearns, also a member of this extraordinary group that awakened, hopefully, at least part of the nation, you're on.

**STATEMENT OF GEOFFREY S. MEARNS, PROVOST AND SENIOR
VICE PRESIDENT FOR ACADEMIC AFFAIRS, CLEVELAND
STATE UNIVERSITY AND MEMBER, COMMITTEE ON
IDENTIFYING THE NEEDS OF THE FORENSIC SCIENCE
COMMUNITY, NATIONAL RESEARCH COUNCIL,
THE NATIONAL ACADEMIES**

Mr. MEARNS. Good afternoon, Mr. Chairman, Ranking Member Boozman, and the other members of the Committee. My name is Geoff Mearns and I am the Provost and Senior Vice President for Academic Affairs at Cleveland State University.

As the Chair said, I had the privilege of serving with Dr. Gatsonis on the NAS committee. After more than two years of work, our committee issued the report that Dr. Gatsonis has summarized very briefly. As a former Federal prosecutor, I believe that Congress should pass legislation that implements all of the recommendations in our report.

Implementing these recommendations will advance the principal goal of our report, which is to assist law enforcement officials in accurately identifying and fairly convicting people who commit crimes.

In order to understand fully why I believe Congress should pass this legislation that embodies these recommendations, it is important to understand how my personal views of forensic science evolved during the two-year period in which I served on the NAS committee.

I believe my own growth may help others to reconsider some of their pre-existing views about forensic science.

Before becoming Dean of the Cleveland-Marshall College of Law at Cleveland State in July 2005, I practiced law and tried criminal cases for more than 15 years. My trial experience included approximately 9 years as a Federal prosecutor, as well as 7 years as a criminal defense lawyer.

While serving in the Justice Department, I had several positions as an Assistant United States Attorney for the Eastern District of New York, I was chief of the organized crime and racketeering section.

I then became the first Assistant United States Attorney for the Eastern District of North Carolina. And I completed my Justice Department career as Special Attorney to United States Attorney Janet Reno.

In that capacity, I had the privilege of assisting in the representation of the United States in the successful prosecution of Terry Nichols for his role in the Oklahoma City bombing.

As a Federal prosecutor, I tried more than 20 criminal cases. As a result, I gained substantial experience preparing and examining expert witnesses from various forensic science disciplines. I questioned chemists who analyzed suspected narcotics. I questioned technicians who compared tool marks. I questioned fingerprint examiners and handwriting experts.

In the Nichols case, I presented expert testimony regarding the chemical composition of plastic fragments that were found in the rubble of the Murrah Federal Building in order to establish a link between that evidence and large plastic drums that were seized from Mr. Nichols.

Based on that experience, I began my service on the NAS committee with two fundamental assumptions about forensic science.

First, I assumed that the vast majority of forensic science disciplines were well-grounded in scientific research and scientific methodologies.

Second, I assumed that forensic science analysts followed uniform processes and procedures to ensure the accuracy and reliability of their tests and their trial testimony.

In short, I had faith in the scientific expertise of the practitioners and I had faith in the scientific validity of the tests and methodologies that they used.

During the two-year period in which I served on the NAS committee, my views about forensic science, generally, and some of the specific disciplines, changed significantly. I came to realize that there was not nearly enough genuine science to validate many forensic science disciplines.

I also come to realize that these disciplines—that these deficiencies were impeding law enforcement’s efforts to identify and apprehend criminals.

I became increasingly concerned that these deficiencies were adversely affecting the fairness of the criminal justice system and undermining the accuracy and reliability of verdicts in criminal cases.

There were several presentations that challenged my assumptions about forensic science and made me realize that significant changes were needed. I would be happy to relate one or two experiences if the Committee is interested in hearing more.

Now, each member of the Committee had a different perspective at the outset of the process, but we unanimously identified many of the systemic problems that plague forensic science and we proposed 13 specific recommendations to address these problems.

But at the core of all of these recommendations is our collective judgment that the forensic science community needs substantial systemic reforms in order to create a culture of science.

As we formulated our recommendations, we became acutely aware that it would take substantial, tangible progress to create this culture. And therefore, we recommended that Congress create the Federal capacity to stimulate research, to set uniform standards, and to ensure that these rigorous standards would be enforced.

In our collective judgment, there were serious systemic problems that required specific, systemic solutions. But although I’m hopeful that Congress will pass this legislation, I don’t think that is sufficient in and of itself.

In order for there to be significant progress, the law enforcement community must also embrace the recommendations in the NAS report. And there are many compelling reasons why law enforcement officers and prosecutors should do so, but there’s one overarching reason.

The central goal of all our recommendations is to enhance the accuracy and reliability of forensic science testing and testimony. No law enforcement officer and no prosecutor who is interested in truth and justice can object to recommendations that will advance that goal. Therefore, it is in the best interests of law enforcement to support systemic reforms.

And let me just use one example and I’ll talk about DNA to illustrate this point. And I think it’s important to reflect upon the evolution and impact of DNA testing. As a result of DNA analysis and expert testimony being grounded in extensive scientific research, DNA testing routinely helps law enforcement to identify dangerous criminals.

DNA expert testimony about the results of DNA testing also frequently persuades juries to return guilty verdicts. While DNA testing has also helped to exonerate people who were wrongfully convicted of crimes that they didn’t commit, DNA testing has been an even more powerful weapon in successfully identifying and prosecuting violent criminals.

I believe that some of the other forensic science disciplines that have not yet been scientifically validated may have the same potential to assist law enforcement in achieving its important mission, which is protecting the public.

And if given an opportunity during the question period, I'd like to speak about the importance of having crime labs be independent of law enforcement in order to advance that goal.

But in sum, I respectfully recommend that Congress enact the legislation that embodies all of our recommendations. Thank you for the opportunity to be with you this afternoon.

[The prepared statement of Mr. Mearns follows:]

PREPARED STATEMENT OF GEOFFREY S. MEARN, PROVOST AND SENIOR VICE PRESIDENT FOR ACADEMIC AFFAIRS, CLEVELAND STATE UNIVERSITY AND MEMBER, COMMITTEE ON IDENTIFYING THE NEEDS OF THE FORENSIC SCIENCE COMMUNITY, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Good afternoon Mr. Chairman, Ranking Member Hutchison, and members of the Committee. My name is Geoffrey Mearns. I am the Provost and Senior Vice President for Academic Affairs at Cleveland State University. I had the privilege of serving as a member of the Committee on Identifying the Needs of the Forensic Science Community at the National Research Council. The National Research Council is the operating arm of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology.

In February 2009, after more than 2 years of work, our committee issued a report entitled, "Strengthening Forensic Science in the United States: A Path Forward." As a former Federal prosecutor, I believe that it is imperative that the recommendations in the National Academy of Sciences report be implemented. Implementing our recommendations will advance the principal goal of the NAS Report: to assist law enforcement officials in identifying and convicting people who commit crimes.

In order to understand fully why I believe Congress should pass legislation that embodies the recommendations in the NAS Report, it is important to understand how my personal views of forensic science evolved during the 2-year period in which I served on the NAS committee. I believe my own growth may help others to reconsider some of their pre-existing views about forensic science.

Before becoming dean of the Cleveland-Marshall College of Law at Cleveland State University in July 2005, I practiced law and tried criminal cases for more than 15 years. My trial experience included 9 years as a Federal prosecutor with the United States Department of Justice. While serving in the Justice Department, I had several positions. As an Assistant United States Attorney for the Eastern District of New York, I was Chief of the Organized Crime and Racketeering Section. I then became the First Assistant United States Attorney for the Eastern District of North Carolina. I completed my Justice Department career as Special Attorney to United States Attorney General Janet Reno. In that capacity, I assisted in the successful prosecution of Terry Nichols for his role in the Oklahoma City bombing.

As a Federal prosecutor, I tried more than 20 criminal cases. As a result, I gained substantial experience preparing and examining expert witnesses from various forensic science disciplines. I questioned chemists who analyzed suspected narcotics, technicians who compared tool marks, fingerprint examiners, and handwriting experts. In the *Nichols* case, I presented expert testimony regarding the chemical composition of plastic fragments that were found in the rubble of the Murrah Federal Building in order to establish a link between that evidence and large plastic drums that were seized from Nichols.

Based on that experience, I began my service on the NAS committee with two fundamental assumptions about forensic science. First, I assumed that the vast majority of forensic science disciplines were well-grounded in scientific research and scientific methodologies. Second, I assumed that forensic science analysts followed uniform processes and procedures to ensure the accuracy and reliability of their tests and their trial testimony. In short, I had faith in the scientific expertise of the practitioners, and I had faith in the scientific validity of the tests and methodologies they used.

During the two-year period in which I served on the NAS committee, my views about forensic science generally and some of the specific disciplines changed significantly. I came to realize that there was not nearly enough genuine *science* to validate many forensic science disciplines. I also came to realize that these deficiencies were impeding law enforcement's efforts to identify and apprehend criminals. I became increasingly concerned that these deficiencies were adversely affecting the fairness of the criminal justice system and undermining the accuracy and reliability of verdicts in criminal cases.

In the NAS Report, our committee identified many of the systemic problems that plague forensic science, and we proposed 13 specific recommendations to address these systemic problems. At the core of all of these recommendations is our collective judgment that the forensic science community needs substantial systemic reforms in order to create a “culture of science.”

As we formulated our recommendations, we became acutely aware that it would take substantial, tangible progress to create this culture. Therefore, we recommended that Congress create the Federal capacity to stimulate research, to set uniform standards, and to ensure that these rigorous standards would be enforced. In our collective judgment, there were serious systemic problems that require specific, systemic solutions. Although the solutions cannot be implemented easily or cheaply, I am hopeful that this “culture of science” can and will be developed. My optimism stems from three principal facts.

First, I am optimistic because the Congressional mandate to conduct the NAS study was initiated by prominent members of the forensic community. These forensic scientists were concerned with the lack of a commitment to scientific protocols and procedures in some disciplines, and they were troubled by the fact that some practitioners did not appreciate the need for basic scientific research and rigorous, mandatory standards. So, even before the NAS committee process began, some members of the forensic science community recognized the need for systemic reform.

Second, since the NAS Report was released, broad support has quickly developed for the specific recommendations we identified. Indeed, a great many forensic scientists recognize that the NAS Report can generate financial resources and other support that will elevate their profession. This response is very encouraging.

Third, within a few months of the release of the NAS Report, the U.S. Supreme Court expressly relied upon the analysis contained in the NAS Report to support the Court’s interpretation of the Confrontation Clause. See *Melendez-Diaz v. Massachusetts*, 129 S. C. 2527 (2009). In that case, a majority of the Court readily grasped one of the central themes of the NAS Report: there is a common misperception among lawyers, judges, and juries that the vast majority of forensic science disciplines are inherently trustworthy and intrinsically sound because they are well grounded in objective science. The fact is, however, as discussed in the NAS Report, many forensic science disciplines have not yet been scientifically validated. I believe that the Court’s reliance on the NAS Report should inspire Congress to embrace our committee’s call for systemic change.

But Federal legislation would not, by itself, be sufficient. In order for there to be significant progress, the law enforcement community must also embrace the recommendations in the NAS Report. There are many compelling reasons why law enforcement officers and prosecutors should do so.

But there is one overarching reason: the central goal of all our recommendations is to enhance the accuracy and reliability of forensic science testing and testimony. No law enforcement officer who is interested in truth and justice can object to recommendations that will achieve that goal. Therefore, it is in the best interests of law enforcement to support systemic reforms.

To appreciate this basic point, it is important to reflect upon the evolution and impact of DNA testing. As a result of DNA analysis and expert testimony being grounded in extensive scientific research, DNA testing routinely helps law enforcement to identify dangerous criminals. DNA expert testimony about the results of DNA testing also frequently persuades juries to return guilty verdicts. While DNA testing has also helped to exonerate some people who were wrongfully convicted of crimes that they did not commit, DNA testing has been an even more powerful weapon in successfully identifying and prosecuting violent criminals. I believe that some other forensic science disciplines that have not yet been scientifically validated may have the same potential to assist law enforcement in achieving its important mission—protecting the public.

In my judgment, the problems that currently plague the forensic science community have undermined this mission. If faulty forensic science produces inaccurate results during an investigation, then law enforcement agents have wasted time and money. If flawed forensic science results or expert testimony have led to an unfounded criminal charge or a wrongful conviction, then a person has been unjustly convicted—and the real perpetrator has remained free to hurt other innocent people.

I understand that some law enforcement officials have opposed our committee’s recommendation that Congress create a forensic science entity that is independent of the Department of Justice. I believe, however, that it is important that the future of forensic science be distanced from the law enforcement agencies that have traditionally controlled forensic science research and testing. I have not formed this conclusion because of a lack of faith in the integrity of forensic science practitioners who work in law enforcement laboratories, or because of a lack of faith in the com-

petence of the administrators who supervise those practitioners. To the contrary, I continue to trust in the integrity and the motives of law enforcement, and I remain quite proud of my past service as a Federal prosecutor.

But law enforcement officials and forensic scientists are human, and all of us have biases that affect our judgment. In order to ensure the public, including judges and juries, that those human biases do not undermine the accuracy and reliability of forensic science testing, we should insulate such testing from the potential, unintended influence of law enforcement agencies. Our goal should be to create a "culture of science" within the forensic science community. To create such a culture, we should remove forensic science research and testing from the law enforcement culture.

In sum, I respectfully recommend that Congress enact legislation that embodies all of the important recommendations that are contained in the NAS Report. I do so because I believe that these recommendations will advance public safety and promote justice.

Thank you for the opportunity to testify. I would be happy to answer any questions the Committee might have.

The CHAIRMAN. Thank you very much. And now, Dr. Terry Fenger, who is Director of the Forensic Science Center at Marshall University.

**STATEMENT OF TERRY W. FENGER, PH.D., DIRECTOR,
MARSHALL UNIVERSITY FORENSIC SCIENCE CENTER**

Dr. FENGER. Chairman Senator Rockefeller, Ranking Member Boozman, Distinguished Senators, I'd like to address the status of forensic science at Marshall University, mainly as a unique model by which forensic science in academia can interact with crime laboratories.

Marshall University Forensic Science Center (MUFSC) was established in 1994 and developed a master's degree program under the authority of the West Virginia Board of Governors for higher education.

Since 1997, 223 students have graduated from the program with Master's degrees in forensic science. Graduates have been hired in Federal, state, local crime laboratories, as well as in the private sector. That same year, the West Virginia Legislature authorized Marshall University Forensic Science Center to perform DNA testing on the state's convicted offenders under the authority of the West Virginia State Police.

As a result of this legislation, Marshall University Forensic Science Center was charged with performing DNA testing on convicted-offender samples, the results being uploaded into the West Virginia CODIS, or Combined DNA Index System database.

Establishment of a CODIS laboratory at an academic institution is unique and points to the services that can be offered by a university to support the forensic science community and other members of the criminal justice system.

As part of the establishment of the forensic science program in the early 1990s, the process required a close working relationship between Marshall University and the West Virginia State Police crime laboratory at several levels.

The input of the crime laboratory practitioners helped guide the development of courses and course content at a time before there were accreditation bodies for academic forensic science programs, such as FEPAC, which I'll describe a little more in depth later.

Conversely, Marshall University offered services in support of the West Virginia State Police. Over the years, five West Virginia

State Police laboratory scientists have enrolled part time in the Marshall University program and graduated with Master's degrees.

In addition, 12 graduates of the MUFSC program have been hired by the West Virginia State Police as civilian examiners. Marshall University has also served as a resource for continuing education for members of the West Virginia State Police laboratory. Seminars are transmitted via live, online communications to the laboratory, which minimizes the time and costs for continuing education of laboratory personnel.

The infrastructure developed at MUFSC through both the accredited DNA laboratory and the academic program allows the Center to offer training to practitioners in the forensic science community, specifically DNA analysts.

DNA analysts have been trained at MUFSC in various technologies, including advanced DNA technologies, parentage and relationship testing using DNA, male (Y chromosome) DNA testing, and the use of expert systems to analyze DNA results.

Since 2005, over 1,500 forensic analysts, crime scene investigators, and sexual assault nurse examiners have traveled to MUFSC for training by our highly qualified training staff in our state-of-the-art training facilities.

I'd like to present the rest of this material as part of written comments later, but I'd like to now switch my comments to recommendations.

The CHAIRMAN. All of your statement, all of your statements, will be included in the record.

Dr. FENGER. Thank you, Senator. Recommendation 10 in the National Academy of Science report on the status and needs of forensic science focused on strengthening undergraduate and graduate education offered through our colleges and universities.

Marshall University Forensic Science Center has been accredited since 2005 by an organization called the Forensic Science Education Program Commission (FEPAC). Based on the experiences of our program and staff, I would like to offer our perspective about the path to strengthen forensic science academic programs.

I would like also to detail some recommendations for moving forward with additional types of programs in academia.

The field of forensic science encompasses diverse types of criminal cases and many types of case evidence. These types of evidence are best analyzed using the methods of chemistry, biology, physics, mathematics, and engineering.

A college-level education is critical for the development of current and future forensic scientists in order to meet the needs of the criminal justice system. In conjunction with a strong curriculum in forensic science, it is imperative that students receive instruction in specific disciplines through extensive laboratory training, and classroom instruction.

In an effort to better prepare forensic science students to meet the needs of the community, forensic science programs should be strongly encouraged to become accredited and maintain accreditation.

Through the efforts of the American Academy of Forensic Science and specifically the Forensic Science Education Programs Accreditation Commission, FEPAC, academic programs that choose the ac-

creditation path are being held to high standards that help assure quality graduates as a result of their academic experience.

An accredited program provides yearly reports to FEPAC. And every 5 years, it undergoes a full accreditation audit.

I further recommend the establishment of doctoral degrees specifically in forensic science. Many doctoral-level faculty members that provide instruction and conduct research in forensic science programs are educated in other scientific fields that fall outside of forensic science.

Because of career changes, they move from those fields into forensic science. There is a paucity of doctoral degree-granting programs in forensic science that have a major laboratory-based research underpinning in the United States and universities should be encouraged to build upon the 15 FEPAC accredited master's degree programs to establish doctorate programs.

Accredited forensic science programs require that, at minimum, 50 percent of the faculty have appropriate doctorate degrees in science, preferably in forensic science, which suggests that, as new forensic science programs develop and faculty retire from existing programs, there will be an even greater demand for doctoral-level faculty.

I will summarize my comments mainly because of time in a few words, in the sense that I view that forensic science in academia is in need of significant development.

I think there's a solid core, but this can be expanded upon and there are many ways of doing this, one of which is accreditation. The second one is developing doctoral degree programs in forensic science specifically, that will produce researchers that will be able to conduct the research that we're talking about here today.

Thank you very much.

[The prepared statement of Dr. Fenger follows:]

PREPARED STATEMENT OF TERRY W. FENGER, PH.D., DIRECTOR,
MARSHALL UNIVERSITY FORENSIC SCIENCE CENTER

Chairman Senator Rockefeller, Ranking Member Senator Hutchison, Distinguished Senators

Thank you for the opportunity to present views of the faculty members of the Marshall University Forensic Science Center relative to academic programs in higher education.

Recommendation 10 in the National Academy of Sciences Report on the status and needs of forensic science focused on strengthening undergraduate and graduate education offered through our colleges and universities. Marshall University Forensic Science Program housed within the Forensic Science Center (MUFSC) has offered a two-year Master's degree in forensic science beginning in 1995 and achieved full accreditation of its program in 2005. Based on experiences of our program faculty and staff, I would like to offer our perspective about a path to strengthen forensic science academic programs. I will then review the role that MUFSC has played in supporting the criminal justice system through training, outreach and research activities.

The field of forensic science encompasses examination of diverse types of case evidence from a wide variety of crime scenes. Technologies and methodologies that arise out of chemistry, biology, physics, mathematics and engineering are employed to seek the truth and to provide scientific results that will withstand the scrutiny of our courts. A college level education is critical for the development of current and future forensic scientists, in order to meet the needs of the criminal justice system. In conjunction with a strong core curriculum in forensic science, it is imperative that students receive instruction in specific disciplines through extensive laboratory training, classroom instruction and discussions. Crime laboratories that employ

entry level forensic scientists seek college graduates having the education and necessary skill sets that will reduce additional post-graduation training provided by a crime laboratory. A theme that has been expressed repeatedly by crime laboratory directors and laboratory technical staff is that graduates of some forensic science programs are not fully trained in scientific technologies, court testimony and legal issues, report writing and in other areas and that some university programs need to better prepare students to enter the workforce. Training deficits may be more significant for new hires who graduate from science programs that lack a forensic science component. Training offered by crime laboratories that supplements the academic education of the new hire may redirect laboratory scientists from other duties, including testing crime scene evidence. Academic programs that award a Master's degree in forensic science have added responsibilities in educating the next generation of laboratory technical leaders. Laboratory accreditation standards of DNA laboratories require that the technical leader have a Master's degree. To best prepare future technical leaders for management and administrative responsibilities, Master's degree granting programs should include courses that feature instruction on laboratory, human resources and compliance management in their curriculum.

In an effort to better prepare forensic science students to meet the needs of the community, forensic science programs should be encouraged to become accredited and maintain accreditation. Through the efforts of the American Academy of Forensic Sciences and the Forensic Science Education Programs Accreditation Commission (FEPAC), academic programs that choose the accreditation path are being held to high standards that help assure a quality education and signal crime laboratories that program graduates are well-educated in a core body of knowledge and laboratory technologies. An accredited program provides yearly reports to FEPAC and every five years it undergoes a full accreditation audit. Failure to consistently meet standards can result in the program receiving probationary status or revocation of accreditation. Hesitancy to seek accreditation by some college and university programs may be the costs. Initial costs for equipment and facilities and salary for faculty and staff can be daunting. In addition, over a five year period total costs to maintain accreditation may reach \$8,000, which may be prohibitive for some programs. From the perspective of MUFSC faculty, the financial costs and time investments by the university are well worth it, because many of prospective forensic science students realize the importance of graduating from an accredited program. The full support of the University through adequate program funding is crucial to achieve full accreditation. All stakeholders, including academic program administrators, representatives from Federal granting agencies and advocates for forensic science must communicate with University administrations and make them aware of pressing issues and how universities can best serve the criminal justice system as well as their students.

The establishment of doctorate programs in forensic science should be an area of primary importance for universities. Many doctoral level faculty members that provide instruction and conduct research in forensic science programs were educated in scientific fields outside of forensic science and have entered into forensic science as a result of a career change. There is a paucity of doctorate granting programs in forensic science that have a major laboratory-based research underpinning in the United States and universities should be encouraged to build upon the 16 existing accredited Master's degree programs in forensic science in order to establish new doctorate programs.

Accredited forensic science programs require that at a minimum 50 percent of their faculty have appropriate doctorate degrees in science, preferably in forensic science, which suggests that as new forensic science programs develop and faculty retire from existing programs, there will be even a greater demand for doctorate level faculty.

As stated in the NAS report, certain disciplines in forensic science require basic research for the development of new technologies and methodologies. Members of crime laboratories are often inundated with casework and validation studies and laboratory personnel cannot be spared to perform basic science research studies. In scientific disciplines outside of forensic science, research projects are lead by doctorate level researchers within academe, Federal institutes and laboratories in the private sector, such as biotechnology companies. It is the opinion of MUFSC faculty that research-based programs in forensic science are needed to serve the forensic science community, working closely with Federal and state crime laboratories to identify problems and to prioritize and chart the direction of research projects.

Certain forensic disciplines have been staffed by professionals who were trained under the mentor-apprentice system and who may not have advanced degrees. At the same time, forensic science programs often do not have qualified instructors to present formal classes and laboratories in some of the comparative sciences. Mar-

shall University, for example, would like to develop an area of emphasis in firearms and toolmarks. Forensic experts in the field may lack the prerequisite Master's degree required to satisfy university requirements for full-time instructors or they may not be available as part-time instructors in a given geographic area. This impasse needs to be addressed to allow forensic science programs to hire instructors and researchers in the comparative sciences who may lack advanced degrees.

Grant funding needs to be available to help develop forensic science programs at all levels. Funding would support the development of academic infrastructure, including hiring necessary numbers of faculty who have a demonstrated background in the forensic sciences, purchasing equipment and chemical reagents, upgrading laboratory facilities and classrooms all in order to provide the best education experience.

Now turning to the *Marshall University Forensic Science Center*

Marshall University Forensic Science Center was established in 1994 and developed a Master's degree program in forensic science under the authority of the West Virginia Board of Trustees for Higher Education. Since spring of 1997, two-hundred and twenty three students have graduated from the program with Master's degrees. Graduates have been hired by federal, state and local crime laboratories, as well as laboratories in the private sector.

That same year the West Virginia legislature authorized MUFSC to perform DNA testing for the State's convicted offenders, under the authority of the West Virginia State Police. As a result of this legislation MUFSC was charged with DNA testing convicted offender samples, the results being uploaded into the West Virginia's Combined DNA Index System (CODIS database). Establishment of a CODIS laboratory at an academic institution is unique and points to services that can be offered by a university to support the forensic science community and other members of the criminal justice system. In addition, the development of MU Forensic Science Program in the early 90s required a close working relationship between MUFSC and the West Virginia State Police laboratory at several levels. The input of crime laboratory practitioners helped guide the development of courses and course content at a time when program accreditation bodies (FEPAC) in forensic science did not exist. Conversely, the MU Forensic Science program has offered services and support to benefit of the WV State Police. Over the years, five WVSP laboratory scientists have enrolled part-time in the MU forensic science program and graduated with Master's degrees. In addition, 12 graduates from the MUFSC program have been hired by the WVSP crime laboratory as examiners. MUFSC has also served as a resource for continuing education for WVSP laboratory. Seminars are transmitted live via on-line communications to WVSP laboratory, which minimizes time spent and costs for continuing education for laboratory personnel.

The presence of both the accredited DNA testing laboratories and the academic program at MUFSC allowed the Center to develop training that is offered to practicing DNA analysts in several sub-disciplines of DNA analysis, including advanced DNA technologies, parentage/relationship testing, male DNA testing and the use of expert systems to analyze DNA results. Since 2005 over 1500 forensic analysts have traveled to MUFSC for training by highly qualified DNA analysts in its state-of-the-art training laboratories. Crime scene investigators have also been trained at MUFSC through a collaborative effort between FBI trainers and MUFSC staff. Also since 2005, 380 sexual assault nurse examiners (SANE) have been trained at MUFSC to meet the 40-hour requirement mandate by their certification body. Training of local police officers in collection and transport of digital devices and basic analysis of cell phones is also part of our training agenda. Instruction in the investigation of computer and digital device crimes and e-discovery has been presented to circuit court judges and attorneys during the last two years.

As stated previously, the focus of the MUFSC DNA testing laboratories has been and continues to be testing convicted offender samples in support of West Virginia CODIS. Over the last decade, however, the capabilities of the DNA laboratory have expanded to include testing evidence for criminal cases and for paternity/relationship testing as part of applied research projects. The MUFSC DNA laboratories are accredited for testing evidence samples from criminal cases and have participated in projects whereby case samples, submitted by law enforcement agencies, have been tested and project data analyzed. Projects included helping Los Angeles Sheriff's Department with DNA testing of samples from sexual assault kits, which helped reduce their backlog. A similar project is ongoing with the New Orleans Police Department. DNA testing of property crime evidence is also an ongoing project and involves testing case samples from three populations; a large demographic (Miami-Dade, Fl.), a medium size demographic (Charleston, S.C.) and a small city

(Huntington, W.V.) Results from these projects are being analyzed and will be published.

A second working laboratory, in the area of digital forensics investigations, is located at the MU Forensic Science Center. This laboratory developed around a Memorandum of Understanding between the West Virginia State Police and MU Forensic Science Center. A law enforcement expert in digital device investigations is stationed full time at the MUFSC facility and, in conjunction with MUFSC examiners, is responsible for analyzing case evidence. The academic program benefits from this arrangement because digital forensic professionals are available to mentor interns in digital forensic projects.

Research laboratories, focusing on chemistry, DNA, digital devices/computers and microscopy are also part of the center's scope. Although only qualified analysts work with case evidence, students benefit from training offered by laboratory analysts and faculty researchers.

Through the joint efforts of the examiners/trainers from the DNA testing laboratories and the faculty from the forensic science program at MUFSC, an internship program has been developed to assist crime laboratories in performing validations and conducting research projects. During the summer months between the first and second year of the two-year program, MU forensic science students are required to perform research-based internships either in crime laboratories or research laboratories. Beginning five years ago the Forensic Science Center at Marshall University initiated the Technical Assistance Program (TAP). The goal of TAP is to make internship research projects more rewarding and productive for both the hosting crime laboratory and the student intern and to assist crime laboratory in validation of equipment and methodologies. The Technical Assistance Program was developed in response to comments voiced by crime laboratory personnel, who perceive a lack of preparation of some students, who enter internships without proper prerequisite training and skill sets. That responsibility for intern training then falls on members of the host laboratory and the time required to prepare the student to perform worthwhile work is a burden on the laboratory. The TAP shifts the burden away from the host laboratory to the academic program. Approximately 8 months prior to the beginning of the internship, first-year students state their desire to participate in the TAP program. MUFSC maintains a list of laboratories that are willing to host a TAP student and each student is paired with host laboratories. The project for the next summer is identified early in the process and over the next 6–7 months the student is provided with intense laboratory and classroom instruction in preparation for the internship research project. When the student begins the summer internship he/she is fully prepared and little is required from laboratory staff. From the perspective of MUFSC faculty, this model can be expanded and has the potential to provide assistance to forensic laboratories nationwide. Recently, MUFSC has been approached about expanding the TAP programs to other forensic disciplines outside of DNA into areas including forensic chemistry and digital device forensics. Grant funding to provide summer stipends for TAP interns could help promote the further development of Technical Assistance Programs at MUFSC as well as initiate similar programs at other universities.

In sum, it is recommended that undergraduate and graduate program in forensic science should aspire to FEPAC accreditation. The programs need to be positioned to adjust their curricula if certification of laboratory personnel becomes a reality. It is further recommended that doctoral level programs in forensic science are needed to promote both research and to educate the next generation of forensic scientists. Funding mechanisms to strengthen existing forensic science programs and develop new ones should be developed through the state and Federal grant funding agencies. A strong partnership between academic institutions and crime laboratories is essential to promote the development of college and university program to best support the criminal justice system.

The CHAIRMAN. Thank you very much. Let's start right out. Several questions occur to me and I'll ask a couple at once.

Funding—NSF and NIH are research agencies. They do research grants. The Department of Justice also does research grants. They did a total of 53 last year, adding up to \$16.8 million, not hefty.

To contrast, NIH did 35,000, \$16 billion, NSF 13,000, \$5.5 billion. In other words, there is a large difference between the availability of funding from the Federal level, and what's going to be enough to get us going, so that's problem number one.

Problem number two, Mr. Grisham and others, what do we do in the meantime until we have accredited forensic specialists who can give testimony which is absolutely unassailable, like nuclear DNA?

I don't know how many years you're talking, but I'd guess 8, 10, 12, 13, 15. And just the fact of the commission, the report, the fact—one of the reasons I wanted to have this hearing today, because it's a subject which profoundly interests, I think, a lot of us.

But in essence, it almost gives a sleepy judge or somebody else a chance to say, "Well, this isn't relevant," you know. We—you—it—how do I know that's true?

In other words, it complicates whatever the—however inadequate the prosecution process might be at this time or the defense of the prosecution may be at this time, it is what it is and it has the forensic knowledge that it has. And it doesn't have what it doesn't have.

And that's a great deal, so that the funding question is less important to me than, actually, what happens in the meantime? How do we do this? How do cases get prosecuted when they have been, in essence, undermined by a very excellent commission study?

Mr. GRISHAM. Until you clean up the forensics with research, and testing, and standards, and validation, these methods are being used every day. This testimony is being used every day in trials all over this country.

Bite-mark analysis? Some hair analysis, although that's pretty much been set aside because of DNA. Most of the time, the DNA—you can test hair with DNA.

But there is still a lot of these shaky forensics. Until—until the problem is solved, the problem's not going to go away. And DNA is used in less than 10 percent of all murders.

So as great as it is, in 90 percent of all murders, you don't have, you know, the clear biological evidence.

The CHAIRMAN. But that's my point. We don't have it. It's going to take time to get it. It's not been well funded. We're not at our most prosperous point in the last 50 years.

And science's STEM is on the rise enormously, forensics greatly with enormous pull in the job market, but still a long period of time. And I just worry or wonder about whether somebody who has a compelling, you know—clearly associated with, clearly appears to be all the language which is used in court, that it's undermined already. It's stipulatedly undermined by the fact of what this commission has said.

And therefore, it may not have standing in court, or people can attack its standing in court, the evidence. Am I over-worrying? Can we have a fair justice system while we're waiting for forensics to catch up?

Mr. GRISHAM. These are—the problems are not going to go away until they're fixed.

The CHAIRMAN. Yes.

Dr. GATSONIS. Senator, I will take up the funding question first and then go to your next question.

The CHAIRMAN. OK.

Dr. GATSONIS. Funding obviously needs to be multiplied by 10 times over the figures you mentioned, or even more, to get any-

where in terms of addressing real research. There's no question about it.

But it's a lot more important how we actually direct this funding. We need to identify who knows how to organize and direct the funding. In other words, who knows how to organize the scientific agenda that has to be addressed?

This was a key issue behind the recommendation to create an institute. This entity would have the scientific know-how and also the know-how from the actual forensic world. Those directing the funding need to have both types of know-how and only then they could determine, for example, whether we need a grant program in this, we need a grant program in that area.

When NIH develops a particular grant program, there's a whole rationale, scientific rationale behind it. And it can take years to develop this rationale. The same kind of thinking we will have to do in forensics.

So we'll need an entity that actually organizes and directs this kind of funding. Just throwing \$300 million at the problem will get you nowhere, nowhere, unless there is direction, and prioritization of the questions, and long-term planning as to where we are going, and so on.

This is how the research can be done. When it comes to what do we do in the meantime, I'll give you two responses. From the Committee's perspective, this question was outside its charge.

The Committee was there to look at the current state of the forensic sciences and identifies its strengths and problems. We were very careful in drafting the report so that it doesn't, for instance, reflect specific judgments on past cases. Surely, we knew that the report would have implications. So that's from the Committee's perspective. From the citizen's and the scientist's perspective, I'll offer the following response.

We use diagnostics in medicine all the time. And we make life and death decisions on the basis of them. Are these diagnostics accurate? No. Are they being developed further as we speak? Yes, they are. Are all of them as good as they should be? No. But life goes on. OK?

I would take a similar approach to forensics. If the country can focus on actually developing the research enterprise, actually getting going on this, putting in place the systems that are in place, a lot of things there can be done quickly.

From there on, the judicial process will run its course and all the developments in the forensic disciplines will have their repercussions in the courts.

But life goes on.

The CHAIRMAN. I thank you and I call on Senator Klobuchar.

Senator KLOBUCHAR. Thank you very much, Mr. Chairman, and thank you for the excellent testimony today. I just have a more general question of all of you.

And we've been talking about the CSI phenomenon. And I actually watched Hawaii 5-O last night, when I couldn't get to sleep. OK. That is a sad admission.

But they have, like, super cool stuff with, like, things and TV. I just wondered if your opinion of the advancement of science that we've seen, scientific developments that have taken place outside

of the forensic community—do you think that that's being taken advantage of by our crime labs?

And are they—have they sufficiently tapped into the latest developments of the scientific community that could help not just prosecute people, but also exonerate them? Anyone can answer.

Mr. MEARNS. Well, I guess I think the answer is very mixed. I think, in some disciplines and in some agencies, the answer is yes. But our concern on the Committee was that not—that not all of them and certainly not enough of them have embraced the core value of research.

And if I can give you just one example that occurred during the course of our committee process, there was an individual who came to make a presentation, essentially to testify before the hearing, who is the head of an international association about tool marks.

And he made a presentation. And at the end of the presentation, there was a standard question that was either asked by Dr. Gatsonis or Judge Edwards, which was, you know, if there were—if Congress were to appropriate additional resources for research, what would be on your research agenda? What are the issues that you think need to be explored?

And this individual said, "Nothing." And Judge Edwards, I think it was, assumed that perhaps this person didn't understand the question, right? This is a softball. If you want more resources, just, you know, this is why we're here.

And so he asked the question again. And the person still said, "Nothing." Well, I mean, that—you know, I made a presentation a year ago to the NAS about this and this was a room filled with real scientists.

And I asked them, you know, raise your hand if any of you think, in your discipline, you know enough, that you know there are no additional research issues that need to be researched.

Well, as you can imagine, none of them raised their hand. Right? And that's because no one who—really understands the culture of science, the values that are inherent in science, would say that the research has been concluded.

So it's very mixed. It's—and I think that is—the concern that we had on the Committee was that there wasn't this culture of science, the recognition that we need to continue to explore.

Senator KLOBUCHAR. Exactly. One of the findings of the National Academies of Sciences' report is that there's insufficient amount of peer-reviewed, published studies establishing the scientific basis and reliability of forensic methods.

How do we address this? How can we marshal resources to better support forensic science? And then I guess, secondly, what about medical schools, law schools? What role could they play here if we wanted to set some higher standards?

Dr. GATSONIS. Well, part of it has to do with the funding and with the direction of the funding. So we need to establish a mechanism that has resources and actually knows how to—to direct them.

Another part is, obviously, linking this enterprise with universities. There are very few universities in the country right now that even offer programs in forensic science. The program described by one of my co-presenters here is a rarity.

Most universities are far away from this. The research agenda of forensics is really not part of the research agenda in academia, broadly speaking. We have to bring it into the mainstream of academia.

How do you bring it in? Well, you bring it in by, A, linking it with other disciplines. For instance, computer scientists and imaging experts could be very interested in pattern recognition and could be interested in the analysis of fingerprints, handwriting, et cetera, et cetera.

Statisticians are interested in all aspects of the forensic disciplines. Engineers of various kinds, such as those who study fluid dynamics, would be interested in how splatter happens and how to model it. A lot of necessary expertise may be there already.

But for all of this has to happen, we need direction and funding.

Senator KLOBUCHAR. Yes. I'm remembering now, some of our crime labs. It's—was so hard to get the DNA experts. They were, like, hiring them away from each other, and just some of the issues with having enough scientists.

My last question would just be along those lines, about delay. What do you see as the magnitude of delay in our problem in analyzing data? And how do we reduce delays? I know you're going to say funding, but I thought I'd ask the question. You want to—delays, Dr. Fenger? Do you want to?

Dr. FENGER. Well, I have a slightly different viewpoint, in response to your other questions as well as this question. There's a wealth of information and expertise embodied in individuals who have been trained by the mentor-apprenticeship approach.

Some practitioners work outside academia, but at the same time, they devote their professional careers to developing best practices and conducting research in their respective fields. What I would like to see is the recruitment of these highly-skilled individuals with their vast experiences and wealth of information into academic environments either as faculty or consultants.

For example, we are interested at MUFSC in starting a firearms and tool mark offering in our curriculum. Where do we find the expertise to initiate this type of offering?

There, is no university that I know, that offers majors covering tool marks and firearms. We cannot recruit expertise out of another university to build our own tool mark and firearms courses.

There are many highly-qualified practitioners that sometimes are labeled as not having a solid scientific background behind their career.

At the same time, these professionals can serve as valuable resources for academics. They can convey to academic researchers what problems need to be addressed within research laboratories.

There is immeasurable expertise that these individuals have acquired during their careers from mentor-apprentice training.

Senator KLOBUCHAR. OK. Very good. Mr. Grisham, have you seen any ideas for books in this discussion here? Maybe you could do a thriller on the very slow process to get things done.

Mr. GRISHAM. Yes. Well, everything's fair game for a book and not—I don't want you all to beat up these TV shows too bad because I got a couple of TV programs in the works myself.

So I don't want—I don't—you know, I see the Cold Case, and crimes, you know. Those shows have all become popular since I left the courtroom, so I haven't had to deal with that part of popular culture in the real life and picking a jury.

I do think, though, that I've seen cases where there was a tremendous amount of pre-trial publicity. And I think it's possible in the jury selection process, inside the courtroom, for the judge to deal with these elements of popular culture that are always kind of seeping into our knowledge and what we believe.

I don't—I don't think it's that big of a problem. I know you have to deal with it. I've talked to lawyers who deal with it. They see it all the time in jury selection, but if you're careful enough, you can get away from that and get back to, you know, the issues that are in front of the jury.

Senator KLOBUCHAR. Thank you very much. I really appreciate you being here today.

The CHAIRMAN. Thank you, Senator Klobuchar. I, among my many, many sins, I failed to call upon the Ranking Member. Mr. Boozman, too, I profoundly apologize.

Senator BOOZMAN. As I said, if that's the worst mistake that you make today, then you're in good shape. We do appreciate you all being here. The testimony has been very, very good. And I think you've all done a really good job of making the case, that we have a significant problem that we have to deal with.

The science—Mr. Grisham has written very eloquently about the human cost, of people being falsely incarcerated. And we probably don't talk enough about them.

My problem, as we deal with this, is what is the role of government? Certainly, I think it has a role. And the question is how do we go about finding how much?

Dr. Gatsonis, you mentioned about studies and efficacy.

As an internist, you see patients that are being treated for cancer with chemotherapies that the science has said it isn't going to do much.

But I don't want to federalize your program. I don't think that would be a benefit. And I don't think it would make it more advantageous to do that or make it more efficient.

So that's really the struggle. And again, your testimony is really good. Let me ask a couple things real quick. Mr. Mearns, in your testimony, you discussed the evolution of DNA analysis and how it has become a reliable forensic method.

Based on your work in the area, could you talk about the DNA advisory board at the Department of Justice and its role in successfully creating a national gold standard for the—for the DNA analysis?

Mr. MEARNNS. I'll speak briefly. I'll—excuse me. Senator, I will answer relatively briefly because I don't have a great deal of familiarity with that particular organization.

But it does, as your question suggests, give us a framework for how these other disciplines can validate or not the techniques that they've—that they've used.

My concern with, you know—again, I think the DNA—the approach to DNA has been an effective one. My concern, though, as we go through some of the other forensic disciplines, because that

advisory board and the approach to DNA emerged, I think, as Dr. Gatsonis said, from the grassroots up.

And it was the research community that brought it to the law enforcement community. Too many of these other forensic science disciplines had their origin in the law enforcement community.

So to replicate that model the same way and to keep them in the law enforcement community will be hard to create the new culture that's necessary.

So I think, again, the—the scientific approach is important, but I think we do need to think about removing them from the law enforcement culture because, in my judgment, that's necessary for progress.

Senator BOOZMAN. And Dr. Gatsonis, could you comment about the rule of the government?

Dr. GATSONIS. Yes. My remarks were about the science of it. When we practice diagnostics in the hospital, we do not do so in a "federalized" program. However, there are strict and widely used standards, professional standards, and accreditation processes in place.

So it is not run by the government, but the professional societies and hospitals have enough oversight. And that oversight has teeth.

In the forensic world there is no teeth in much of the oversight. In many jurisdictions and disciplines with a couple of years of apprenticeship, you could hang your shingle and declare, "I am an expert."

That's a different story. That's not how science training is done, as you know. I take your point that the diagnostics in medicine are not 100 percent accurate and I don't expect that many of the forensics necessarily would be 100 percent accurate.

But we have to study them. We don't know how accurate they can be. That's my point.

Senator BOOZMAN. No, and I agree. I guess what I was saying was that your discipline does a tremendous job. It wouldn't be advantageous to federalize it. OK?

These disciplines have to have something that has some teeth in them to have a very advisory capacity at the least.

I'm out of time, so I yield back.

Senator KLOBUCHAR [presiding]. OK. Senator Udall?

Senator UDALL. Thank you. Mr. Grisham, you are coming from a little bit different direction, I think, than the other three panelists.

And I was wondering, from listening today to their testimony, I don't know how much of the 2009 report you've reviewed and their recommendations. That central recommendation is to have a completely independent Federal agency, I believe, that would do a lot of this work outside of the Justice Department. I think the term that was used, national institution of forensic science or something along that line. What are—what are your thoughts on what you've heard today? And how do we get to the solution?

You have brilliantly described the problem, I think, when—in both your work and in your writing, but I'm wondering what your thoughts are on that.

Mr. GRISHAM. Well, again, I'm not a researcher, or a scientist, and I'm not really—I'm not really fluent in the language of Con-

gress, and Washington, and agencies, and how things work. And I wouldn't dare suggest in this current fiscal climate that we create a new Federal agency.

We have a lot of Federal agencies already. We have a lot of Federal agencies that do great scientific work. And again, I don't—I don't think it would take a whole lot of work to validate or invalidate some of these forensic practices, whether it's bite-mark analysis, or you know, all the ones I mentioned, the ones that are still being used, the ones that are creating bad verdicts.

It's—again, I can't tell you how to do it, but I don't think it would be that complicated. I do believe strongly that you've got to leave the science in the hands of the scientists, not the lawyers, not law enforcement.

You've got to have the Federal—you've got to have Federal action because science cannot vary from state to state. It's got to be the same everywhere. And you've got to have the Federal Government to coordinate the research, to whatever agency, whatever scheme works best, and I can't tell you what that is.

But to—to drive the research and then set the standards once the research is—once a method is validated or invalidated, it's invalidated, it's gone, hopefully nationwide.

If it is validated, then what are the standards, the terminology, whatever? I mean, we have agencies that do that.

And then maybe, at that point, you work with DOJ, and law enforcement, and the people who have direct contact with the 355 crime labs there are in this country. You know, maybe that's the way it works. I don't know. But that's the best I can do.

These methods, as Mr. Mearns has said, these methods that we are so critical of now, are so afraid of now, and have produced so many bad verdicts now, were created by law enforcement. They weren't science driven.

And that's not a criticism of law enforcement. They're trying to solve crimes. They're using hair analysis and bite-mark analysis, trying to solve a crime, but these practices have not gone through the scientific rigor that is necessary to validate them, to make us believe them.

Senator UDALL. Now, you—I think you made this statement in your testimony with regard to the scientific issues in the courtroom. And that wasn't the place to resolve them.

As all of us are familiar and you obviously are, when you try a case, there's a whole preliminary approach before you put the evidence in, where the judge looks at the science and does all of that.

But you're basically saying, you don't—you don't think that's the place to do it.

Mr. GRISHAM. Well, that doesn't always happen.

Senator UDALL. Yes. At first, it doesn't happen, but I—

Mr. GRISHAM. Right.

Senator UDALL. But my guess is, even in some of the cases you're talking about, it happens, but they don't come to the right conclusion.

Mr. GRISHAM. Well, yes, and what's terrifying is to see some of these cases where witnesses who had no real qualifications were allowed to testify and give opinions that were outrageous. In Mississippi, for years, we had a pathologist on the loose. We didn't

have a State medical examiner. We had a pathologist who was not board-certified, who was the favorite of all of our prosecutors to come in and do the autopsy.

He was doing 1,000 autopsies a year, by his own admission. And he was involved in every murder case. And the prosecutors loved him because he would pretty much say whatever they wanted to hear, to fit their notion of whatever the case was.

And we can't even begin to speculate the damage he's done. There's—there are horror stories. That's a rare example, you know. That's a rare example, but it still happens.

Senator UDALL. Yes. Thank you. I'm out of time. I wish I could question you all a little bit more, but I yield back.

Senator KLOBUCHAR. Senator Lautenberg?

Senator LAUTENBERG. Thank you, Madame Chairman. The —I'm here in this almost land of mystery for me because I'm not a, as I said earlier, a lawyer or a student of—I believe in equity and balance. That's what I like to see.

And when I understand, Mr. Grisham, you said establish the factual innocence in DNA testing of 280 Americans, 17 of whom were sentenced to death, ready to be executed.

How do we induce that kind of diligence, that kind of effort? And how about the public defender group? Does a person charged have a good chance to make that kind of a challenge?

It doesn't seem that way, with the kind of ordeal that it takes to find out whether the science backs the conclusions that are made.

Why is it that it takes an Innocence Project, which is fairly limited in terms of the places it can go, have to have the superstars supporting that in order to save these people from prison terms, save their lives, et cetera?

Should we hear calls from one side of the Senate or the Congress that calls for a less active government, smaller government, and so forth? You've called for Federal standards and resources for developing and validating the sound forensic science.

How do these two philosophies or policies merge in order to get the kind of outstanding or critical support that these people need to save, to be treated fairly in our society?

Mr. GRISHAM. Well, your first point was about the defense lawyering. And there are many, many wonderful public defender groups in this country. The best is here in this city. There are a lot of wonderful public defenders who are committed to defending their clients.

There's some superb capital defense lawyers who do nothing but that. And it's very, very tough work. However, in a lot of cases, the public defender's offices are overworked, understaffed, and it's not unusual to get a lawyer in a capital murder case who shouldn't be there. He's not experienced.

That happens in big cities and a lot of rural areas. Where I practiced, we didn't have—we didn't have a public defender system, you know. It was kind of court-appointed.

Ron Williamson, the guy I wrote about, the guy I mentioned—his lawyer was just a local lawyer who was court-appointed. Ron wanted to hire an expert to balance the expert called in by the prosecutor.

And that's typically what you want to do, but if you're indigent, most judges won't let you have your own expert. So you've got an expert called in by the State and you're the defense. You can't afford one.

You don't get an expert. So it's—it's not a level playing field. And you know, you're going against the State with—with basically unlimited resources if they want to spend the money in—in a capital murder case, if it's a big case, and you're the—you're the defendant with a public defender and with no expert.

And you know, it's not a fair fight. It's not a fair trial. That's what happens in so many of these cases. And frankly, when you—when you study these cases, the level of defense lawyer at times is really, really disheartening and bad.

That's just, you know—and that's what happens in these cases. The guy—the defense lawyers are not experienced. I think Mr. Mearns can probably add to that.

Senator LAUTENBERG. So poverty has penalties in ways, obviously, recognized, and in my view, this is one of them. And how do you—when you're training students, how do you train them to make sure that all of the evidence is turned over?

Because I think it's—it gets to be such an ordeal to do the kind of search that we have. You know, I'm prefacing a question very frankly here.

And that is, do—in order to provide the fairness and balance in our society that we need, do we have to invest government money and government ability in order to clear this situation once and for all and establish the fact that just because it's evidence, it isn't scientific or accurate?

What do we do in these situations, gentlemen? I ask any one of you.

Dr. FENGER. I'll address the student aspect of it. The training of students is critical, as far as I'm concerned, because they represent the next generation of forensic scientists. A quality forensic science education may not help tomorrow or next year, but it will address needs of the forensic community in the future by having well-trained and well-educated groups of forensic scientists graduating from academic programs.

What will really facilitate our ability to train forensic science students is feedback and guidance received through the accreditation process, because it lays out what needs to be addressed by forensic science programs, such as legal issues, report writing, quality assurance, in addition to technology itself.

I think that educating the next generation of forensic scientists is critical to our discussion because these individuals, after 2 years in our master's degree program, will possibly be conducting DNA testing or other types of analysis as well as testifying in court.

Now, that's not a long time frame.

So that is my perspective having been in higher education for over 30 years.

Senator LAUTENBERG. It looks, Mr. Chairman, like you can't—you can't do something like that, which is requested here, in the remarks of our expert witnesses. You can't do it on the cheap.

And what we have to do is make the investments early in order to provide the kind of security and balance that we owe citizens of the United States. Thank you very much.

The CHAIRMAN [presiding]. Thank you, Senator Lautenberg. Senator Nelson, who comes from—I forget what the state is. I think it's called Florida.

**STATEMENT OF HON. BILL NELSON,
U.S. SENATOR FROM FLORIDA**

Senator NELSON. It's called Sunshine. Mr. Grisham, I enjoyed our visit earlier and thank you for that information. I ask any one of you which research opportunities show the most promise to not only help us in the criminal justice system, but also with our national security threats.

Mr. GRISHAM. I'm going to let a researcher answer that.

Mr. MEARNS. I think—let me, if I may, separate the—responses into two categories. First, I think we should focus our research efforts on some of the pattern disciplines that are used quite frequently, certainly things like fingerprint analysis, tool mark analysis, tire tracks, those kind of pattern analysis, which have shown reasonable reliability, but in my judgment, have not yet been appropriately and thoroughly scientifically validated.

There has been a lot of research that has already been conducted. So with additional research and an additional comprehensive analysis of existing research, I think we can make the kind of determination that Mr. Grisham was talking about earlier, of whether they're valid or not, relatively inexpensively.

In terms of the national security impact, issue, I don't think—well, again, I think there's kind of—two parts to that is, from a detection of international terrorism, my sense—and this is now my view, to—so I make clear, this isn't the view of the Committee or the NAS report. I believe there is a reasonable amount of science in the national security agencies that are helping us to detect threats of international terrorism.

I was personally impressed with the quality of the presentation, the quality of the education, the quality of the training of those officials.

Our weakness is on the domestic side because all of the issues that we've been talking about, all of the kinds of forensic science disciplines that we've been talking about, are the ones that are used domestically that could help us detect and prevent a domestic terrorist attack.

And more importantly, irrespective of whether it's an international attack or a domestic attack, if it occurs in the homeland, the first responders are going to be primarily state and local law enforcement officials.

So if we don't solve this problem comprehensively, the weaknesses that continue to permeate the state and local agencies are going to impede those investigations because those are going to be the first individuals on the scene.

Senator NELSON. Give us some examples of some of the forensic science that would help us.

Mr. MEARNS. Well, again, I would—again, I would confirm that the—the tool mark analysis, the fingerprint analysis, and the

other, and tire marks, and things like that. There's some other, blood spatter. I would—based upon what I've seen, is—I would—this is, again, my personal view. Doesn't seem to be a good investment to examine forensic odontology, you know, bite marks.

That, just from the evidence I've seen, just appears to be very far away, away from being scientifically valid, and only would affect a relatively small number of cases.

Dr. GATSONIS. If I may add to that, medical examiners have a big role to play in terms of domestic terrorism. For example, they would be the ones up front there detecting new cases, say, of epidemics or whatever bad biologics are disseminated.

One of our recommendations was exactly to replace the system of coroners with medical examiners. And I don't know if you saw that part of the report, but this is something on which the country has been making progress for 100 years.

The Academy had a committee recommending this reform in 1928. So we are just about 80, 90 years behind that recommendation.

Certainly, though, in modern type of terrorism and chemical warfare or whatever it is, you need the medical examiners to be medical examiners.

Senator NELSON. Did you, Dr. Fenger, want to comment?

Dr. FENGER. Yes. Just a few comments. There are new areas of forensic science that I think have a major role to play in anti-terrorism—detecting potential terrorist threats.

One is digital forensics. There's so much information sent over the wire, or wirelessly, that can be mined to extract information about possible terrorist activities or solving crimes.

This, to me, is the next DNA, and where resources need to be directed. It's an area that, in our program at MUFSC is undergoing rapid development.

Another area that I think needs to be developed is microbial forensics. Bioterrorism agents such as anthrax and smallpox virus can be identified using DNA analysis and other methods.

Not all anthrax strains are the same, and they may differ in their DNA sequence. By using those differences, we can pinpoint a source.

So there are other scientific disciplines outside the areas that we've been talking about that deserve attention.

Senator NELSON. We saw a good case of that, unfortunately, for a person who initially was accused, who apparently was not the right one. And he suffered through a lot, but we learned a lot from that case on the anthrax attack here.

I made the mistake of taking a shortcut one day to get to the office, by going in the freight elevator. And then I learned, anybody that went in the freight elevator—some of the mail had been in there.

And so I had to go on the 60 days of antibiotics, just as a precaution.

I'd like to ask one more question, Mr. Chairman. May I?

The CHAIRMAN. You're going to do it, no matter what I say.

[Laughter.]

Senator NELSON. No. Not if you say no, Mr. Chairman.

[Laughter.]

Senator NELSON. I'm curious about the jobs and the economic activity that could come out of the investments in forensic science research. And talk to us about that.

Dr. FENGER. We had a homeland security conference at Marshall University not too long ago that Senator Rockefeller hosted. Secretary Napolitano was there as the keynote speaker. Speaking specifically of digital forensics, she indicated that the Federal Government could hire every graduate that we produced in the area of digital forensics. There's a great need for these individuals.

It's not just digital forensics that needs highly trained career professionals. We have individuals who are retiring from forensic science who need to be replaced by a new generation of young people, that are trained to meet the highest standards.

So I think there are a lot of career opportunities in forensic science.

Senator NELSON. And one of the reasons she can't get them is that the NSA gets them before she does, but it's illustrative, NSA, Homeland Security, FBI. They all need these experts on identification, on these new kinds of tools that bad guys can use. Thank you, Mr. Chairman.

The CHAIRMAN. You're very welcome, Senator Nelson. I'm just going to ask one final question.

Senator BOOZMAN. Then I get to ask one.

The CHAIRMAN. Of course, you can. I wouldn't be bad to you twice in one meeting. In a way, there's so much substance in all of this, that it's almost impossible to do much in a hearing.

I wanted—I have not read that report. I want to get that report and read it through. I fear to imagine how much of it I won't understand, but I'm going to do it nevertheless.

It's so critical, the whole concept, John Grisham, of somebody being innocent, and after 12 years or close to death row, whatever, whatever it is they go through. I mean, that's PTSD. It has to be, of some form, or a bitterness of society that would last forever, sometimes gratitude, I guess, but probably not very often.

And then—and then you see, on some of these things, like the CSIs and the NCISs, the rapidity with which everything is done. And actually, I've seen some of the scripts and they're all very short lines. They talk quick. They go around.

None of them are scientists. Well, one of them is on one program. But they're FBI and they're—they know their stuff and they are professionals. And their marriages break up. They don't get any sleep. And they're doing their absolute very best on this.

So now comes the question which Senator Nelson just asked, about the Feds looking at this. I mean, the American Bar Association, the forensics people, have all said you've got to have—you've got to have a certification for forensics before they can testify in court.

Nurses have it. Lawyers have it. Doctors have it. Anybody else has it. If they're going to testify in court, they've got to be up to speed.

I go back to my first question, how long is that going to take, my second question, which was, what do we do in the meantime? And sort of the general answer is, we go along as we have, as we are, to the best extent that we can.

And that makes sense to me. What doesn't make immediate sense to me—and then set me straight if I'm wrong—is that when you say that the law enforcement community has sort of risen most of these non-science-based, non-DNA matters, to a forensic level which passes court test, influences juries, and influences judges, and whatever, and then you get up to something called the Department of Justice—and you know, the Department of Justice is a pretty formidable, smart outfit.

I do not know how many forensic scientists they have. But if you say that the Department of Justice, being an extension of law enforcement, the ultimate extension of law enforcement, cannot pass, as is said in this certification process, that they can't do it because they're part of law enforcement, then you have to create a new Federal agency, which is—I would happily do, but which most folks around here don't want to do.

This is such a vastly important subject. Maybe they could be changed. We'll see. But are you—you really are saying, all of you, that the Department of Justice, being the extension at the top of law enforcement, therefore by association, being the creators of this non-forensic DNA history somewhat inaccurate. To what extent, we don't know.

Should not be those people who deal with certification, cannot be those people who deal with broader problems of the development of forensics? There needs to be some other group in order to protect the sanctity of pure science. Is that what you're saying, is being said?

Dr. GATSONIS. No. The issue of no linking, of independence from law enforcement, had to do with the operations, the daily operations and the funding of the actual labs themselves.

It's not about how certification is going to get done. That's a different question. And also, the fact that you need an organization that knows about the science to be able to organize it and direct it—that necessitates that it also be independent of the Department of Justice, which is not a scientific organization.

It's not the NSF. It's not the NIH. It's not any—any of those organizations that develop, direct, and fund scientific research programs. It doesn't have that kind of background. So the DOJ has a role, but it's not the role that we have carved out for this national institute.

The CHAIRMAN. Well, then, you gentlemen are all going to have to step forward when the nation needs you, to make this case, because it's awfully hard to keep an agency in existence, much less start a new one these days, and I say that without mirth.

John Grisham, you disagreed.

Mr. GRISHAM. No. I don't think that the DOJ can be a scientific agency. We have enough scientific agencies already who can do the work. I'm not advocating a new agency. We have a number of agencies who do great scientific work.

But it's—you know, it's probably more cost-effective, or less, or more cost-effective to have the science do the work than try to make the DOJ a scientific agency. Their thrust, their mission, their goal is law enforcement.

And I'm not—I'm not blaming DOJ, or law enforcement, or whatever, for bad science. It's just the way it's developed over—over dec-

ades. OK? It's time to clean up the bad science with scientists. It's time to set the standards with scientists.

And once that's done, let law enforcement implement.

The CHAIRMAN. So then, for a period of, let's say, 15 or 20 years, the National Science Foundation, for example, could fill in that role? And then when and if DOJ and the whole, huge ship of law enforcement were gradually turned around on this, it could go back to DOJ?

I'm not—I'm not being difficult. I'm just curious about this. It's an interesting point.

Dr. GATSONIS. One recommendation that is not made in the report, but some of the professional societies have made afterwards, is, for instance, to have the National Institution of Standards take the role of an incubator.

The CHAIRMAN. The best.

Dr. GATSONIS. Yes. To be an incubator.

The CHAIRMAN. That'd be the best. Yes.

Dr. GATSONIS. I support this idea, but NIST has to be a real incubator. In other words, there has to be a statute of limitations, by the end of which they will deliver a new agency.

The CHAIRMAN. Yes. They'd probably be thrilled to offload that responsibility. You're saying not. OK.

Dr. GATSONIS. Yes. NIST is contiguous enough to the research. They do part of it and they have a enough of a background in this. So they could act as the incubator.

I think larger agencies, NIH and so on, are too specialized in their directions to be able to go and actually do that sort of thing.

The CHAIRMAN. Senator Boozman has a question and I think that'll be the final question. But I just want to say that, to me, this has been an absolutely wonderful hearing because of all the things that I don't know, and how embarrassed I am about that, and yet how excited I am by that.

I mean, it's sort of the essence of a large fact of life, of an unmet need coming upon us in very drastic form, through writing, through Fred Zain, through all that kind of thing. And it's a huge sort of—it defines a large part of what America is and what American justice is.

And yet, so few people know about it, as we go through the blur of computers and fast decisionmaking on some of these, on these television programs, which have an enormous effect. I mean, 75 million people watch CSI every week.

Senator Boozman?

Senator BOOZMAN. Well, thank you, Mr. Chairman. And I'm like you. I really have enjoyed the hearing, but as you said earlier, it's difficult in the timeframe that we have.

Something that we might consider at some point is maybe having a roundtable and getting this group, and perhaps NIST with us, DOJ, you know, to sit down and really kind of hash out, because as you pointed out, this is something that's not a problem that needs to be dealt with as government. I'm not looking to start a new agency.

As I pointed out, if that solves problems, then we need to do that in internal medicine and everything else. But even if you did that,

then you're talking about years and years as far as setting it up and getting the resources.

But I do believe that, right now these are things that we can get to work on. Today, I think oversight has come out. Dr. Fenger, you're doing a great job of educating people to fill these roles.

So we've got the problems with the standards of the science, but you also have to have some sort of accreditation for the people that are the people that are doing the science.

And it's remarkable, Mr. Grisham, but as you pointed out, if you're a poor person who's being accused of capital murder, you can't always get an expert up there.

This can be a do-or-die deal, literally, if you have that evidence come out, and then you do not have the ability to hire somebody.

Those are very difficult disciplines that people go into. But the idea, then, that you don't have the resources to be able to refute that testimony is so important, that's a real problem, too. So we've got all kinds of problems in the system.

I just appreciate you all being here and appreciate your testimony and you've really helped us with a lot of really thought-provoking ideas today.

So thank you very much.

The CHAIRMAN. And I, again, thank you and point out that it really takes quite a lot to catch the attention of the U.S. Congress near the end of its term. And you have done it. You've just been excellent and I totally thank you. Hearing adjourned.

[Whereupon, at 4:20 p.m., the hearing was adjourned.]

A P P E N D I X

PREPARED STATEMENT OF THE INNOCENCE PROJECT

Thank you Chairman Rockefeller, Ranking Member Hutchison, and members of the Committee, for holding today's hearing, "Turning the Investigation on the Science of Forensics." This is a critical topic—our research into the causes of wrongful conviction reveals that the reliance on un-validated and/or improper forensics was the second-greatest contributing factor to those wrongful convictions—and we are grateful that the Committee is turning its attention to the National Academy of Sciences (NAS) report on forensics and to the complex issue of reform. In particular, we are pleased that the Committee with jurisdiction over science is looking into this issue given the scientific shortcomings identified by the NAS.

The Innocence Project, affiliated with the Cardozo School of Law, was founded by co-directors Peter J. Neufeld and Barry C. Scheck in 1992. The project is a national litigation and public policy organization dedicated to exonerating wrongfully convicted people through DNA testing and reforming the criminal justice system to prevent future miscarriages of justice. Without the development of DNA testing, there would be no Innocence Project; 281 factually innocent Americans would remain behind bars, and 17 of those 281 could have been executed.

Given what those DNA exonerations have taught us about the shortcomings of forensic science, the Innocence Project is extremely thankful to Congress for authorizing and appropriating the funds responsible for the National Academies of Science Committee to undertake its two year study of the state of the nation's forensic science system. By convening some of the very best minds in the nation to focus on the needs and shortcomings of forensic practice and how to remedy them, the nation has been provided with both an alarm regarding the serious shortcomings that exist regarding forensic evidence, and a roadmap to addressing the major improvements in the forensic system necessary to ensure the most accurate evidence—and therefore justice—possible.

As our review of DNA exonerations shows, unvalidated and improper forensics contributed to approximately 50% of wrongful convictions overturned by DNA testing. In the DNA exonerations alone, we have had wrongful convictions based on unvalidated or misapplied serological analysis, microscopic hair comparisons, bite mark comparisons, shoe print comparisons, fingerprint comparisons¹, forensic geology (soil comparison), fiber comparison, voice comparison, and fingernail comparison², among the many forensic disciplines that have produced these tragic miscarriages of justice in our courts. There have even been a few innocents whose convictions relied, in part, on shoddy DNA testing in the early years of its forensic application. It comes as no surprise to us that the NAS concluded: "With the exception of nuclear DNA analysis, however, no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source."³ The overarching problem has been that all too frequently, these other forensic disciplines have been improperly relied upon to connect our innocent clients to crime scene evidence.

In contrast to DNA, the vast majority of non-DNA forensic assays have never been subjected to basic scientific research or federal review. Moreover, as pointed out by the NAS, neither the FBI nor the National Institute of Justice have, over the years, "recognized, let alone articulated, a need for change or a vision for achieving it. Neither has full confidence of the larger forensic science community. And because both are part of a prosecutorial department of the government, they could be subject to subtle contextual biases that should not be allowed to undercut the power

¹ Garrett and Neufeld, Virginia Law Review, Vol. 95, No. 1, March 2009, p. 8.

² *Ibid.*, p. 13.

³ Strengthening Forensic Science in the United States: A Path Forward, Committee on Identifying the Needs of the Forensic Science Community, The National Academies Press (2009), p. 7. (Hereinafter NAS report).

of forensic science.”⁴ Without a push for vigorous adherence to the scientific method, innocent people have gone to prison or death row while the real perpetrators remained at liberty to commit other violent crimes.

Many non-DNA forensic assays have not been scientifically validated, and there is no formal apparatus in place to scrutinize developing forensic technology. Though the technology has changed over time, the sources of human error, misinterpretation, and misconduct have not. Most of the assays used in law enforcement have no other application; they were developed for the purpose of investigation, prosecution and conviction and took on a life of their own without being subjected to the rigors of the scientific process. Essentially, the assays were simply accepted as accurate. Many of these forensic disciplines—some of which are experience-based rather than data-based—went online with little or no scientific validation and inadequate assessments of their robustness and reliability.

One case in point is the great strides that have been made in bitemark identification research by scientists inspired by the NAS report. While forensic dentists have been practicing bitemark identification for decades, rigorous research has demonstrated that the principles upon which bitemark identification is based are unfounded. Using cadaver models, a team of researchers led by Dr. Mary Bush at the University of Buffalo found that skin is a poor registration material for bitemarks—in some instances dentitions that did not make the mark matched a bitemark more closely than the actual set of teeth that created the bitemark.^{5,6} In subsequent studies, the research team established through two and three-dimensional statistical analysis of dental models, that dental shape matches could readily be found in given populations.^{7,8} Together, these studies show that statements of dental uniqueness with respect to bitemark analysis in an open population are unsupported, and that distortion in skin can be substantial. These findings put into question the overall reliability and validity of bitemark analysis. Consider this—while this research began in earnest in 2009, bitemark identification evidence has been admitted in US courts since at least 1948.

While there is research and work that establishes what needs to be done to improve various forensic practices, the fact is that no existing government entity, nor the forensics community itself, has been able to sufficiently muster the resources nor focus the attention necessary to use the existing information as a launching pad to comprehensively improve the integrity of non-DNA forensic evidence. The NAS Report is the first step—and a tremendous one—toward fully establishing and acting upon what we already know. From the perspective of justice and public safety, it is tragic that it has taken this long to act on the desperate need to improve the quality of forensic evidence. Given the clear and comprehensive message delivered by the NAS on this subject, further delay would be unconscionable.

We therefore urge the Senate Commerce Committee to develop legislation that would make use of existing scientific agencies of the U.S. Government to conduct the research and standardization that the NAS said is so critical. A scientific funding agency like the National Science Foundation (NSF) can be tasked with funding rigorous scientific research that will be methodologically sound and will generate unassailable work. After a comprehensive assessment of the validity and reliability of various forensic science disciplines, the National Institute of Standards and Technology (NIST) can lend its expertise to basic and applied standard setting. Given NIST’s reputation as a highly respected and admired standard-setting agency, as well as its history of employing Nobel prize-winning scientists who conduct superb research and translate basic science to applied commercial standards and its tradition of objective, independent, science-grounded work, we agree with the NAS report that NIST would make a sensible partner for setting those standards. The Department of Justice (DOJ) can then put these independently developed standards into practice by overseeing the accreditation of laboratories and certification of forensic examiners. A federal effort is needed to ensure that the best standard and a singular standard is implemented so that we don’t have 50 states operating under 50 definitions of “science”; forensic science in America needs one standard of science so we can have one standard for justice.

⁴ *Ibid.*, p. 16.

⁵ Bush MA, Miller RG, Bush PJ, Dorion RBJ. Biomechanical Factors in Human Dermal Bitemarks in a Cadaver Model. *J Forensic Sci*, 2009; 54(1):167–76.

⁶ Miller RG, Bush PJ, Dorion RBJ, Bush MA. Uniqueness of the Dentition as Impressed in Human Skin: A Cadaver Model. *J Forensic Sci* 2009; 54(4):909–14.

⁷ Sheets HD, Bush PJ, Brzozowski C, Nawrocki LA, Ho P, Bush MA. Dental shape match rates in selected and orthodontically treated populations in New York State: A 2 dimensional study. *J Forensic Sci*. 2011; 56(3):621–6.

⁸ Bush MA, Bush PJ, Sheets HD. Similarity and Match Rates of the Human Dentition In 3 Dimensions: Relevance to Bitemark Analysis. *Int J Leg Med* 2011; 125(6): 779–784.

The Innocence Project believes that there needs to be a strong relationship between the independent scientists charged with undertaking the research and standard-setting functions and the expert practitioners who use these techniques each day. It is those users who will abide by those standards, so it is essential they be able to adopt and follow them. We also believe that for the endeavor to succeed, it is important that the new standards be phased-in without causing a significant disruption to the criminal justice system. Therefore, we believe that practitioners have a critical role to play in advising and providing feedback to the scientific research and standard setting process. Advice and feedback should also be divined from the vast experience accumulated through the apprenticeship model of learning among forensic practitioners, which holds great value; that body of expertise would be a helpful addition to the rigorous scientific research to establish the parameters of a forensic discipline.

Research scientists, however, who have a background in physics, biology, chemistry, statistics, cognitive science, engineering, and other sciences, from academic institutions or in science based agencies of the Federal government rather than in law enforcement agencies, have the training to scrutinize and improve the current body of research. The absence of an independent research infrastructure, upon which medicine, industry, and technology can rely, has prevented the full development of the field of forensic science. Despite good intentions and much specialized forensic knowledge, forensic examiners do not have the methodological training and specific research knowledge essential to develop empirical studies that will withstand criticism and create a comprehensive frame for forensic science reform. Forensic science is a multi-disciplinary field and the engagement, input, and leadership of the scientists, engineers, and statisticians are critically needed for reform to work and to restore confidence in the accuracy and reliability of forensics.

It is time for a serious commitment to providing an ongoing and permanent scientific system of support for forensic science in order to ensure ongoing evaluation and review of current and developing forensic science techniques, technologies, assays, and devices; and continued government leadership, both publicly and through private industry, in the research and development of improved technology with an eye toward future economic investments that benefit the public good and the administration of justice. The impact of rigorous scientific research will be enormous. There is a global market for technologies with an application to public safety and the United States has the capacity to capture that market with a national commitment today. As the forensic market expands to meet this global need, more jobs will be created as scientists are engaged in research and more Americans are trained to conduct forensic analyses under American developed protocols and standards. However, as the United States begins to make greater investments in forensic technologies, it is even more important that the underlying science of the forensic techniques used in these technologies are understood and developing technologies scrutinized before they are implemented so that we do not find ourselves in the same position in the future.

The Innocence Project understands that to implement the complete package of reforms recommended in the NAS report may take years. However, we believe that there are steps the government can take before wholesale reform is completed. In the interim period, we can do our best to ensure that forensic science is applied to its currently supported parameters. Our first suggestion is to direct the National Science Foundation (NSF) to set a research agenda for future forensic science research. Up to this point, the National Institute of Justice (NIJ) has led research activity regarding forensic disciplines. While many of their reports have recommended validity and reliability research for many non-DNA forensic disciplines, and NIJ has issued recent grant solicitations to fund basic validation research, the agency has not proposed a clear roadmap for the specific research needs for each forensic science discipline addressed in Chapter 5 of the NAS report.^{9,10} Forensic science is a multidisciplinary field that requires the expertise of life and physical scientists, many of whom are not aware of the opportunities inherent in this nascent field. Development of a specific research agenda will allow scientists to identify the contributions they can make to growing the research engine of forensic science. A recent NAS study on the NIJ found the grantmaking function of the entity to be greatly hampered by the dearth of “researchers” or staff with a comprehensive scientific research background to administer scientific grants.¹¹ Additionally, a recent DOJ In-

⁹National Institute of Justice, *Forensic Sciences: Review of Status and Needs* (1999).

¹⁰National Institute of Justice, *Status and Needs of Forensic Science Service Providers: A Report to Congress* (2004).

¹¹National Academy of Sciences, *Strengthening the National Institute of Justice* (2010).

spector General report regarding the NIJ's grant award practices found deficiencies in the agency's ability to demonstrate a fair and open competitive grant making practice.¹² For this reason, the NSF would serve as the ideal agency for developing a comprehensive research agenda for the forensic sciences.

A second immediate step Congress and the Administration could take is to direct NIST to design a standardized requirement, format, and terminology for laboratory reports that serves multiple consumers in the criminal justice system. In order for forensic science to mature to a discipline with a strong scientific culture, it will be important for the reports that laboratories produce to reflect the principles of science. Currently, there are no national or even discipline-based standards for report writing and courtroom testimony. Many, if not most of the wrongful convictions we documented arose when criminalists wrote misleading reports or offered testimony which grossly exaggerated the probative value of the forensic evidence. By requiring laboratory reports to be more comprehensive and for all opinions and conclusions to be supported by data or scientific literature, judges, attorneys, and fact finders will be provided the same base of information to understand the testing and results in a given case.

A third interim step would be to adopt the discovery rules of the Federal Rules of Civil Procedure. Under Rule 26, every expert must submit "a complete statement of all opinions the witness will express and the basis and reasons for them; the facts of data considered by the witness in forming them" and "any exhibits that will be used to summarize or support them."¹³ In contrast to criminal courts, experts in civil courts are required to document their entire testimony prior to taking the stand.

Science can light the way to the path forward and every effort should be made to support innovation and research. Post-conviction DNA exonerations have shown the catastrophic consequences of such a lack of research, standards, and oversight. It is clear that the nation's forensic science community is ready and willing to work with the federal government, law enforcement, and other scientists to ensure a brighter future for forensic science. Science-based forensic standards and oversight will increase the accuracy of criminal investigations, strengthen criminal prosecutions, protect the innocent and the victims, and enable law enforcement to consistently focus its resources not on innocent suspects, but on the true perpetrators of crimes. For as the nation's post-conviction DNA exonerations have proven all too clearly, when the system is focused on an innocent suspect, defendant or convict, the real perpetrator remains free to commit other crimes.¹⁴ With your support, we will not only significantly enhance the quality of justice in the United States, but we will also minimize the possibility that tragedies like that endured by the nation's 281 (and counting) exonerees and their families will needlessly be repeated time and again.

AMERICAN STATISTICAL ASSOCIATION
Alexandria, VA, December 20, 2011

Hon. JOHN D. ROCKEFELLER IV,
Chairman,
Commerce, Science, and Transportation
Committee,
U.S. Senate,
Washington, DC.

Hon. KAY BAILEY HUTCHISON,
Ranking Member,
Commerce, Science, and Transportation
Committee,
U.S. Senate,
Washington, DC.

Dear Chairman Rockefeller and Ranking Member Hutchison,

Thank you for your attention to improving the science in forensic science and, in particular, for holding the December 7 hearing entitled "Turning the Investigation on the Science of Forensics."

As experts in data collection, analysis, and dissemination, as well as experimental design, statisticians have played an important role in the constructive criticism of forensic science and can play an important role in its reform.

I write to again offer the help of the American Statistical Association (ASA) as you move forward and to provide materials for the written record of the hearing.

¹²U.S. Department of Justice Office of the Inspector General Audit Division, *Audit of NIJ Practices for Awarding Grants and Contracts in FY2005–FY2007* (2009), iii.

¹³Federal Rules of Civil Procedure, Rule 26, 2(b), i–iii.

¹⁴In the wake DNA exonerations of the wrongfully convicted, that same DNA analysis has enabled the identification of 131 of the true suspects and/or perpetrators of those crimes.

I enclose letters I sent Chairman Rockefeller and Chairman Leahy earlier this year that urge forensic science reform overseen by an independent agency. I also attach a statement by the ASA Board of Directors endorsing the National Academies' *Strengthening Forensic Science in the United States* recommendations and citing the importance of sound statistical practice to the success of a forensic science institute.

The ASA stands by its endorsement of an independent body to oversee forensic science reform, but we recognize the difficult fiscal environment. We urge you to work with the Administration to facilitate forensic science reform to the extent possible in the short run. Options include greater transparency by Federal and federally funded laboratories of their forensic science research reports, protocols and related materials; research support by science agencies to bolster the science in forensic science disciplines; development, definition, and enforcement of standards; and education of judges, defense attorneys and prosecutors on forensic science issues.

Sincerely,

ROBERT N. RODRIGUEZ, PH.D.
 2012 President,
 American Statistical Association.

Enclosures: March 31, 2011 letters to Chairman Rockefeller and Chairman Leahy;
 Statement by the ASA Board of Directors

AMERICAN STATISTICAL ASSOCIATION
 Alexandria, VA, March 31, 2011

Hon. JOHN D. ROCKEFELLER IV,
 Chairman,
 Senate Commerce, Science, and Transportation Committee,
 United States Senate,
 Washington, DC.

Dear Chairman Rockefeller,

Thank you for making forensic science reform a priority for the Commerce, Science, and Transportation Committee in 2011. The forensic science system has serious problems that are undermining confidence in our justice system, as the National Academies' *Strengthening Forensic Science in the United States: A Path Forward* reveals. A justice system informed by solid science is imperative. To address the systemic deficiencies, *Strengthening Forensic Science* recommended measures that amount to no less than changing the culture of the forensic science community.

The board of directors for the American Statistical Association (ASA) issued a statement in April 2010 endorsing *Strengthening Forensic Science*, including its recommendations. On behalf of the ASA Board of Directors, I write to urge you to enact these recommendations, especially the creation of a National Institute of Forensic Science (NIFS) with the independence necessary to address the profound issues identified in *Strengthening Forensic Science*. A new agency is necessary because of the strong leadership required to address these issues and the current lack of any governance structure in the forensic science enterprise.

We believe an independent agency is the ideal and respectfully ask you to explore such an option to the extent possible. If the current environment precludes the establishment of a stand-alone NIFS, the National Institute of Standards and Technology (NIST) could serve as the incubator for NIFS, if the following conditions are met. Most importantly, placing NIFS within NIST should be temporary, with the legislation specifying that independence be considered after, say, three years and realized within, say, five years. NIFS also should have the autonomy and resources within NIST to meet its responsibilities and foster its independence. We emphasize the importance of a properly funded NIFS so that it doesn't tax the many other important and varied NIST activities. The guidance around Recommendation 1 in *Strengthening Forensic Science* also should be closely heeded in the creation of a NIFS temporarily hosted at NIST.

An independent NIFS—either from inception or after a short time in NIST—is important to the long-term success of NIFS because of the importance of strong relationships with the many stakeholder communities. These communities range from the Department of Justice (DOJ) to the forensic science community to scientists of other disciplines (typically associated with the National Science Foundation, National Institutes of Health, or other federal agencies). Hosting NIFS indefinitely at NIST will not develop the stature among the varied stakeholders necessary to transform the forensic science culture.

Independence from law enforcement agencies is especially fundamental to a successful NIFS for a number of reasons. A forensic science institute hosted at the DOJ, for example, presents inherent potential conflicts of interest because of DOJ's mission to enforce the law. Furthermore, because DOJ is so integrally tied to the forensic science culture and the current problems, a forensic science institute must be independent of DOJ to realize the necessary changes in a timely manner. Finally, DOJ lacks the expertise and infrastructure to support the scientific needs of a forensic science institute.

Thank you for your consideration. I attach a copy of the statement by the ASA Board of Directors endorsing the *Strengthening Forensic Science* report and citing the importance of sound statistical practices to the success of a forensic science institute.

Sincerely,

ROBERT N. RODRIGUEZ, Ph.D.,
2012 President,
American Statistical Association.

AMERICAN STATISTICAL ASSOCIATION
Alexandria, VA, March 31, 2011

Hon. PATRICK LEAHY,
Chairman,
Senate Judiciary Committee,
United States Senate,
Washington, DC.

Dear Chairman Leahy,

Thank you for your forensic science reform efforts in S. 132, "The Criminal Justice and Forensic Science Reform Act." A justice system informed by solid science is imperative. The 2009 National Academies' report *Strengthening Forensic Science in the United States: A Path Forward* revealed the many weaknesses in forensic science and recommended measures that amount to no less than changing the culture of the forensic science community.

While creating an office of forensic science—as your bill does—addresses a *Strengthening Forensic Science* recommendation, its placement in the Department of Justice (DOJ) would not address the underlying issues. As *Strengthening Forensic Science* notes, DOJ's "principal mission is to enforce the law and defend the interests of the United States according to the law." A DOJ-hosted OFS therefore presents potential conflicts of interest precluding the independence required for a forensic science office to be effective at serving the entire forensic science community, including defendants. Furthermore, because DOJ is so integrally tied to the forensic science culture and current problems, a forensic science office must be independent of the DOJ to realize the necessary changes in a timely manner. Finally, DOJ lacks the expertise and infrastructure to support the scientific needs of a forensic science institute. The attached excerpt from *Strengthening Forensic Science* persuasively and compellingly captures our sentiments.

For these reasons, the American Statistical Association does not support S. 132 and we respectfully urge you to reconsider the placement of OFS in DOJ.

Thank you for your consideration. In addition to the *Strengthening Forensic Science* excerpt about DOJ hosting a forensic science office, I attach a copy of the statement by the ASA Board of Directors endorsing *Strengthening Forensic Science* and citing the importance of sound statistical practices to the success of an office of forensic science. I also attach the June 9, 2010, letter from 2009 ASA President Sally Morton to you regarding "Outline of Draft Forensic Reform Legislation."

Sincerely,

ROBERT N. RODRIGUEZ, Ph.D.,
2012 President,
American Statistical Association.

Excerpt from *Strengthening Forensic Science in the United States: A Path Forward*, executive summary, p. 17:

There was also a strong consensus in the committee that no existing or new division or unit within DOJ would be an appropriate location for a new entity governing the forensic science community. DOJ's principal mission is to enforce the law and defend the interests of the United States according to the law. Agencies within DOJ operate pursuant to this mission. The FBI, for example,

is the investigative arm of DOJ and its principal missions are to produce and use intelligence to protect the Nation from threats and to bring to justice those who violate the law. The work of these law enforcement units is critically important to the Nation, but the scope of the work done by DOJ units is much narrower than the promise of a strong forensic science community. Forensic science serves more than just law enforcement; and when it does serve law enforcement, it must be equally available to law enforcement officers, prosecutors, and defendants in the criminal justice system. The entity that is established to govern the forensic science community cannot be principally beholden to law enforcement. The potential for conflicts of interest between the needs of law enforcement and the broader needs of forensic science are too great. In addition, the committee determined that the research funding strategies of DOJ have not adequately served the broad needs of the forensic science community. This is understandable, but not acceptable when the issue is whether an agency is best suited to support and oversee the Nation's forensic science community. In sum, the committee concluded that advancing science in the forensic science enterprise is not likely to be achieved within the confines of DOJ.

American Statistical Association Statement on
Strengthening Forensic Science, 4/17/10

The 2009 National Academies' report, *Strengthening Forensic Science in the United States: A Path Forward*,¹ identified many serious deficiencies in the nation's forensic science system and called for major reforms and new research. The report came after years of critiques of specific forensic science practices as well as calls for reform but especially broke new ground by offering a comprehensive review and adding the authority of the National Academies.

Statisticians have played an important role in this constructive criticism and can play an important role in the reform urged by the National Academies' report. Indeed, the *Strengthening Forensic Science* report cites examples of the lack of sufficient recognition for sources of variability and their effects on uncertainties in forensic science analyses. Statisticians are vital to establishing measurement protocols, quantifying uncertainty, designing experiments for testing new protocols or methodologies and analyzing data from such experiments.

The American Statistical Association Board of Directors recognizes the urgent need to improve forensic science because of its pivotal role in our judicial system and therefore endorses *Strengthening Forensic Science in the United States: A Path Forward*¹ and the recommendations therein. To better achieve many of the report recommendations, the report urges the establishment of a separate institute for forensic science (Recommendation 1 of the report). The board notes that sound statistical practices are essential for the proposed institute to achieve its mission. Specific examples include:

1. Current and newly developed forensic practices should be assessed using properly designed experiments and data analytic methods.
2. Statistical methods based on established principles and procedures should be used for the analysis of data, including estimated error rates.
3. Novel methods (beyond variants of established methods) developed for the analysis of data should be reviewed in mainstream scientific journals that include statistically qualified experts as reviewers.
4. Modern statistical quality control and quality assurance procedures should be used to assure that measurements, procedures, and testimony are of high quality.
5. Proficiency tests should use accepted statistical designs that are, whenever possible, double blind to avoid testing-response-grading biases.
6. All expert reports should be available to interested parties and sufficient supporting data and information provided to permit independent review (including replication and verification of findings).

Background

The 2009 National Academies' Report *Strengthening Forensic Science in the United States: A Path Forward* provided 13 recommendations including the establishment of an independent body, the National Institute for Forensic Science, to fa-

¹http://www.nap.edu/catalog.php?record_id=12589.

facilitate the development of scientific research and standard practices in forensic science. The report describes the following requirements for the institute:

- It must be an independent federal agency established to address the needs of the forensic science community
- It must have a culture that is strongly rooted in science, with strong ties to the national research and teaching communities, including federal laboratories
- It must have strong ties to state and local forensic entities, as well as to the professional organizations within the forensic science community
- It must not be in any way committed to the existing system, but should be informed by its experiences
- It must not be part of a law-enforcement agency
- It must have the funding, independence, and sufficient prominence to raise the profile of the forensic science disciplines and push effectively for improvements
- It must be led by persons who are skilled and experienced in developing and executing national strategies and plans for standards setting; managing accreditation and testing processes; and developing and implementing rulemaking, oversight, and sanctioning processes

The *Strengthening Forensic Science* noted that no federal agency exists that meets these well-considered and important criteria and therefore recommended the development of a new and separate body. We support the *Strengthening Forensic Science* recommendation for developing the institute. We also second their emphasis on the institute having the independence necessary to produce the needed scientific outcomes. Any perception of outside influence on the institute's products will undermine its credibility. Such independence is a key principle for statistical agencies as made clear in the National Academies' *Principles and Practices for a Federal Statistical Agency* (Fourth Edition, 2009). Indeed, although the proposed Institute is not a statistical agency, much of the content of *Principles and Practices* is relevant to an institute of forensic science.

For the statistical community it is especially critical that the new agency use appropriate statistical practices to raise the level of forensic science in the United States. Here we elaborate on six sound statistical practices listed above as essential for the proposed institute to achieve its mission.

1. The need for well-designed experiments—Current forensic practices have not always been supported by valid assessments that yield defensible and transparent error rates. We view this as a critical need. As Donald Kennedy, then Editor-in-Chief of *Science*, noted in an Editorial,² “It’s not that fingerprint analysis is unreliable. The problem, rather, is that its reliability is unverified either by statistical models of fingerprint variation or by consistent data on error rates. Nor does the problem with forensic methods end there. The use of hair samples in identification and the analysis of bullet markings exemplify kinds of ‘scientific’ evidence whose reliability may be exaggerated when presented to a jury.” The following examples demonstrate how assessments that have been done are too often flawed:

- The so-called FBI 50K fingerprint comparison study was particularly weak. In an attempt to establish the uniqueness of fingerprints, the FBI contracted with a company to examine 50,000 fingerprints against each other and quantitatively assess the degree of similarity. David H. Kaye exposed this test as unsound.³ Quoting from the abstract of his article: “Forensic scientists or analysts concerned with ‘individualization’ often presume that features such as fingerprint minutia are unique to each individual. In the United States, defendants in criminal cases have been demanding proof of such assumptions. In at least two cases, the government of the United States has successfully relied on an unpublished statistical study prepared specifically for litigation to demonstrate the uniqueness of fingerprints. This article suggests that the study is neither designed nor executed in a way that can show whether an individual’s fingerprint impressions are unique.” Issues with the 50K study include comparing a digitized image of a fingerprint to itself rather than a second fingerprint of the same finger (even though the latter is the relevant comparison), using unrealistic estimates for standard error, and poor modeling of the underlying distribution used to make inferences.

²Kennedy, D., “Forensic Science: Oxymoron?” *Science*, (2003), **302**, p. 1625.

³Kaye, D.H., “Questioning a Courtroom Proof of the Uniqueness of Fingerprints,” *International Statistical Review* (2003), **71.3**, p 521–533.

- In a recent review of fingerprint validation, Haber and Haber⁴ conclude: “We analyze evidence for the validity of the standards underlying the conclusions made by fingerprint examiners. We conclude that the kinds of experiments that would establish the validity of ACE–V [Analysis-Comparison-Evaluation-Verification—the current standard fingerprint methodology] and the standards on which conclusions are based have not been performed. These experiments require a number of prerequisites, which also have yet to be met, so that the ACE–V method currently is both untested and untestable.”
2. *Use of well-accepted statistical methods for analysis of data*—It is critical that appropriate statistical methods be used to analyze data obtained in support of forensic methods. The validity of these methods should be demonstrated, preferably in peer-reviewed statistical or mainstream scientific journals before being used in litigation. This has not always been the case.
- Compositional analysis of bullet lead (CABL): The FBI practice of comparing crime scene bullets with bullets found in the possession of a potential suspect illustrates the consequences of a poorly designed analysis. The “working hypothesis” justifying CABL is that the chemical concentration of the lead used to make a ‘batch’ of bullets provide a unique signature, so bullets that come from the same batch of lead should have the same concentrations of certain trace elements. To show a low error rate for matching bullets the FBI said that it selected one bullet from each of 1837 cases and experimental bullets randomly and matched them to each other. The FBI claimed the bullets were chosen to be representative of the population of manufactured bullets, but also acknowledges that the bullets in this set were “selected”. Spiegelman and Kafadar provided indications that the “selection” was neither random nor representative.⁵ Consequently, the way that these bullets were chosen led to an indefensibly low error rate (see Ch 3 of Reference 6). Finally, the “statistical test” used to compare bullets was an unjustified modification of Student’s t test. The reaction from the scientific community and the media ultimately led the FBI to both abandon the procedure and issue a letter to many convicts that the testimony used against them did not have scientific support.
3. *Rigorous review of new data analysis methods*—Novel methods for analysis of data in cases do not always have support that would pass scientific muster if subject to peer review. Two illustrations are:
- The FBI had used an ad-hoc data clustering method (“chaining”) in CABL that led to clustering together bullets of very different compositions that were claimed to have come from the same batch.^{5,6} The 2004 NRC report⁶ showed a high rate of false matches; as a result, chaining is no longer used by the FBI.
 - DNA profiling is a powerful tool for identification when a single source of DNA is present in an evidence sample (or a resolvable mixture of multiple sources). But no consensus yet exists on the analysis of more complex mixtures of DNA (using the current, 15-year old STR methodology) where “allelic dropout” is present due to poor quality or limited quantity of sample. In 2006, the DNA commission of the International Society of Forensic Genetics issued a report on the situation.⁷ Its abstract states: “The purpose of the group was to agree on guidelines to encourage best practice that can be universally applied to assist with mixture interpretation. . . . Our discussions have highlighted a significant need for continuing education and research into this area. We have attempted to present a consensus from experts but to be practical we do not claim to have conveyed a clear vision in every respect in this difficult subject. For this reason, we propose to allow a period of time for feedback and reflection by the scientific community.” Despite the continuing lack of consensus regarding the analysis of complex DNA mixtures, crime laboratory technicians often make strong and unqualified statistical statements in court about the strength of such evidence using ad hoc and unsupported statistical methods.

⁴Haber, L., and Haber, R.N., “Scientific validation of fingerprint evidence under Daubert,” *Law, Probability and Risk* (2008), **7**, p. 87.)

⁵Spiegelman, C.H., and Kafadar, K., “Data Integrity and the Scientific Method: the Case of Bullet Lead Data as Forensic Evidence,” *Chance* (2006), **19.2**, p. 17–25.

⁶Forensic Analysis: Weighing Bullet Lead Evidence, National Research Council, 2004; http://www.nap.edu/catalog.php?record_id=10924.

⁷Gill, P., et al. “DNA commission of the International Society of Forensic Genetics: Recommendations on the interpretation of mixtures,” *Forensic Science International* (2006), **160** p. 90–101.

4. *Modern statistical quality control and quality assurance procedures*—Forensic laboratories should have in place appropriate quality control procedures to ensure high-quality measurements, standardized procedures, and valid testimony.

- The Clinical Laboratory Improvement Amendments (CLIA), passed by Congress in 1988, established “quality standards for all laboratory testing to ensure the accuracy, reliability and timeliness of patient test results regardless of where the test was performed.”⁸ Forensic laboratories are explicitly exempt from the CLIA standards (as are some other categories such as research laboratories that “do not report patient-specific results”). The College of American Pathologists do regulate some forensic practices such as Forensic Pathology, but such regulation external to the profession is the exception rather than the rule in forensic science.

5. *Double-blind proficiency testing*—Existing forensic associations recognize the need for proficiency testing. Unfortunately existing proficiency tests do not always mirror the level of complexity found in actual practice and are rarely (if ever) double blind. As is well known in medical research the latter can lead to biased evaluations. Examples establishing the need for more challenging tests and the potential value of blind tests are described below:

- Historically, even well established areas of forensic science did not implement appropriate proficiency testing until relatively recently. For example, in 1995 the Collaborative Testing Service (CTS) administered a fingerprint proficiency test. According to David Grieve, then editor *Journal of Forensic Identification*,⁹ “the CTS latent print proficiency test was designed, assembled, and reviewed by those representing the IAI [International Association for Identification], thus making it the first such examination authorized by the association.” Its results were unanticipated and illustrate how important such tests are: “Of the 156 respondents, only 68, or 44%, had correctly identified the five latent impressions as well as correctly noted the two eliminations.”⁹ Grieve went on to describe the reaction of the forensic community to the results of the CTS test as ranging from “shock to disbelief.”⁹
- A 2008 *Champion* paper¹⁰ by Adina Schwartz includes a quotation that addresses the importance of appropriate testing, “One examiner who took the 2006 CTS cartridge case test commented, ‘This test was straightforward and very easy. It took only a few minutes to make correct associations using toolmarks devoid of subclass influence . . . I suggest that you consider making the test more of a challenge in order to determine an error rate really reflective of actual casework where borderline cases are not uncommon.’” This is an example of a test that is too easy and not blind in any manner.
- A study published by Dror, Charlton, and Péron in 2006¹¹ demonstrates how strong contextual biases can be and thus how important blinding is. In the study, they told five experienced fingerprint experts from around the world (including the USA) that they were to look at a reference fingerprint from Brandon Mayfield (the American attorney wrongfully identified as matching a latent fingerprint found in the 2004 Madrid terrorist train bombing) to see if they thought there was a match between his print and the 2004 Madrid latent. Three experts said there was no match and one was “not sure.” The participants were in fact shown prints (reference and latent) from their own cases (not the Spanish train suspect) where they had previously declared a match. Four of the five participants changed their opinion, suggesting the existence of contextual bias.
- Double blind proficiency studies have long been used to assess the accuracy of many types of diagnostic and screening procedures. A survey by Gastwirth (1987)¹² provides a number of examples, including the 1984 paper by Morgan¹³ both of which demonstrate the long recognized need for double blind testing.

⁸ See, for example, <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/IVDRegulatoryAssistance/ucm124105.htm>.

⁹ Grieve, D., “Possession of Truth,” *Journal of Forensic Identification* (1996), **46**, p. 521.

¹⁰ Schwartz, A., “Challenging Firearms and Toolmark Identification-Part One,” *The Champion* (2008), **XXXII**, 8, p. 10–19; and “Challenging Firearms and Toolmark Identification-Part Two,” *The Champion* (2008), **XXXII**, 9, p. 44–52.

¹¹ Dror, I.E., Charlton, D., Péron, A.E., “Contextual information renders experts vulnerable to making erroneous identifications,” *Forensic Science International* (2006), **156**, 1, p. 74–78

¹² Gastwirth, J.L., “The Statistical Precision of Medical Screening Procedures: Application to Polygraph and AIDS Antibodies Test Data,” *Statistical Science* (1987), **2**, p. 213–238.

¹³ Morgan, J.P. “Problems of mass urine screening for misused drugs,” *Journal of Psychoactive Drugs*, (1984), **16**, p. 305–317.

6. *Public Availability of Expert Reports*—Any statistician who has tried to obtain supporting data for a published paper but met resistance from an uncooperative author, knows the difficulty of verifying or testing the conclusions in that paper. Unlike civil cases, discovery in criminal cases is often much more limited, and similar problems arise. It is also the case that some law enforcement organizations will conduct studies to support a methodology but not make the supporting data available to scientists interested in reviewing their findings, as the following example illustrates:

- In the early 1990s, when the FBI RFLP population database (consisting in part of samples from FBI agents) was the primary basis for published theoretical analyses used justifying case work calculations, the FBI refused to make its database available to independent scholars who wished to subject those published analyses to critical scrutiny (unless ordered in some cases by a court and even then protective orders were sought to prevent further dissemination of the database. (Note: this was not an offender or forensic casework database, but a database collected solely for statistical analyses.) One statistician who encountered this problem was Seymour Geisser: “After submitting his article to the *American Journal of Human Genetics*, Professor Geisser was asked to obtain permission from the FBI to use their original data rather than the data submitted by the FBI to defense attorneys in court cases. Geisser then requested this data from Dr. Budowle, the top FBI DNA scientist. The FBI informed Geisser that (1) the FBI had made commitments earlier to other scientists (Chakraborty, Devlin, Risch, and Weir) and therefore his study must not conflict with their studies, (2) the FBI data may be used only in a joint collaboration with Dr. Budowle, (3) the use of the data was restricted to this one paper, and (4) all authors must agree to the entire contents of a final manuscript prior to submission to a journal.”¹⁴ (See also Reference¹⁵, and especially footnote 23 therein.)

PREPARED STATEMENT OF LISA WAYNE, PRESIDENT, ON BEHALF OF THE NATIONAL ASSOCIATION OF CRIMINAL DEFENSE LAWYERS

Chairman Rockefeller, Ranking Member Hutchison and Members of the Committee:

On behalf of the National Association of Criminal Defense Lawyers (NACDL), I am writing to express the views of the criminal defense bar on the state of forensic science and the need for specific reforms. We understand that not all of the reforms proposed here are within the Committee’s purview, but we hope that this statement serves as a useful overview of the type of systemic and comprehensive reform that is needed to ensure the reliability of forensic evidence and the integrity of our criminal justice system.

The National Association of Criminal Defense Lawyers (NACDL) is the pre-eminent organization in the United States advancing the mission of the Nation’s criminal defense lawyers to ensure justice and due process for persons accused of crime or other misconduct. A professional bar association founded in 1958, NACDL’s 10,000-plus direct members in 28 countries—and 90 state, provincial and local affiliate organizations totaling more than 40,000 attorney’s—include private criminal defense lawyers, public defenders, active U.S. military defense counsel, law professors and judges committed to preserving fairness within America’s criminal justice system.

Fundamental components of the representation of the accused are that all defendants have the Fifth Amendment right to due process of law and the Sixth Amendment rights to present evidence, to confront witnesses against them, to a fair trial, and to the effective assistance of counsel.

The great number of DNA and other exonerations undermines the belief that the criminal justice system correctly identifies the perpetrators of criminal offenses and prevents wrongful convictions. Especially troubling is the role that invalid and unreliable forensic evidence has at times played in contributing to those wrongful convictions. By way of illustration, a recent study observed that forensic science practitioners called by the prosecution provided trial testimony with conclusions either

¹⁴ Giannelli, P.C., “Book Review: *The DNA Story: An Alternative View*,” [book review of “*And the Blood Cried out by Harlan Levy*,”] *The Journal of Criminal Law and Criminology*, (1997) 88.1, p. 380–422.

¹⁵ Thompson, W. C., “Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the DNA War,” *The Journal of Criminal Law and Criminology* (1993), 84.1, p. 22–104.

misstating empirical data or wholly unsupported by empirical data in greater than the majority of cases where DNA evidence exonerated someone whose conviction had been supported by forensic evidence.¹

There is, of course, a great difference between the use of forensic evidence to identify an individual as having left evidence at a crime scene and its use to exclude an individual as the possible contributor. It is generally a relatively simple and undisputed matter to exclude someone as the contributor of forensic evidence. Most problems in forensic identification evidence occur when practitioners conclude that a particular person is the contributor of evidence found on the scene.²

The United States Supreme Court cautioned a generation ago that “[e]xpert evidence can be both powerful and quite misleading because of the difficulty in evaluating it.”³ The recognition of deficiencies with forensic evidence has only grown since then.⁴ Nonetheless, the prevalence of forensic evidence in criminal cases has grown over time. In this era of increasing reliance on forensic evidence, defense lawyers, more than ever, need to have the ability to understand such evidence to effectively represent those accused and to ensure that every defendant is afforded due process of law. When it is the defense counsel who considers the affirmative use of forensic evidence—whether to provide reasons for the jury to doubt the prosecution’s charges or even to fully exonerate the defendant—defense lawyers, consistent with their Sixth Amendment and ethical obligations, need independent access to scientific and forensic experts and evidence to prepare and present the defense. In the more frequent instances in which it is the prosecution that seeks to use forensic evidence to carry its burden to prove beyond a reasonable doubt that a criminal defendant committed a crime, defense counsel is constitutionally and ethically obligated to ensure that the evidence is sufficiently accurate and reliable to be presented to a jury and that, if it is so presented, that the jury understands the limits of the evidence.

Contrary to media portrayals of forensic science in popular TV shows, forensic evidence presented in court is at times based on speculative research, subjective interpretations, and inadequate quality control procedures. Ensuring the scientific integrity of forensic evidence is essential to prevent wrongful convictions and to exonerate the innocent. In February 2009, the National Academies’ National Research Council issued a report, *Strengthening Forensic Science in the United States: A Path Forward* (National Academies Press 2009) (“NAS Report”), that set forth a roadmap for reform and renewed the promise of fairness in the criminal justice system.

The NAS Report highlighted important deficiencies, and NACDL supports the recommendations intended to remedy those deficiencies. In addition, NACDL adopted the following Principles and Recommendations to produce accurate and reliable forensic evidence results and to increase the likelihood of fair and accurate verdicts in our courtrooms. The Principles and Recommendations discuss seven central areas of need: (1) a central, science-based Federal agency, (2) a culture of science, (3) a national code of ethics, (4) the prerequisite of research, (5) education, (6) transparency and discovery, and (7) defense resources, particularly for indigent defense services.

I. Central, Science-Based Federal Agency

Principle: The NAS Report’s primary and central reform—that Congress should establish and appropriate funds for the establishment of a science-based Federal agency—is of the utmost importance. This agency’s purpose would be to promote the

¹ Brandon L. Garrett & Peter J. Neufeld, *Invalid Forensic Science Testimony and Wrongful Convictions*, 95 Va. L. Rev. 1 (2009) (82 of 137 DNA exoneration cases relied upon invalid forensic evidence).

² Compare David H. Kaye, David E. Bernstein & Jennifer L. Mnookin, *The New Wigmore: Expert Evidence* 450 (2004) [hereinafter “Kaye, et al., *The New Wigmore*”] (“A suspect who is excluded rarely would be prosecuted. . . . Unless the government shows that the exclusion could be spurious or advances as to how a defendant who is not the source of the trace evidence could be guilty, the exclusion should be disparities.” (footnote omitted)); National Research Council, *The Evaluation of Forensic DNA Evidence* 51 (1996) (“The use of DNA techniques to exclude a suspect as the source of DNA has not been the subject of controversy.”) with Kaye et al., *The New Wigmore*, supra 447 (For matches, “ascertaining any association requires the assistance of technology to detect the characteristics. In addition, determining the extent to which the more esoteric trace evidence narrows the set of possible suspects requires specialized knowledge and study.”).

³ *Daubert v. Merrell Dow Pharm.*, 509 U.S. 579, 595 (1993).

⁴ See *Melendez-Diaz v. Massachusetts*, ___ U.S. ___, ___, 129 S. Ct. 2527, 2537 (2009) (“Serious deficiencies have been found in the forensic evidence used in criminal trials. . . . [T]he legal community now concedes, with varying degrees of urgency, that our system produces erroneous convictions based on discredited forensics.” (quoting Pamela R. Metzger, *Cheating the Constitution*, 59 Vand. L. Rev. 475, 491 (2006))).

development of forensic science into a field of multidisciplinary research and practice founded on the systematic creation, collection, and analysis of relevant data. As the NAS recognized, this agency cannot be part of the Department of Justice or any other existing Federal department or agency whose primary mission involves prosecution or law enforcement. This agency should be created and established as an immediate policy priority while there are ongoing efforts to fund and generate research. Validated and reliable forensic evidence is an important and necessary component of the criminal justice system, and the development of such evidence should be encouraged. The results of any forensic theory or technique whose validity, limitations, and measures of uncertainty have not been established should not be admitted into evidence to prove the guilt of an accused person. *See* Section IV (Prerequisite of Research). Therefore, a central priority of the agency should be research programs to determine the validity, limitations, and measures of uncertainty associated with the forensic disciplines, particularly relating to forensic evidence that purports to identify any specific individual as the contributor of crime scene evidence.

RECOMMENDATION 1 (Staffing):

As the NAS Report suggested, the Federal agency should have a full-time executive director, professional staff, and an advisory board composed of a broad range of individuals with interest and expertise in issues that relate to the forensic disciplines and the criminal justice system.

RECOMMENDATION 2 (Scope of responsibilities):

Congress should allocate funds to the Federal agency, which should serve as the authority by which funds are conscientiously dispensed with a national strategy in mind. As recognized by the NAS Report, the Federal agency should, *inter alia*, oversee all programming that relates to forensic science and forensic evidence in the United States, establish national reporting standards for each forensic discipline, and encourage research by national research universities and other independent research-based institutions, including providing scholarships, fellowships, and grants to promote interest in the forensic disciplines among graduate students and faculty in the basic sciences, statistics, and engineering.⁵

RECOMMENDATION 3 (Board of accreditation and certification):

To strengthen regulation of the forensic disciplines, the Federal scientific agency should establish a board of accreditation and certification with full authority to accredit and revoke the accreditation of all laboratories, to certify and discipline all forensic science practitioners, and to establish a program to audit all laboratories to ensure compliance with national standards.⁶ Oversight of accreditation and certification programs should be housed outside the forensic disciplines themselves and should be the sole responsibility of the Federal agency. Certification is a matter for the Federal agency and not for the courts. Forensic science practitioners who practice laboratory bench work should be certified. Conversely, because there is a difference between conducting bench examinations and evaluating the results of the examinations or evaluating the methodology underlying the examinations, those forensic science practitioners and other scientists and experts who have specialized knowledge and expertise and/or conduct research and/or teach in academic and private institutions but who do not perform routine bench work in a forensic facility do not need to be cer-

⁵The NAS Report details the broad scope of the agency's mandate. Such programming could include the development of programs to determine the validity and limitations of the forensic disciplines and to improve the understanding of them by members of the criminal justice system; a strategy to improve forensic science research and educational programs; the funding of academic, independent, and government research projects and educational programs, with emphasis on programs that address the credibility, validity, reliability, and understanding of forensic evidence; the establishment of best practices for forensic science practitioners and laboratories; the determination whether the government should financially support freestanding forensic science programs in colleges and universities or encourage conventional science, statistics, and engineering programs to include forensic tracks as part of their programs; and evaluation of the development and introduction of new technologies in forensic investigations, the use of established technologies on new or different types of evidence, a comparison of new technologies with older ones, and a consideration of the limits of new ones.

⁶Fraud in case work and other intentional acts of misconduct—as defined by the Federal agency—are illustrative of grounds for revocation of accreditation or decertification.

tified in the particular procedure to evaluate the empirical evidence concerning the validity, reliability, and accuracy of various examinations.⁷

RECOMMENDATION 4 (Proficiency testing program):

The Federal agency should institute a national, uniform proficiency testing program. Proficiency testing should mirror actual case work. Because proficiency testing is an integral part of the accreditation and certification process, proficiency testing should be mandatory for forensic science practitioners.⁸

II. Culture of Science

Principle: A culture of science that encourages independence, openness, objectivity, error management, and critical review should be promoted in forensic science practitioners and facilities. Many forensic science practitioners and facilities already exhibit this culture. However, as the NAS Report recognized in calling for segregation of forensic facilities from law enforcement and prosecutorial offices, a close working relationship with law enforcement has detrimentally influenced the mindset of other forensic laboratories and facilities and the personnel within them.⁹ There should be a national, fundamental commitment to a culture of science among all facilities and all practitioners.

RECOMMENDATION 1 (Independence):

Governmental forensic facilities and practitioners should be administered by independent agencies of federal, state, territorial, tribal, or local government. Law enforcement and prosecutorial agencies should have no controlling administrative, budgetary, or managerial relationships to forensic facilities and practitioners. Access of defense attorneys to governmental forensic facilities and forensic practitioners should not be limited by law, policy, or managerial attitude.

RECOMMENDATION 2 (Openness):

The exchange of research information, methods, and data is critical to the advancement of forensic science; therefore, forensic facilities should adopt policies that promote openness in operational, management, and scientific procedures. All scientific protocols, methodologies, and data should be available for examination and critique by academic and research scientists, legal scholars, and forensic science practitioners to promote knowledge, development, and education.

RECOMMENDATION 3 (Objectivity):

Forensic facilities and practitioners should ensure the segregation of case information extraneous to the examination and minimize the impact of unconscious bias on the interpretation of results.¹⁰

⁷The existence of certification should neither create a presumption of admissibility of the forensic science practitioner's testimony nor obligate the court to admit the testimony. Similarly, the absence of certification should neither create a presumption of inadmissibility nor obligate the court to exclude the evidence.

⁸Efforts should be made to join with academic institutions and researchers to fund research for the development and implementation of "blind" proficiency testing that (1) mirrors actual case work, (2) is as difficult as true practitioner case work, (3) is well documented; (4) evolves with the learning of new developments that may affect proficiency, and (5) is, to the extent possible, not made known to the practitioner to be a test. Proficiency testing programs should provide a mechanism whereby failure to successfully complete a test is reported to the agency and made known to those legal professionals who rely on or who have relied upon the practitioner's work, and results in a corrective action plan for the forensic science practitioner.

⁹Many forensic facilities have a number of ways in which they consciously and unconsciously have replaced a culture of science with a law enforcement mentality. See National Research Council, *Strengthening Forensic Science in the United States: A Path Forward* 24 (National Academies Press 2009) [hereinafter "Strengthening Forensic Science"] ("Congress should authorize and appropriate incentive funds . . . for the purpose of removing all public forensic laboratories and facilities from the administrative control of law enforcement agencies or prosecutors' offices."); <http://www.asclcd.org/files/membershipinfo.pdf> (defining membership of American Society of Crime Laboratory Directors as leadership of forensic facilities "whose principal function is the examination of physical evidence for law enforcement agencies in criminal matters and who provide testimony with respect to such physical evidence to the criminal justice system." (emphasis added)).

¹⁰Garrett & Neufeld, *supra* note 1, at 67–71 (discussing erroneous forensic odontology interpretations); Dan E. Krane, *et al.*, *Sequential Unmasking: A Means of Minimizing Observer Effects in Forensic DNA Interpretation*, 53 J. Forensic Sciences 1006 (2008) (calling for forensic science practitioners to analyze evidence without knowledge of known profiles); Robert B. Stacey, *A Report on the Erroneous Fingerprint Individualization in the Madrid Train Bombing Case*, 54 J. Forensic Identification 706 (2004) (discussing false fingerprint identification of United States lawyer suspected of overseas terrorist act in part because lawyer was known to

RECOMMENDATION 4 (Error management):

Forensic evidence conclusions should include the limitations of the opinion offered and the various error rates associated with the method or technique.¹¹ Error rates encompass both methodology error and practitioner error: the chance that the scientific procedure may produce the wrong result and the chance that the practitioner may not have done the procedure correctly. As the NAS Report recognized, errors associated with the method and those associated with the practitioner are inextricably linked. If research to quantify the various error rates is still ongoing and a report is written and/or trial testimony is given regarding the results of a forensic examination, forensic science practitioners should acknowledge the unknown nature and degree of error in such written and testimonial reports of their findings.¹²

RECOMMENDATION 5 (Critical review):

Employment with a forensic facility should require rigorous, continual evaluations of professional competency and independent technical review of case work. Within the forensic science community, there should be critical assessment by the scientific and legal communities through widely read and well-respected professional journal publications, conferences, and training seminars.¹³

III. Code of Ethics

Principle: All forensic science practitioners and supervisors should be required to adhere to a professional code of ethics that clearly articulates ethical obligations and contains a meaningful enforcement mechanism.¹⁴

RECOMMENDATION 1 (Continuing education):

The code of ethics should include continuing educational requirements for all forensic science practitioners that includes specialized training, discovery obligations, and evidence-handling requirements.

RECOMMENDATION 2 (Acknowledgement of subjectivity):

The code of ethics should require the acknowledgement of subjectivity in opinions and conclusions that may be presented in court given a particular set of findings.

RECOMMENDATION 3 (Disclosure obligations):

The code of ethics should reflect an understanding of discovery obligations and the constitutional duty of the government and its agents to disclose to the defense potentially favorable information in criminal proceedings.

RECOMMENDATION 4 (Enforcement):

worship at mosque); William C. Thompson, *Painting the Target Around the Matching Profile: The Texas Sharpshooter Fallacy in Forensic DNA Interpretation*, 8 Law, Probability & Risk 257 (2009) (discussing *post hoc* interpretive shifting that can occur with forensic testing by practitioners seeking to fit crime scene evidence with known profile of suspect).

¹¹See, e.g., Strengthening Forensic Science 142 (“Although there is limited information about the accuracy and reliability of friction ridge analyses, claims that these analyses have zero error rates are not scientifically plausible.”); *id.* 154 (“[T]he decision of the tool mark examiner remains a subjective decision based on unarticulated standards and no statistical foundation for estimation of error rates.”). Forensic opinions of individualization and identity should be replaced by opinions that include probabilistic match associations, as is done with DNA evidence, together with provision of the error rates involved in determining that various characteristics on specimens “match.” Simon A. Cole, *Forensics without Uniqueness, Conclusions without Individualization: The New Epistemology of Forensic Identification*, 8 Law, Probability & Risk 233 (2009); Michael J. Saks & Jonathan J. Koehler, *The Coming Paradigm Shift in Forensic Identification Science*, 309 Science 892 (2005).

¹²This recommendation is made with the realization that some of the recommendations contained in this report may take longer to implement than others, and that, if some courts nevertheless admit forensic evidence prior to completion of studies to determine the measures of uncertainty of the particular forensic techniques, forensic science practitioners should then acknowledge the unknown nature and degree of error in such written and testimonial reports of their findings. Cf. Section IV (Prerequisite of Research), Principle (“The results of any forensic theory or technique whose validity, limitations, and measures of uncertainty have not been established should not be admitted into evidence to prove the guilt of an accused person.”).

¹³Exchange programs, fellowships, and scholarships should be established to promote interaction and communications between the academic, research and forensic science practitioner communities.

¹⁴While a national code of ethics would provide needed uniformity, discipline-specific codes or state codes enforced through licensing boards may be sufficiently effective. National model codes may provide useful guidance in unifying practices and standards.

The code of ethics should have a clearly articulated process for making complaints, and a transparent enforcement mechanism with a range of meaningful penalties that include the disqualification from forensic practice as an available sanction for intentional fraud and other gross misconduct. Adverse ethical findings should be made public.

IV. Prerequisite of Research

Principle: Research programs pertaining to the accuracy, reliability, and validity of forensic theories and techniques, and their limitations and measures of uncertainty where calculable, should immediately be established, fully funded, and carried out. This research should be led and primarily conducted by credentialed and qualified scientists at national research institutions; forensic science practitioners—particularly those guided by a culture-of-science mindset and with histories of independence from law enforcement—should be active research participants and partners.¹⁵ Not all forensic disciplines are equally grounded in validated science.¹⁶ Nor are all forensic processes within a particular discipline equally grounded in validated science.¹⁷ The results of any forensic theory or technique whose validity, limitations, and measures of uncertainty have not been established should not be admitted into evidence to prove the guilt of an accused person.¹⁸ Prior admissibility or use of the results of a forensic discipline, technique, or theory is not conclusive proof of validity or reliability.¹⁹

¹⁵Strengthening Forensic Science 71 (“Although the FBI and NIJ have supported some research in the forensic science disciplines, the level of support has been well short of what is necessary for the forensic science community to establish strong links with a broad base of research universities and the national research community. Moreover, funding for academic research is limited and requires law enforcement collaboration, which can inhibit the pursuit of more fundamental scientific questions essential to establishing the foundation of forensic science.”); *id.* 189 (“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.”).

¹⁶*Id.* 6–7 (“The term ‘forensic science’ encompasses a broad range of forensic disciplines, each with its own set of technologies and practices. In other words, there is wide variability across forensic science disciplines with regard to techniques, methodologies, reliability, types and numbers of potential errors, research, general acceptability, and published material. . . . Many of these differences are discussed in the body of this report.”); *id.* 127–82 (describing various forensic disciplines and the differences in their scientific underpinnings).

¹⁷For example, most uses of forensic evidence to exclude an individual as the possible contributor of evidence left on a crime scene are relatively straightforward applications of accepted procedures. *See supra* note 2.

¹⁸*See generally In re Winship*, 397 U.S. 358, 362 (1970) (referring to presumption of innocence as “that bedrock ‘axiomatic and elementary’ principle whose ‘enforcement lies at the foundation of the administration of our criminal law’” (quoting *Coffin v. United States*, 156 U.S. 432, 453 (1895))).

While the prosecution presents at trial the vast majority of forensic evidence, defense counsel sometimes use forensic evidence affirmatively in their representation of accused persons. Defense attorneys should seek to use validated science—and should seek to avoid using science that has been demonstrated to be invalid—in their representation. Ultimately, a defense counsel’s use of forensic evidence in the case-in-chief is guided by all defendants’ constitutional right to present evidence in their behalf and by all defense attorneys’ obligations to zealously represent their clients and to provide constitutionally effective assistance of counsel. *See generally Chambers v. Mississippi*, 410 U.S. 284, 302 (1973) (“Few rights are more fundamental than that of an accused to present witnesses in his own defense. . . . [W]here constitutional rights directly affecting the ascertainment of guilt are implicated, the hearsay rule may not be applied mechanically to defeat the ends of justice.”); *Washington v. Texas*, 388 U.S. 14, 19 (1967) (“The right to offer the testimony of witnesses, and to compel their attendance, if necessary, is in plain terms the right to present a defense, the right to present the defendant’s version of the facts as well as the prosecution’s to the jury so it may decide where the truth lies.”); *Patrick v. State*, 750 S.W.2d 391, 391 (Ark. 1988) (“The legal question in this case is whether the results of a portable breath test, or what is sometimes called a roadside sobriety test, which are not admissible to prove a person is guilty of driving while intoxicated, are admissible when they would indicate a person is not guilty. In this case the answer is yes because the evidence is exculpatory, was crucial to the defense, and sufficiently reliable to warrant admission.”).

¹⁹*See, e.g., United States v. Green*, 405 F.Supp.2d 104, 109 (D. Mass. 2005) (“The more courts admit this type of tool mark evidence without requiring documentation, proficiency testing, or evidence of reliability, the more sloppy practices will endure; we should require more.”). Courts have historically exhibited extreme reluctance to deny the prosecution the use of forensic evidence at trial. *See* Strengthening Forensic Science 96 (citing Peter J. Neufeld, *The (Near) Irrelevance of Daubert to Criminal Justice: And Some Suggestions for Reform*, 95 American J. Public Health S107, S109 (2005), and Paul C. Giannelli, *Wrongful Convictions and Forensic Science: The Need to Regulate Crime Labs*, 86 N.C. L. Rev. 163 (2007)). The NAS Report, since its publication in February 2009, has become part of a change in the legal landscape in which the need for demonstration of the scientific validity and limitations of forensic theories and techniques can no longer be doubted, and therefore unvalidated forensic evidence should not be admitted against a defendant in court. Despite this proscription against admission by the prosecution of

RECOMMENDATION 1 (Determination of probability associations):

Based upon the research into the uncertainties inherent in most forensic processes, match probability associations about the evidence should, whenever possible, generally replace conclusions such as “match,” “uniquely associated with,” “source attribution,” “individualization,” “conclusive,” “positive,” “absolute,” and other similar terminology; and if such terms *are* used, they should only be used when probabilistically defined elsewhere in the report.

RECOMMENDATION 2 (Relationship between research studies and case work):

Studies of the reliability, validity, and accuracy of forensic techniques or theories should mirror actual case work and samples. The research should distinguish between industry performance (achieved across practitioners and facilities) and individual performance (achieved by specific practitioners and specific facilities).

RECOMMENDATION 3 (Critical review):

All research concerning the validity of a forensic theory or technique should be the product of high-quality research using sound methodology and published in well-regarded scientific journals that are widely, publicly available.

RECOMMENDATION 4 (Error rates):

Research should be conducted to establish the various types of error rates associated with the analysis. *See, supra* Section II (Culture of Science), Recommendation 4 (Error management) and note 12. To explore these issues, research methods should follow those used in clinical laboratories to generate such error rates.

RECOMMENDATION 5 (Automated techniques):

Research conducted to develop automated techniques capable of enhancing forensic technologies should include consideration of subjective interpretations and assumptions embedded in the technique and any limitations associated with the automated technique. Notification of such limitations should be provided together with results.

RECOMMENDATION 6 (Minimizing bias):

The basic principles of human observer bias and sources of human error are sufficiently established that there are precautions that can and should be implemented now.²⁰ As research into observer bias continues, additional findings should be taken into account in continual improvement of policies, protocols, and procedures.

RECOMMENDATION 7 (Documentation):

Documentation of all procedures and results of forensic examinations is necessary to permit an independent reconstruction of the examination to establish the reliability of the results. Research should be conducted to determine what constitutes sufficient documentation to permit an independent reconstruction of a forensic examination. Research should also be conducted into appropriate procedures for case-specific peer review by practitioners of each other’s work and documentation of such, taking into account, *inter alia*, the extensive current literature on observer bias.

V. Education

Principle: The NAS Report accurately observed that legal professionals generally lack the scientific expertise necessary to comprehend and evaluate forensic evidence in an informed manner. Attorneys and judges need significant education and training in the fundamentals of science, statistics, and common forensic practices; and in the limitations of, and potential forms and scope of error associated with, those practices.

unvalidated forensic evidence, some courts may nonetheless improperly admit such evidence prior to completion of the necessary studies to determine their validity and limits. Such circumstances should not occur; however, if they do, at a minimum, jurors must be instructed about the lack of demonstrated validity, the limitations of the opinion offered, and the existence and degree of various error rates associated with the method or technique; and the defense must be permitted to present evidence consistent those instructions.

²⁰*See, e.g.,* D. Michael Risinger, *et al.*, *The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion*, 90 Cal. L. Rev. 1 (2002).

RECOMMENDATION 1 (Law students):

Law schools should offer courses in scientific principles and scientific evidence. As part of a law school curriculum, students should be encouraged to take courses in science and statistics. The development of J.D.-Ph.D. programs in basic sciences, statistics, and engineering should be encouraged through grants, fellowships, and other means.

RECOMMENDATION 2 (Lawyers and judges):

The Federal Government should appropriate funding for the training of criminal defense attorneys, prosecutors, and judges in science, general scientific principles, and the ethical and constitutional obligations related to the disclosure and presentation of forensic evidence. Given the different roles in the adversarial process between the prosecution and the defense,²¹ separate trainings for prosecutors and defense counsel should be the primary pedagogical model, with the possibility of additional joint training where common purposes are identified. The training of prosecutors should include their disclosure obligations and the limits of forensic evidence. The training of defense lawyers should be focused on lawyers for indigent defendants, who have historically had the least access to forensic resources and on those regions of the country that have historically not had the funds to provide high-quality training to lawyers. The Federal government should dedicate funds to public defender organizations, criminal defense bar associations, and other criminal defense organizations that currently have effective training programs and to any new or existing entities that demonstrate a commitment to training and present an effective training proposal for indigent representation.

RECOMMENDATION 3 (Educational resources):

Funds should also be appropriated for the purpose of establishing through the Federal agency a public repository for transcripts of forensic science practitioners; pleadings and transcripts in cases involving challenges to forensic evidence; and journal articles and treatises involving forensic evidence, especially those journals or treatises that are out-of-print or in limited circulation. The overseeing scientific Federal agency should make available a public repository of such material.

VI. Transparency and Disclosure

Principle: The principle of transparency is fundamental to a fair and effective criminal justice system and is a hallmark of good science. As one scholar put it, "Science and secrecy do not sit comfortably together."²² The ability of attorneys to evaluate, investigate, present, and confront forensic evidence at trial is dependent upon the complete and timely disclosure of information about the examination, the conclusions of the forensic science practitioner, and the facility where the examination was conducted. In every case involving forensic evidence, regardless of the current state of the science and/or advancements made, both the prosecution and the defense will require full access to the forensic evidence and underlying data related to a particular case.

RECOMMENDATION 1 (Transparency of forensic facility operations):

All operations of forensic facilities should be open to scrutiny; their training, administrative, and policy manuals should be publicly accessible.

RECOMMENDATION 2 (Ethical requirement):

Forensic facilities and practitioners should adopt and follow a code of ethics that emphasizes, among other things, the importance of full disclosure. *See* Section III (Code of Ethics), Recommendation 3 (Disclosure obligations).

RECOMMENDATION 3 (Disclosure obligations):

²¹ Compare *Kyles v. Whitley*, 514 U.S. 419 (1995), *Giglio v. United States*, 405 U.S. 150 (1972), *Brady v. Maryland*, 373 U.S. 83 (1963), and *Napue v. Illinois*, 360 U.S. 264 (1959), with *Holmes v. South Carolina*, 547 U.S. 319 (2006), *Wiggins v. Smith*, 539 U.S. 510 (2003), *Crane v. Kentucky*, 476 U.S. 683 (1986), *Strickland v. Washington*, 466 U.S. 668 (1984), *Chambers v. Mississippi*, 410 U.S. 284 (1973), and *Washington v. Texas*, 388 U.S. 14 (1967). *See also* note 19, *supra* (citing cases on burden of proof, presumption of innocence, and right to compulsory process).

²² Sheila Jasanoff, *Transparency in Public Science: Purposes, Reasons, Limits*, 69 *Law & Contemporary Problems* 21 (2006).

Forensic science practitioners and forensic facility leadership should be trained on the legal obligations of disclosure of *Brady v. Maryland*, 373 U.S. 83 (1963) and *Kyles v. Whitley*, 514 U.S. 419 (1995), and local discovery rules to ensure a full understanding of the constitutional duty of the government and its agents to disclose to the defense potentially favorable material and other discoverable information in criminal proceedings.

RECOMMENDATION 4 (Access to researchers and litigants):

Forensic research should be available to be scrutinized by scientists outside the forensic community. Research findings, underlying data, and courtroom testimony concerning such research and data should be archived in a publicly accessible database. See Section V (Education), Recommendation 3 (Educational resources).

RECOMMENDATION 5 (Minimum disclosure requirements):

Uniform minimum disclosure requirements should be imposed in all jurisdictions to promote the effective assistance of counsel, due process, and fair trials for all criminal defendants.²³ Because, as noted before, see, *supra* notes 19 & 22, the prosecution and defense counsel have different responsibilities in our constitutional structure and because local discovery rules usually expand upon those differences by imposing broader disclosure obligations on the prosecution than on the defense, prosecution and defense disclosure obligations necessarily differ from each other.

RECOMMENDATION 6 (Reports):

Forensic reports should be complete, thorough, and accurate. Reports should be written so that members of the legal system are able to discern what method of comparison or technique was used. The report should clearly define the standards for the method or technique, all terms used in the report, and the results of the comparison.

RECOMMENDATION 7 (Databases):

Defense attorneys should have access to data in government-administered forensic databases upon a written statement that such access may lead to relevant evidence and is necessary for effective representation of a criminal defendant. Access should be provided in a manner consistent with the privacy rights of the individuals in the databases.

VII. Defense Resources

Principle: Forensic reform must be viewed within the framework of the fundamental constitutional protections established to ensure fair and accurate verdicts based on trustworthy evidence and to prevent wrongful convictions. While the prosecution has historically been the primary proponent of forensic evidence, the defense bar also uses forensic evidence. Defense counsel sometimes use forensic evidence at trial, and, as is well known, many of the exonerations of innocent persons have been based on defense counsel's use of forensic evidence. Additionally, even hampered by severe economic constraints, it is typically the defense bar that has spotlighted deficiencies in, and limitations of, the various forensic disciplines.²⁴ Defense counsel should have the ability to consult with experts in the forensic disciplines and in related scientific fields to identify for the courts and juries the scientific limits of the

²³The following should be readily accessible to attorneys representing criminal defendants in cases involving scientific evidence: (1) all information pertaining to the analysis; (2) information pertaining to quality control within the forensic facility; (3) information pertaining to the forensic science practitioner; and (4) standard operating procedure manuals and validation studies. Reports should include: (1) the opinion that will be presented in court; (2) all assumptions being made in rendering the above opinion; (3) a clear characterization of any limitations and an associated statistic that describes the weight that should be attributed to the evidence; and (4) the underlying basis of the opinion including identification of any published or unpublished material relied on. Forensic facilities should provide up-front information regarding the results of examinations, all results of automatic database searches conducted as part of the examination (*e.g.*, CODIS and AFIS), documentation of quality control problems in the facility or associated with a particular forensic science practitioner, and standard operating procedures and validation studies. While these disclosure requirements are broader than the current policies of most forensic facilities, they are not onerous and should not only be provided after litigation. In fact, some forensic facilities already disclose the case-specific information as a matter of course upon request, and/or provide protocols and other non-case-specific information publicly online.

²⁴See generally Jay D. Aronson, *Genetic Witness* (2007) (discussing how defense courtroom challenges to admission of forensic DNA evidence led to vast improvement in its development and presentation).

evidence and to present the results of independent testing and the testimony of independent experts when appropriate. Forensic reform should therefore include providing the defense with resources to obtain the assistance of forensic and scientific experts for confidential consultation and testimony, and the use of forensic facilities for independent, confidential testing. In all jurisdictions, indigent defendants, like defendants with financial means, should have access to assistance from appropriate experts.

RECOMMENDATION 1 (Scope):

Criminal defendants should be provided expert assistance commensurate with the needs of the case. Assistance shall include consultation with experts, expert testimony, and testing at forensic facilities.

RECOMMENDATION 2 (Indigent defense):

The Federal Government, through the central Federal scientific agency, should provide increased resources to the institutional indigent defense bar to provide for greater access to, and assistance by, experts versed in the forensic disciplines and their scientific underpinnings. In those circumstances where some or all indigent representation is provided by public defender offices, this money should be provided directly to federal, state, territorial, tribal, and local public defender offices for those offices' independent determinations of how best to use funding for forensic services in the representation of their indigent defendants. In those circumstances where indigent representation is provided by non-institutional court-appointed attorneys and circumstances where the accused can retain counsel but cannot afford expert services, the central Federal scientific agency should provide money specially targeted for scientific and forensic assistance to the courts or agencies designated to administer funding to court-appointed counsel. All such funds for non-institutional court-appointed lawyers should be available to court-appointed counsel upon a written, *ex parte* statement that expert assistance is necessary to effectively represent the defendant.

RECOMMENDATION 3 (Experts):

Although individuals trained as forensic science practitioners are one category of expert who may possess relevant and specialized knowledge, there are many other types of experts to whom prosecutors and defense lawyers can and should turn for assistance in understanding forensic evidence. In addition to forensic science practitioners, lawyers frequently consult with and call as trial witnesses scientists employed by academic and private institutions who have expertise and training in scientific and forensic disciplines, scientific principles including validity testing and the evaluation of empirical data, and in other scientific disciplines that provide the underpinning for, and context of, forensic disciplines. Further, courts have also recognized that even scholars and academic researchers who do not have degrees in science but whose publications demonstrate an understanding of the underpinnings of particular forensic discipline can contribute to the full and proper evaluation of forensic evidence. The funding for expert assistance should necessarily support and encourage assistance both from forensic practitioners and from scientists and academicians whose expertise can relate to and inform the meaning of the forensic evidence.

RECOMMENDATION 4 (Consultation):

Government forensic laboratories and other facilities that contract with the government should be open and accessible to both prosecutors and defense lawyers.²⁵ In that regard, forensic science practitioners and directors should be available to meet with defense counsel and experts retained by the defense to discuss and answer questions regarding the methodologies, tests, and findings in a particular case. Government forensic science practitioners should also, when practical, be available to consult with defense counsel about cases from the same or other jurisdictions in circumstances in which there is no legal conflict of interest if defense counsel elects to seek assistance from such experts. Best practices generally prescribe that defense counsel consult an expert who

²⁵ The association between forensic facilities and practitioners and law enforcement must end, with a culture of science fully inculcated throughout the entire forensic science community. Recommendations 3 and 4 of this section are made with the realization that some of the recommendations contained in this report may take longer to implement than others, and that the existing structure is one in which many forensic facilities *are* in an administrative, budgetary, and/or managerial subordinate role relative to law enforcement and prosecutorial agencies. See *supra* note 10.

is entirely independent of law enforcement and the prosecution. There should, therefore, never be a requirement or expectation that defense counsel will rely upon government forensic science practitioners as experts instead of consulting with private, independent experts.

RECOMMENDATION 5 (Confidential testing):

Government forensic facilities should be available if there is no conflict of interest to conduct confidential testing and to provide confidential results to the defense at the request of defense counsel. Best practices generally prescribe that defense counsel use a forensic facility that is entirely independent of law enforcement and the prosecution. Therefore, there should never be a requirement or expectation that defense counsel will use government forensic facilities to conduct independent testing. The defense may employ whatever facility—public or private—that it deems appropriate in a particular case. Because forensic facilities offer different services and have different strengths and weaknesses, funding should be made available to the defense to seek forensic testing from more than one facility on the same piece(s) of evidence.

On behalf of NACDL, I am grateful for the opportunity to submit this statement. Thank you for considering our views on this matter. We stand ready to assist the Committee and its staff in developing measures that would strengthen forensic evidence and its presentation in the courtroom.

PREPARED STATEMENT OF NORAH RUDIN, PH.D. (FORENSIC CONSULTANT) AND KEITH INMAN, M.CRIM (ASSISTANT PROFESSOR, CALIFORNIA STATE UNIVERSITY, EAST BAY)

In February, 2009 the National Research Council of the National Academies issued their report, *Strengthening Forensic Science in the United State: a Path Forward*. Although the report shocked much of the general public, for many associated with the judicial system, and even for some forensic scientists, its revelations are inescapable. Although some in the forensic community have been sounding the alarm bell for years, our profession, as a whole, has been chosen stagnation over progress, deliberate ignorance over enlightenment. Given the grave consequences of our work—deprivation of liberty or life on one hand, allowing violent offenders to remain at large on the other—aspiring to anything short of the highest scientific standards fails to serve the best interest of justice. In addition to the obvious impact of questionable forensic work on the safety and security of the populace, an indirect consequence to society at large manifests in an erosion of trust that the judicial system will function fairly and objectively.

Over more than a century of practice, the efficacy of forensic science rarely has been questioned. As Judge Harry T. Edwards (co-chairman of NRC group) stated in previous comments to the U.S. Senate Committee on the Judiciary¹

Rather, I simply assumed, as I suspect many of my judicial colleagues do, that forensic science disciplines typically are grounded in scientific methodology and that crime laboratories and forensic science practitioners generally are bound by solid practices that ensure that forensic evidence offered in court is valid and reliable. I was surprisingly mistaken in what I assumed. The truth is that the manner in which forensic evidence is presented on television—as invariably conclusive and final—does not correspond with reality.

Judge Edwards further comments on the lack of universally accepted scientific practices, including:

. . . The frequent absence of solid scientific research demonstrating the validity of forensic methods, quantifiable measures of the reliability and accuracy of forensic analyses, and quantifiable measures of uncertainty in the conclusions of forensic analyses; . . .

These observations go to the heart of the NRC committee's disillusionment with forensic science, and must be addressed if the profession is to regain the professional capital it historically has enjoyed. We take these ideas one at a time.

As so often happens, "validation" has become a buzzword fed to the court as part of an automatic admissibility package. First, it is necessary to appreciate the difference between attempting to confirm the validity of an existing method, and performing fundamental research to determine the capabilities and limitations of a

¹Statement of The Honorable Harry T. Edwards Co-Chair, Committee on Identifying the Needs of the Forensic Science Community The Research Council of the National Academies before the U.S. Senate Committee on the Judiciary March 18, 2009.

method. The former assumes the validity of the method, then sets out to prove it, directly antithetical to the scientific method; the latter is what is required, especially in the historical disciplines comprising comparison evidence, such as fingerprints, bullet striations, and shoeprints. True validation forms the basis for a set of interpretation guidelines that support a conclusion incorporating, among other things, the limitations of the procedure (and the evidence) and the uncertainty associated with the result. Unfortunately, the intractable response of the forensic community has been simply to support current practice, by proposing “validation” of existing methods, rather than taking a step back and performing fundamental inquiries into the nature of physical evidence. Unfortunately, this is a Band-Aid approach guaranteed merely to obscure a deep fundamental problem within forensic science.

Second, the idea of quantifying the uncertainty in various aspects of forensic analysis leads directly to a fundamental issue in the justice system, the inherent tension and conflict between science and the law. While the law must definitively resolve the specific issue at hand with, science can only make provisional conclusions, always subject to update based on new information, and always subject to at least some level of ambiguity. At its very core, science eschews the type of certainty required by law; rather, science seeks to measure uncertainty.² However, because of its long and intimate relationship with the legal system, the applied science described by the adjective forensic has been subtly co-opted by the law; its practitioners have succumbed to the paradigm of the legal system, providing opinions of individualization and identification under the guise of fact, instead of insisting that science be their primary allegiance. Forensic science must seek its scientific roots if it has any hope of retaining, or perhaps, gaining, credibility going forward. Individualization, identification, source attribution, or any other inference of unique common origin is not only unnecessary, it is scientifically unsupportable.³ Further, such inferences of source must properly remain with the trier of fact; the forensic scientist must restrict herself to quantifying the uncertainty attached to the observation that two items appear to be indistinguishable by the tests performed.

Another observation made by Judge Edwards is:

the paucity of research programs on human observer bias and sources of human error in forensic examinations;

Although the forensic community has made some progress in accepting observer bias as fundamental to the human condition, many retain the misguided notion that subconscious bias may be overcome by education, understanding, or simply brute force of will^{4,5}. While further research into this issue, is clearly necessary, specifically with regard to the specific circumstances encountered in forensic science, no reason exists to delay the implementation of sequential unmasking protocols⁶ designed to minimize the opportunity for such bias to affect conclusions derived from forensic analyses.

Another of Judge Edwards’ points we would like to address is:

the lack of autonomy of forensic laboratories (which are often subject to the administrative control of law enforcement agencies or prosecutors’ offices;

As evidenced by this quote, the problem of undue influence over forensic laboratories by law enforcement is oft-perceived to be simply administrative in nature. Consequently, the proposed solution is to remove the laboratory from the chain of command. This is the situation for all of the government laboratories cited as “independent” by Judge Edwards in the addendum to his comments. While these laboratories are separated administratively and financially from law enforcement, they do not function as truly independent laboratories; they still perform work only for prosecutorial agencies. In our experience, including specific knowledge gained from reviewing some of the aforementioned laboratories, administrative separation does nothing to alter the loyalty to, or perceived affiliation with, law enforcement. To shift that particular paradigm, a laboratory would need to accept work from both prosecution and defense. The criminalists would need to be challenged to act as truly independent scientists, actively seeking alternative explanations for the data,

²Ten myths of science: Myth #5 ; Science and its Methods Provide Absolute Proof http://www.bluffton.edu/~bergerd/NSC_111/TenMyths.html.

³Cole, S., Forensics without uniqueness, conclusions without individualization: the new epistemology of forensic identification *Law, Probability and Risk* 2009;

⁴http://www.swgfast.org/Comments-Positions/SWGFAST_NAS_Position.pdf.

⁵Budowle, et. al., A Perspective on Errors, Bias, and Interpretation in the Forensic Sciences and Direction for Continuing Advancement, *J. Forensic Sci.*, 54:798, 2009.

⁶Krane, D., et al., Sequential Unmasking, A Means of Minimizing Observer Effects in Forensic DNA Interpretation, *J. Forensic Sci.*, 53:4, 2008.

and providing true transparency into their work. The model for this is provided by a few (although not nearly all) private laboratories which perform fee-for-service work for any professional client. Although we do not suggest complete privatization as a solution to this issue, elements of it could be applied to the government laboratory system to foster greater neutrality and openness.

One strong suggestion by the NAS committee is to mandate accreditation of laboratories that perform forensic work. The call for accreditation has been adopted as a chant by, not only the forensic community, but other stake holders, suggesting it as almost a systemic cure-all. We could not disagree more with the notion that accreditation is a universal panacea. While uniform regulation and oversight is useful to create an underlying infrastructure upon which quality casework can be performed, it is neither designed to, nor has the capacity to, guarantee the veracity of results and conclusions produced by forensic laboratories. Like “validation,” “accreditation” has been reduced to a buzzword that conveys a false sense of security to the courts and to the public. Yes, accreditation for all laboratories testing physical evidence should be required, but it is really only one piece in the middle of a complex jigsaw puzzle, as the following analysis will demonstrate.

Long before evidence ever reaches the laboratory, it must be identified and collected. The best analysis can never compensate for the failure to collect relevant evidence or store it properly. In many jurisdictions, law enforcement personnel, rather than criminalists, are assigned to process crime scenes. They often receive minimal training and the workforce is subject to rotation and turnover. We must direct more attention to training the officers that perform this critical work. And we must realize that collecting evidence requires a much more sophisticated approach than just donning a pair of latex gloves and moistening a swab to collect a blood stain. Even at this early stage in the process, a hypothesis, or better yet competing hypotheses, must be articulated, and the individual tasked with collecting evidence must search for relevant evidence with intelligence. Blindly collecting what appears to be obvious physical evidence will almost certainly leave important clues at the scene.

In the laboratory, the really important decisions bookend the actual analysis (and it is only the analytical procedures on which accreditation focuses). Prior to testing, the criminalist must decide which items of evidence should be analyzed, using which protocols; he must determine which screening tests should be performed before a piece of evidence is consumed using an analytical procedure. The most accurate and reliable test can be performed, but if it answers an irrelevant question, the results are useless. As an example, your doctor listens to your complaints, examines you, and orders five tests. The laboratory conducts them all correctly, in duplicate, gives results that include an error range, and also provides information about the range of normal values, in complete compliance with their SOP and QA guidelines (in other words, meeting all of the requirements of accreditation). But if the doctor has ordered the wrong tests, the results of those tests will at best be worthless, and at worst lead the doctor in the wrong direction, resulting in a diagnosis that is incorrect, and potentially harmful.

The interpretation of results after the analysis comprises the other bookend. As we have discussed previously, interpretation of laboratory results must be supported by true scientific validation that determines the capabilities and limitation of the method. Assumptions must be recognized, and explicitly incorporated into the interpretation. Finally the written report must reflect the totality of the analyst’s results, inferences, and conclusions, and it should be written in clear, informative language; testimony should hold no surprises.

Further, it is crucial to understand that forensic science does not operate in a vacuum; rather it interfaces with the legal and judicial system at every level. Thus, rather like a dysfunctional family, the failures are systemic, supported at each step of the process by the larger entity. Not only do forensic practitioners bear the responsibility to ensure that the craft they practice is valid and reliable, the scientific community at large must embrace forensic science in order to hold the profession to the highest scientific standard. Historically, this has not been the case, as many of the forensic disciplines evolved under the auspices of law enforcement rather than academics. Attorneys must educate themselves to use forensic science responsibly, and judges must be aware of the capabilities and limitations for various forensic disciplines.

To again quote Judge Edwards’ comments to the Senate Judiciary Committee:

The judicial system is encumbered by, among other things, judges and lawyers who generally lack the scientific expertise necessary to comprehend and evaluate forensic evidence in an informed manner, defense attorneys who often do not have the resources to challenge prosecutors’ forensic experts, trial judges (sitting alone) who must decide evidentiary issues without the benefit of judicial col-

leagues and often with little time for extensive research and reflection, and very limited appellate review of trial court rulings admitting disputed forensic evidence.

In short, fixing forensic science alone is insufficient when addressing the shortcomings of science practiced within the context of law. The legal side of the equation must be remedied as well.

In some sense, the players who struggle the most with science are judges. Judges work in relative isolation, typically consider only information provided to them by the litigating attorneys, and are afforded few case-independent educational opportunities. Additionally, because judges are the ultimate authority figure in trial-level litigation, they are rarely questioned, certainly not from below, and all too rarely from above. Yet they, and they alone, are the gatekeepers of how and when forensic evidence interfaces with the criminal justice system. Educating judges about physical evidence must be a priority if we are to elevate the use of forensic evidence in the courts.

While judges are not and should not attempt to become scientists, neither should attorneys. To avoid this temptation, both prosecution and defense must have equivalent access to qualified experts. The current situation is clearly lopsided, as the prosecution has free access to government laboratory scientists, while most defendants must beg for court-mandated funding to hire independent experts. As long as the U.S. maintains an adversarial legal system, the best opportunity for justice to be served is to ensure that attorneys on both sides have access to commensurate resources.

Finally we address transparency, an element sadly lacking in many jurisdictions. We are constantly dismayed at the attitude that discovery is somehow a shell game, that defense must ask three times nicely, using the right words, to obtain certain pieces of information from the government crime laboratory, such as error logs or underlying data. A better model for discovery is the military model, detailed in the *Uniform Code of Military Justice*. Although a Court Martial proceeds in a similar fashion to a civilian criminal trial, with full advocacy from both sides, complete transparency in discovery is both required and uniformly executed. This streamlines the process and minimizes theatrics. The civilian criminal justice system would do well to emulate this model.

To quote Judge Edwards a final time:

As the Committee's report makes clear, what is needed is a massive overhaul of the forensic science system in the United States, both to improve the scientific research supporting the disciplines and to improve the practices of the forensic science community.

The path forward for forensic science remains shrouded in uncertainty. We have addressed a few of the most pressing issues here and look forward to continuing to participate in elevating our profession. We leave you with this closing thought:

Forensic science developed historically as an adjunct to the law enforcement effort, subject to the same point of view (bias) as law enforcement. In our parlance, forensic science has been used for verification, simply corroborating what is believed to be true without actually challenging it. However, science is capable of providing much greater value to the law, by serving as an *independent check in the administration of justice*. The paradigm must shift away from science used in blind support of law enforcement to science employed as one instrument, among many, with which to administer justice.

PREPARED STATEMENT OF DR. KEITH B. MORRIS, DIRECTOR OF FORENSIC AND INVESTIGATIVE SCIENCE, WEST VIRGINIA UNIVERSITY

The Forensic & Investigative Science Program (FIS) at West Virginia University has been in existence for more than 10 years. During this time it has developed both its undergraduate and masters degree programs.

The quality of forensic science programs needs to be evaluated based on a number of factors namely the quality of the students it produces, the quality and applicability of the research it produces, its involvement and support to the community and, in the case of WVU as a land-grant university, the state in which it is located. The administration of WVU believes that to be positive all programs need to have three features: faculty, facilities, and equipment. It is challenging to recruit suitable faculty in the field, but WVU is in a fortunate position to have a faculty cadre with both the academic and practical experience in forensic science. These experiences are used to develop students both at the graduate and undergraduate level. Three students have graduated with PhDs in Chemistry (with a focus in forensic science)

over the past 5 years and currently there are 9 students enrolled in this PhD program. In addition, six students have graduated with masters degrees, one of whom received the *Emerging Forensic Scientist Award* at the 2008 meeting of the American Academy of Forensic Sciences. Currently the program has 380 registered majors and pre-majors on the undergraduate level and 16 in the masters program. Facility wise the program has 18,000 sq. ft. of laboratory space dedicated solely for its use as well as a crime scene facility consisting of three houses and a vehicle processing laboratory. The program is searching for two additional tenure track positions to expand the current research faculty.

The program has, as it has matured, received significant donations and support for its activities. Of specific note is the donation from Mr. Ming Hsieh of 3M Cogent. Part of this donation included a Cogent AFIS system. The FBI has made available 1.8 million fingerprint sets to the program for specific research projects. Mr. Hsieh has also endowed two distinguished professorships in the FIS program. As far as we are aware the FIS program is the only forensic program to have endowed professorships. This supports the concept of the National Academy of Sciences report in developing new strategies for research in forensic science. Faculty members in the program have had research funded by the Department of Defense, the National Institute of Justice, the FBI, NIST, and others. Research is focused on areas identified by the NAS report as weak points.

Evaluating the recommendations of the NAS study, it is evident that the role that WVU has played, and will continue to play, in teaching and research will support the future of the forensic science enterprise in the USA. Students at the undergraduate level are well prepared. The FIS Program believes that strong Federal support for research specifically focused on forensic science is needed where a well-defined research agenda has been determined.

PREPARED STATEMENT OF ROBIN T. BOWEN, INTERIM DIRECTOR, FORENSIC SCIENCE INITIATIVE, WEST VIRGINIA UNIVERSITY

The West Virginia University (WVU) Forensic Science Initiative (FSI) plays a critical role in the identification, development, coordination, and execution of forensic science resource and development projects that directly aid state and local forensic science agencies. For instance, FSI provide ASTM standards to crime laboratories throughout the United States. FSI has a long and developed record of demonstrated service in the forensic community. Since its inception in 2002, the FSI has provided research, testing and evaluation, training, and resources to the forensic science community. The FSI seeks to improve and professionalize forensic science through peer interactions and training in the sciences, technologies, and processes critical to the application of forensic science. Thousands of forensic professionals have been helped with their jobs, careers, and, most importantly—cases by utilizing projects offered by FSI. Of forensic professionals surveyed who have used FSI resources, 95% report that the content has been useful to them in their daily official duties.

FSI projects maintain the mission of the National Institute of Justice Office of Science and Technology, specifically, “to carry out programs that, through provision of equipment, training, and technical assistance, improve the safety and effectiveness of law enforcement technology and improve access to such technology by Federal, State, and local law enforcement agencies.” According to the *Census of Publicly Funded Forensic Crime Laboratories*, training comprises less than 1% of criminal justice agency’s total budget, thus showing a severe need for such training programs. Laboratories are facing increased workloads, backlogs, and ever changing technologies and methodologies despite the decrease in budgets. FSI projects address training needs of the forensic community. These needs are stated in the National Research Council report, *Strengthening Forensic Science in the United States: A Path Forward* (2009) as well as these studies funded by NIJ—*Forensic Sciences: Review of Status and Needs* (1999);¹ *Education and Training in Forensic Science: A Guide for Forensic Science Laboratories, Educational Institutions, and Students* (2004),² developed by TWEGD and a report prepared by ASCLD or NIJ,

¹National Institute of Justice. 1999. *Forensic Sciences: Review of Status and Needs*. Washington, D.C.: National Institute of Justice.

²National Institute of Justice. 2004. *Education and Training in Forensic Science: A Guide for Forensic Science Laboratories, Educational Institutions, and Students*. Washington, D.C.: National Institute of Justice.

published in May 2004, which has become known as the *180-day Study Report: Status and Needs of United States Crime Laboratories*:³

Prior to conducting analysis on evidence, forensic scientists require both basic scientific education and discipline-specific training. To be in compliance with widely-accepted accreditation standards, scientists in each of the disciplines must have, at a minimum, a baccalaureate degree in a natural science, forensic science, or a closely-related field. Each examiner must also have successfully completed a competency test (usually after a training period) prior to assuming independent casework.⁴

Training and education are persistent needs in the forensic science profession. WVU's Forensic Science Initiative is a leader in training forensic professionals. To date, hundreds of classes have been held at WVU and around the nation in topics as diverse as fiber and textile analysis, crime scene investigation, court testimony, bloodstain pattern analysis, and shooting incident reconstructions. Thousands of forensic scientists have gained new skills or enhanced existing ones through FSI courses. In order to best serve state and local forensic science providers, these courses are offered at no cost to participants with lodging costs offset through the FSI. Since 2006, FSI has held multiple large-scale training events, each conducted over 6 days with roughly 30 separate classes offered in a mini-semester format. Thousands of forensic professionals have attended and no training of forensic professionals at this scale has been attempted by any other entity.

While the WVU FSI has become synonymous with training forensic professionals, many forensic professionals cannot afford training, are not permitted to participate, or cannot take time away from casework to attend training sessions in person.

To meet the training needs of those who cannot get away from the laboratory, FSI has developed 25 online courses in collaboration with the Extended Learning Department at WVU. These courses have won international awards for content and design. Courses include Ethics in Forensic Science, Forensic Photography, Hair Evaluation for DNA Analysis, The Science of Fingerprints, Integrated Ballistic Identification Systems (IBIS), and many more that directly address needs stated by the NAS report as well as the forensic science community. Thousands of professionals have taken these courses; several agencies have made some courses required as a part of their in-house training curriculum. These courses are provided at no cost to duly authorized law enforcement personnel, crime laboratory personnel, correctional officers, and crime scene staff with the administrative costs being borne by the FSI.

The program's overall impact on the forensic science community is training practitioners to thoroughly process, investigate, and prosecute criminal cases, resulting in more efficient and effective practices that will ultimately lead to a safer and happier community. By any measure, the training has been a success, delivering quality content with reliable logistics.

The FSI has involved numerous faculty members, departments, and schools (Arts and Sciences, Engineering, Business and Economics, and Health Sciences) within WVU in past forensic resource projects, research, testing and evaluation, and training. These projects have provided needed deliverables to the forensic science community while building award-winning infrastructure at WVU for future projects and a competitive ability for other grants. The FSI has also broken new ground by initiating the study of forensic laboratories from a business and economics perspective. The Forensic Science Initiative is an integral part of building the quality reputation of forensic sciences at WVU and across the world.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN D. ROCKEFELLER IV
TO DR. CONSTANTINE A. GATSONIS

Scale of the Issue

Question 1. Some have raised criticisms of the National Academy of Sciences review of forensics claiming that the panel lacked forensic analysts, did not review all of the existing research, and did not consider the knowledge gained by decades of courtroom scrutiny. KDr. Gatsonis, as a committee member, how would you respond to each of these criticisms?

Answer. The NAS Committee had broad representation from the forensics communities, including a current director of a state department of forensic sciences, two medical examiners, two professors in forensic science programs, and a former deputy

³American Society of Crime Laboratory Directors. 2004. *180-day Study Report: Status and Needs of United States Crime Laboratories*. Largo, FL: ASCLD.

⁴*Ibid.*, p. 12.

director of the FBI forensics laboratory. As detailed in the report, the Committee heard from a very broad range of forensic experts and reviewed voluminous published materials.

Question 1a. While the National Academy's report highlighted this issue, how long has this actually been a problem?

Answer. The challenges faced by the forensic communities have been felt for decades. Recent advancements in science, such as DNA analysis, have highlighted some of the problems.

Question 1b. What have been the impediments to getting these issues addressed?

Answer. I am afraid there is no succinct answer to this question. The Committee's report highlights major challenges in the organization, governance, funding, and quality assurance and control of the forensic disciplines and units across jurisdictions. The report also highlights major challenges in the scientific underpinning of forensic disciplines and the scientific research and educational infrastructure.

The Role of the Federal Government

Question 2. Forensic science is practiced in local, state, and Federal jurisdictions. How would changes in Federal crime labs propagate to labs at the state and local levels?

Answer. My personal opinion is that the Federal crime labs can help significantly in efforts to enhance research in the forensic sciences and to develop and implement standards.

Question 2a. What should be the role of the Federal Government in addressing the needs of forensic science, and what should be left to state and local governments?

Answer. The major conclusion of the Committee on this point is the need for a new independent Federal entity, the National Institute of Forensic Science (NIFS). The mission and goals of NIFS are described in the report. The intention is not to suggest a Federalization of the entire forensic sciences system. However, an entity like NIFS will be able to provide the necessary cohesion, overview, direction, and funding.

The Need for Scientific Independence

Question 3. The primary recommendation of the National Academy's report was the establishment of an independent agency to oversee and support forensic science. However, the current fiscal realities make the creation of a new Federal agency difficult. A failure of the current system has been the lack of involvement of the academic community in research and standard setting. How can we guarantee their participation without support from a Federal agency dedicated to forensic science?

Answer. The academic community can make major and on-going contributions to the forensic disciplines, both in research and in education. In order for this to materialize, it is important to develop a coherent national approach to the challenges of the forensic disciplines and to provide the necessary direction and funding. The role of NIFS in this effort seems indispensable.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. FRANK R. LAUTENBERG TO
DR. CONSTANTINE A. GATSONIS

Question. The National Research Council has raised concerns with the science behind ballistic matching and other forms of analysis involving guns. How can we improve our ability to prevent and prosecute gun crime using forensic science?

Answer. As detailed in the relevant section of Chapter 5 of the report, much research is needed to address the scientific challenges in firearm analysis. For example, we need to understand and potentially improve the reliability and repeatability of methods used in firearm analysis and to address fundamental questions about the possibility of identifying firearms uniquely. In order to be effective, this research should be integrated into a strategic vision for the scientific development of the forensic disciplines and, of course, should be supported with adequate funding.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN BOOZMAN TO
DR. CONSTANTINE A. GATSONIS

Question 1. Do you think that with additional research, including on error rates and validity, forensic science disciplines, such as fingerprint analysis, ballistics, and hair analysis, could be used with greater accuracy and reliability?

Answer. The research described in this question will assess the potential for improvement in the techniques currently used in each of the forensic disciplines. As is typically the case in science, this research may also point to new approaches that go well beyond current capabilities.

Question 2. Do you think that incorporating and improving upon existing processes within the forensic science community for certification, accreditation and quality control would be more effective than creating wholesale new standards for each forensic discipline?

Answer. Any effort to develop programs for certification, accreditation, and quality control would naturally need to involve the forensic communities, which have a lot to contribute to such developments. It is likely that we will need to cut from new cloth to meet some of the challenges. Overall, it seems very important to have clarify about the goals and to establish a process that will not be hindered by institutional inertia and other potential impediments.

Question 3. You mentioned that the major recommendation from the Academies report was the establishment and appropriation of funds for an independent Federal entity. What possible alternatives to Federal intervention were explored?

Answer. The Committee documented pervasive fragmentation in forensic disciplines and practices across the country. This led us to believe that a coherent, integrated national effort is needed. The creation of a Federal entity for this purpose was the consensus of the Committee. It seems unlikely to me that without a Federal mandate and, importantly, funding, there will be much progress in this area.

Question 4. What are your thoughts on creating a central repository of validated protocols that all forensic science providers can access? Do you think this proposal would be an effective and efficient way to address some of the concerns you all have raises?

Answer. The creation and promotion of standards and best practices across the country would benefit substantially from central resources such as the one you describe. These resources would achieve their full potential if they are integrated in a national forensics effort.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN D. ROCKEFELLER IV
TO GEOFFREY S. MEARNS

Scale of the Issue

Question 1. Some have raised criticisms of the National Academy of Sciences review of forensics claiming that the panel lacked forensic analysts, did not review all of the existing research, and did not consider the knowledge gained by decades of courtroom scrutiny. Mr. Mearns, as a committee member, how would you respond to each of these criticisms?

Answer. I do not think these criticisms have merit.

The claim that the NAS committee lacked forensic science analysts is demonstrably unfounded. Of the 17 members of the committee, four have extensive experience as forensic science analysts: Mr. Pete M. Marone; Dr. Randall S. Murch; Dr. Robert Shaler; and Dr. Jay Siegel. As detailed in Appendix A of the NAS Report, each of these highly respected experts has extensive experience as a forensic analyst, and their experience covers a wide variety of forensic science disciplines. Two other members of the NAS committee, Dr. Marcella F. Fierro and Dr. Ross E. Zumwalt, have extensive experience as forensic science analysts in a specific discipline—as medical examiners.

The claim that the NAS committee did not review the relevant research is also unavailing. I will not fully describe the scope and depth of the NAS committee's research, but I will highlight several important points in response to this criticism.

- At the first NAS committee meeting, we asked the representatives of each of the major forensic science organizations to provide us with a list of all research that these individuals believed was relevant to our report; members of the NAS committee and/or staff reviewed all of the research that was recommended by these representatives.
- During the process, we consistently asked the representatives of each scientific working group (SWG) to submit all relevant research to us; members of the NAS committee and/or staff reviewed all of the research that was recommended by the SWGs.
- Members of the NAS committee, based on their expertise and experience, identified and reviewed additional research.

- Members of the NAS committee and/or staff reviewed every article published in “The Journal of Forensic Science” in the preceding 10 years.
- Members of the NAS committee asked staff to conduct literature searches to identify and review any other research that was relevant to the NAS report.

Moreover, this criticism ignores one critical element of the NAS process: before the NAS report was released, a draft was provided to a group of independent reviewers chosen for their diverse perspectives and technical expertise. One of the purposes of this pre-release, independent review is to ensure that the NAS committee had reviewed and considered all of the relevant research. The NAS committee responded fully to any such concerns before our report was released. Had we not done so, the NAS would not have authorized the publication of our report.

Finally, the claim that the NAS committee did not consider knowledge gained about forensic science by decades of courtroom experience is equally without merit. I was selected to serve on the NAS committee because of my substantial trial experience as a Federal prosecutor. Mr. Marvin Schechter, who also served on the NAS committee, has extensive trial experience as a criminal defense lawyer in state and Federal courts. And Judge Harry Edwards, who was one of the co-chairs of the NAS committee, has served as a Federal appellate court judge for more than 30 years; he has decided hundreds of criminal appeals. As detailed in Chapter Three of the NAS report, this experience contributed to our collective judgment that the adversarial litigation process has not been able to solve the systemic problems that presently undermine the accuracy and reliability of many forensic science disciplines. In short, we did not ignore our courtroom experience; to the contrary, that experience informed our judgment that these systemic problems could only be solved through the implementation of the specific recommendations identified in our report.

Question 2. While the National Academy’s report highlighted this issue, how long has this actually been a problem?

Answer. The problems discussed in the NAS report have existed for decades because, with the exception of forensic DNA analysis, most forensic science disciplines have not been grounded in genuine, rigorous scientific research. It has only been within the last two decades, however, that these problems have been brought to the attention of practitioners and scholars.

Question 3. What have been the impediments to getting these issues addressed?

Answer. The impediments to solving these problems are discussed at some length in the NAS report. In my judgment, the most substantial impediment is the lack of a “culture of science” in many forensic science disciplines. This deficiency has led to the absence of a coordinated strategy to develop the scientific research agendas needed to validate many forensic science disciplines and the failure to fund that vital research.

I also believe that the law enforcement community has been too complacent about the need to address these issues. Prosecutors and other law enforcement officers apparently do not perceive the potential benefit of conducting this research—or they fear that the results of this research will undermine past convictions or require that they change how they present forensic science evidence at trial. This resistance and reluctance must be overcome.

The Role of the Federal Government

Question 4. Forensic science is practiced in local, state, and Federal jurisdictions. How would changes in Federal crime labs propagate to labs at the state and local levels?

Answer. There are many ways in which changes in Federal crime labs could lead to improvements in state and local crime labs. For example, the Federal agencies could share research results with their state and local counterparts. Federal agencies could also develop and share best practices regarding how to conduct tests, to report results, and to testify in court about those tests and results. Similarly, Federal agencies could develop accepted standards for accrediting laboratories and certifying practitioners. In short, leadership at the Federal level is vital.

Question 4a. What should be the role of the Federal Government in addressing the needs of forensic science, and what should be left to state and local governments?

Answer. As discussed in the NAS report and briefly summarized above, the Federal Government must assume a leadership role in order to address the problems that presently plague many forensic science disciplines. Nevertheless, state and local governments have a very important role to play. Among other things, they can encourage their respective colleges and universities to develop interdisciplinary educational programs to train forensic scientists and legal practitioners—prosecutors, defense lawyers, and judges. State and local governments can also position these in-

stitutions to conduct the research agenda established at the national level. Finally, state and local governments can require their law enforcement agencies and officials to adopt national standards and best practices.

The Need for Scientific Independence

Question 5. The primary recommendation of the National Academy's report was the establishment of an independent agency to oversee and support forensic science. However, the current fiscal realities make the creation of a new Federal agency difficult. How can we meet this need for independent research and oversight within existing Federal agencies?

Answer. I remain convinced that Congress should create a new, independent forensic science agency. I do not believe that any existing agency, including DOJ or NIST, is capable of implementing all of the recommendations needed to address all of the problems we identified in the NAS report.

If Congress were to conclude, however, that it is impracticable to create a new, independent agency at this time, then Congress can achieve some progress. For instance, Congress can direct NSF and NIH to allocate more funding for forensic science research. Congress should also direct the National Academies to develop a research agenda that would be conducted with this additional funding.

Finally, Congress could direct the DOJ to coordinate the creation of a national organization to develop mandatory standards for accrediting forensic science labs and certifying forensic science practitioners. In order to ensure that these standards were fully effective, Congress could pass legislation providing that any forensic science expert who intends to offer testimony in Federal court must be certified and be associated with an accredited lab before their testimony is deemed admissible.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. FRANK R. LAUTENBERG TO
GEOFFREY S. MEARNs

Question. You and the other witnesses offered a number of ideas on improving the use of forensic science in our criminal justice system. Forensic science can also be used to improve homeland security, particularly when it comes to preventing attacks and identifying evidence after a disaster. How can the recommendations made in the hearing be tailored to meet the unique needs of homeland security?

Answer. Good forensic science practices are of clear value from a homeland security perspective because such practices can assist in bringing criminals to justice and in dealing with the effects of natural and human-made mass disasters. Forensic science techniques enable the thorough investigations of crime scenes. Routine and trustworthy collection of digital evidence, and improved techniques and timeliness for its analysis, can be of great potential value in identifying terrorist activity. In short, a strong and reliable forensic science community is needed to maintain homeland security.

To capitalize on this potential, however, the forensic science communities must be effectively coordinated with homeland security efforts, so that they can contribute when needed. To be successful, this coordination requires: (1) the establishment of good working relationships among Federal, state, and local jurisdictions; (2) the creation of strong security programs to protect data transmittals across jurisdictions; (3) the development of additional training for forensic scientists and crime scene investigators; and (4) the promulgation of contingency plans that will promote efficient team efforts on demand. Improvements in the forensic science community could greatly enhance the capabilities of homeland security.

Therefore, Congress should provide funding to prepare forensic scientists and crime scene investigators for their potential roles in collecting, maintaining, and analyzing evidence from events that affect homeland security, so that maximum evidentiary value is preserved from these unusual circumstances and the safety of these personnel is guarded. This preparation should also include planning and preparedness, including exercises, for the interoperability of local forensic personnel with Federal counterterrorism organizations.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. JOHN BOOZMAN TO
GEOFFREY S. MEARNs

Question. In your testimony, you discussed the evolution of DNA analysis, and how it has become a reliable forensic method. Mr. Mearns, based on your work in this area, could you talk about the role of the DNA Advisory Board at the Department of Justice in successfully creating a national gold standard for DNA analysis?

Answer. I do not have personal experience with the DNA Advisory Board (“the Board”). It is my understanding, though, that the Board has played a very constructive role in successfully establishing DNA testing and testimony as a standard to which other forensic science disciplines should aspire. For example, the Board has helped to develop quality assurance standards and appropriate proficiency testing methodologies.

Notwithstanding this success, however, I do not think we should expect that the DOJ and the FBI can achieve this same level of success with respect to other forensic science disciplines, because our experience with DNA was different in one very important respect: the use of DNA testing and analysis in criminal investigations and prosecutions emerged from scientific research, but the vast majority of the other forensic science disciplines emerged from the law enforcement community. With respect to DNA, its origin enabled the DOJ and the FBI to create, on a blank canvas, the needed standards and protocols. I believe that, because of the tendency of all law enforcement officers, including those in the DOJ and the FBI, to rely too heavily on their past experiences and to cling to their preconceived notions of the various forensic science disciplines, we should not assume that the DOJ and the FBI can replicate their success with DNA analysis in the other forensic science disciplines, which emerged from—and remains embedded within—the law enforcement culture.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN D. ROCKEFELLER IV
TO DR. TERRY W. FENGER

Scale of the issue

Question 1. While the National Academy’s report highlighted the depth and breadth of the issues in forensic science, how long has this actually been a problem? What have been the impediments to getting these issues addressed?

Answer. The focus of my comments expands upon those presented in the U.S. Senate Commerce Committee hearing held on December 7, 2011. My comments were limited to the development and enhancement of existing forensic science programs in higher education. Overall there is limited Federal funding directed towards establishing high quality forensic science programs. As technologies employed in forensic investigations continue to develop, if certification of forensic scientists becomes mandatory, and if accreditation of all forensic laboratories becomes a requirement, the demand for highly qualified forensic scientists will increase exponentially. A new generation of forensic scientists will not only be required to have technical knowledge and skills to perform analysis of crime evidence, but next-generation forensic scientists will need to participate in research, both basic and applied, in the large number of disciplines that constitute forensic science. Crime laboratories cannot be burdened with educating and training newly-hired forensic scientists that enter laboratory systems. The responsibility must fall on academic programs to prepare students for the workforce, in order to minimize crime laboratory based training upon being hired. Academic forensic science programs should also serve as a resource for other stakeholders in the criminal justice system by providing continuing education to forensic scientists, judges, attorneys, members of law enforcement, medical examiners and certain members of the medical profession, *e.g.*, forensic nurses. To ensure the quality of education of students and continuing education of members of the criminal justice system, accreditation of academic programs, both at the graduate and undergraduate levels, is essential. Prior to 2003 accreditation of forensic science programs in academia was non-existent, although the need for establishing accreditation standards was well recognized. The impediments for establishing accreditation standards are multifold. Prior to popularity of forensics science among the TV viewing population and high profile criminal cases that highlighted the role of forensic scientists, forensic science was not embraced as an academic discipline by most colleges and universities. Therefore, awareness of forensic science and the realization of the need for highly qualified graduates in this discipline by the academic community has been a major impediment. Funding for the establishment of forensic science programs at the undergraduate and graduate levels has also been lacking. Some academic programs develop a few courses with forensic science underpinnings and link them to courses with little forensic science focus and offer them as a forensic science program or area of emphasis. Key to ensuring high quality education is accreditation of forensic science programs through the Forensic Science Education Programs Accreditation Commission (FEPAC).

Academic programs in forensic science have focused on undergraduate and Masters level graduate education. Currently, there is a paucity of PhD granting programs in forensic science, which equates to a lack of PhD level faculty to staff undergraduate and graduate programs and conduct discipline-specific research. Tradi-

tionally, scientists from other disciplines, such as chemistry and biology have shifted their professional focus to include forensic science. The lack of PhD granting programs in forensic science has also hampered the development of research programs in academia. Although chemistry and biology based forensic research has developed well at some universities, comparative disciplines, such as tool mark examination and latent print examination, have not fared as well. The lack of PhD faculty in academia with substantial experience in the comparative forensic sciences has contributed to the inability of higher education to address the needs for forensic scientists in comparative disciplines.

The Role of the Federal Government

Question 2. Forensic science is practiced in local, state, and Federal jurisdictions. How would changes in Federal crime labs propagate to labs at the state and local levels? What should be the role of the Federal government in addressing the needs of forensic science, and what should be left to state and local governments?

Answer. Again focusing only on higher education in forensic science, from my experiences funding is limited both at the state and national levels for the establishment and development of forensic science programs at undergraduate or graduate levels. I recommend that Federal agencies provide grant-based funding to accredited, academic programs or those seeking accreditation, in order to enhance research opportunities, to develop areas of forensic science which are not traditionally covered in academic programs and to provide funding for outreach training for stakeholders throughout the criminal justice system. Research grants in all aspects of forensic science, particularly in the comparative sciences, are much needed. Grants to support research sabbaticals are essential to promote interactions between researchers and working laboratories. A grant program that would encourage forensic practitioners working in various forensic science disciplines to participate in research projects in academia would further partnerships between crime laboratories and laboratories within academia. Grant funding of post-doctoral research fellowships is also needed once doctoral programs in forensic science become a reality.

The Need for Scientific Independence

Question 3. Research, standards, and regulations are important, but it is the people working in crime labs who put these practices to use. How can we facilitate dialog between researchers and practitioners for the best practical outcome?

Answer. The NAS Report emphasizes the need for all stakeholders in the criminal justice system to work cooperatively for the advancement of forensic science, the judiciary and legal systems and academics. Although opinions may differ, this writer suggests that there is only a minimal representation of academicians on national committees that develop policies governing forensic science at state and national levels.

Traditionally crime, laboratories fall under the control of law enforcement which does not routinely interact with academic program. FEPAC accreditation standards, however, promote these interactions and make it a requirement for the development of strong ties between working crime laboratories and accredited forensic science programs. The formation of a Scientific Working Group of Forensic Science Educators (SWGFSSE) to develop a national plan for developing and maintaining quality, accredited forensic science programs in conjunction with forensic laboratories would be one suggestion. A funding mechanism needs to be established to sustained SWGFSSE as a permanent working group. SWGFSSE could help develop academic curriculum that will best position graduates to pass a national certification examination if national certification becomes a reality.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN BOOZMAN TO DR. TERRY W. FENGER

Question 1. You discuss the need for doctoral programs in forensic science. What topics would be covered that may ordinarily not be covered in other doctoral programs that overlap with forensic science? What other fields closely overlap with forensic science? For example, would forensic psychiatry be covered in a program in psychiatry?

Answer. Interest in forensic science as a career has grown exponentially for various reasons. Some observers suggest that the CSI effect plays a major role in stimulating interests of student in forensic science. Young people are influenced by the myriad of television shows that emphasize the importance of forensic science in solving crime. The crime laboratory is presented as a high tech, dynamic environment which allows criminal cases to be solved in a short time span. As the plot unfolds during these programs, the same individuals that investigate the crime scenes are

also the ones that analyze the evidence in the forensic laboratory, which conveys the impression that lab analysts also have the opportunity to chase down the bad guy. Some students are attracted to forensic science because it allows them to use scientific principles to solve real life problems and to have a direct impact on society. The quality and reputation of the accredited, forensic science program at MU is also a primary factor in attracting students. Because of these and other reasons we have many more students interested in our program than we can accept. Marshall's two year Master's degree accepts a maximum of 20 students per year. This upper limit is determined by the limited number of laboratories available to instruct students in several forensic disciplines, including chemistry and microscopy. Another factor that limits class size at MU is the small number of full-time forensic science faculty that are dedicated to the program. Relative to the Marshall Forensic Science Program approximately 100 students apply to the program each year for the 20 openings. Interest in entering the program is greater than the actual applicant numbers. Students with undergraduate degrees in criminal justice usually do not have the prerequisite science courses required for admission into the MUFSC program and therefore they do not qualify despite being interested in the field.

The total number of applicants has declined slightly since the inception of the MU Forensic Science Program in 1995. This decline reflects the development of forensic science offerings at a large number of universities both at the undergraduate and graduate levels. Therefore there is greater competition for well-qualified students.

Question 2. Dr. Fenger, you and your colleagues work at the Marshall University Forensic Science Center is impressive, especially since you have built it into a world class facility. Could you give me a rough estimate how student interest in your program has grown? Is this an area where students can easily find jobs or is there some skepticism of forensic science as a career? If a college or university wanted to start a program in forensic science, what is the greatest 'barrier to entry'? What role did Federal funding play in creating your facility?

Answer. Although I can only speak for the MUFSC program with any authority, our graduates readily find positions in crime laboratories or as investigative agents in Federal and state agencies. The MU Forensic Science Program has a history of producing quality graduates and we receive inquiries and job notifications from laboratories seeking our graduates. It was noted in the NAS Report, as well as other sources, that there will be a paucity of qualified forensic scientists in the future as a result of retirement of existing personnel. If funding to support state and local crime laboratories is available for laboratory expansion, it is anticipated that the need for additional laboratory personnel will also increase.

Question 3. With regards to research, the field of forensic science is broad, ranging from psychiatry to entomology to applied physics (ballistics) to computer forensics to forensic geology. As we become more technologically advanced, this scope will continue to increase. Any thoughts how your Center is best equipped to handle this uncertain future?

Answer. Obstacles for establishing forensic science programs often reflect university funding and the level of university support for development of a forensic science curriculum. Some universities have added courses to an already existing curriculum (forensic chemistry course(s) added to an existing chemistry track) and market it as a forensic science offering. Instructors in these courses may have little to no forensic science background. Other universities have developed stand-alone forensic science programs at the undergraduate and graduate levels. The costs and time to develop the latter programs is great. A primary barrier to the development of any program in academics is stiff competition between all academic programs at a university for limited state funding. Against this backdrop a new forensic science program requires the full support of the university administration who can ensure that a quality program develops. The university's goal should be full accreditation of the program through the Forensic Science Education Programs Accreditation Commission (FEPAC). (<http://www.aafs.org/fepac>) Accreditation helps establish uniformity and consistency among academic program nationally.

Question 4. What are your thoughts on creating a central repository of validated protocols that all forensic science providers can access? Do you think this proposal would be an effective and efficient way to address some of the concerns you raise?

Answer. Federal funding of MU Forensic Science Center has allowed the Center to offer services to state and local crime laboratories. Federal funding specifically supporting our academic programs has not been available. Federal funds were used to develop the accredited DNA testing laboratories at MUFSC which conducts DNA testing on West Virginia's convicted offenders, the resulting DNA profiles being included in the WV Combined DNA Index System (WV CODIS). The MUFSC DNA laboratories also performs DNA testing on evidence from criminal cases in support

of specific crime laboratories outside of West Virginia. In addition, Federal grant funding has enable MUFSC to develop DNA analysis training laboratories again targeted to training professionals from state and local crime laboratories. Training laboratories, when not being used to aid state and local stakeholders, are utilized to train and educate students in the MU academic program. State-of-the-art equipment and facilities developed using Federal funds is one of the primary factors that allows our students to receive a quality education in an accredited environment. A research based internship is required to satisfy requirements for the program and the program's accreditation requirements. The crime laboratories that host MUFSP summer interns often receive Federal funding for capacity building and developing laboratory infrastructures. Thus, Federal grants that support crime laboratories indirectly benefit the education and training of forensic science students through summer internships.

APPENDICES

Maps

President's DNA Initiative (PDI) and Advanced DNA Technologies Training in Support of State and Local Crime Laboratories
Forensic Y-STR Analysis Training
Forensic Relationship DNA Analysis Training
Sexual Assault Nurse Examiner Training
FBI Crime Scene Training
Technical Assistance Program (TAP)
Forensic Relationship/Paternity Cases

Commendation/Citation

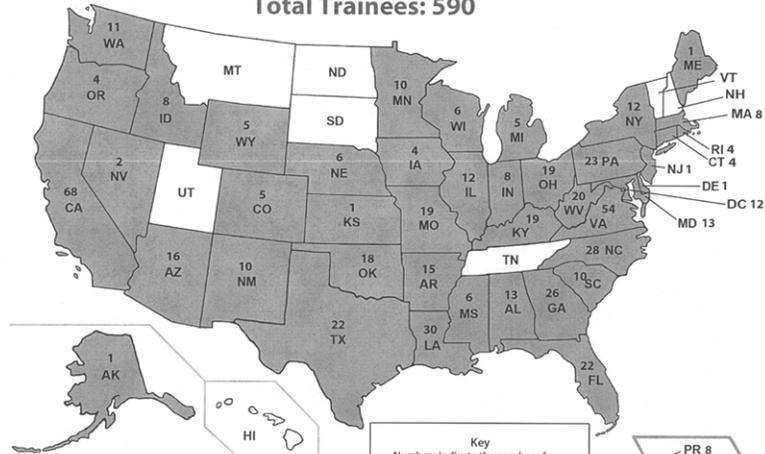
Metropolitan Police Department of the District of Columbia
International Association for Identification

Publication

Marshall University Forensic Science Center: Excellence in Forensic Science

Marshall University Forensic Science Center
PDI & Advanced DNA Technologies Training in Support of State & Local Crime Laboratories

Total Trainees: 590



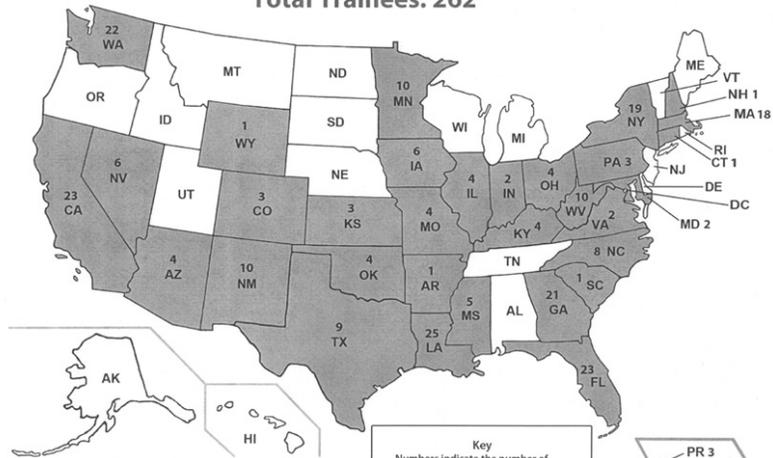
States Represented April 2005 - November 2011

**Supported by the President's DNA Initiative (2001-RC-CX-K002) and the NIJ Technology Development Delivery & Training Program (2007-MU-MU-K007)*

Revised 12.2.11

Marshall University Forensic Science Center
Forensic Y-STR Analysis Training

Total Trainees: 262



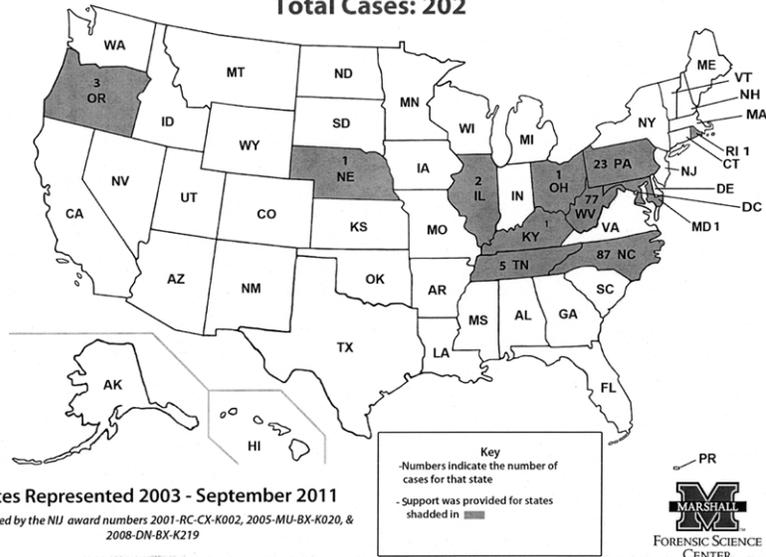
States Represented June 2009 - August 2011

**Supported by the NIJ Technology Development Delivery & Training Program (2008-DN-BX-K185)*

Revised 12.5.11

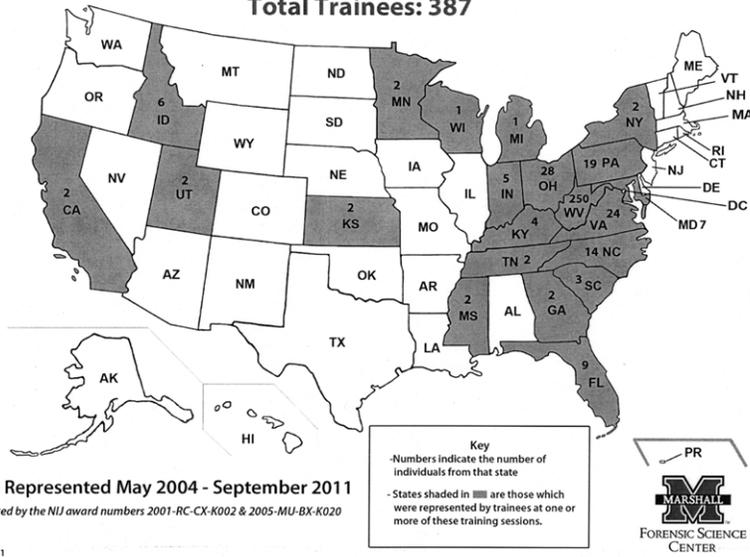
Marshall University Forensic Science Center
Forensic Relationship/Paternity Cases

Total Cases: 202

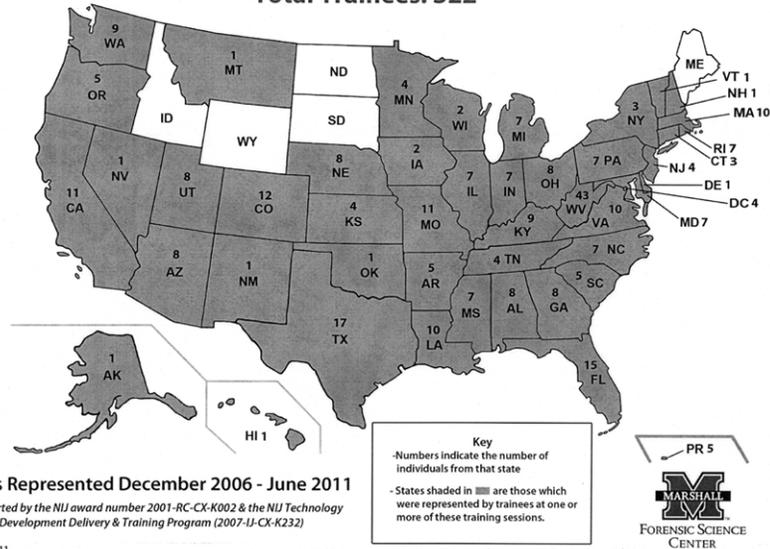


Marshall University Forensic Science Center
Sexual Assault Nurse Examiner Training (Adult and Pediatric)

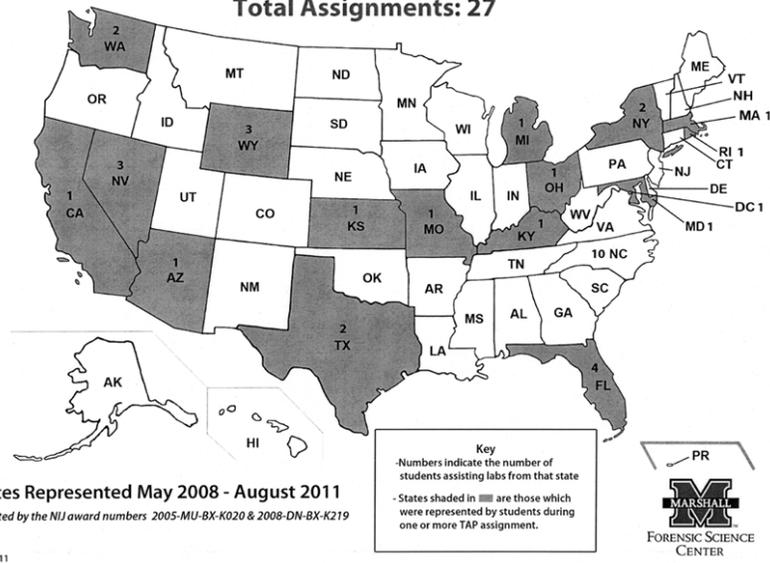
Total Trainees: 387



**Marshall University Forensic Science Center
FBI Training
Total Trainees: 322**

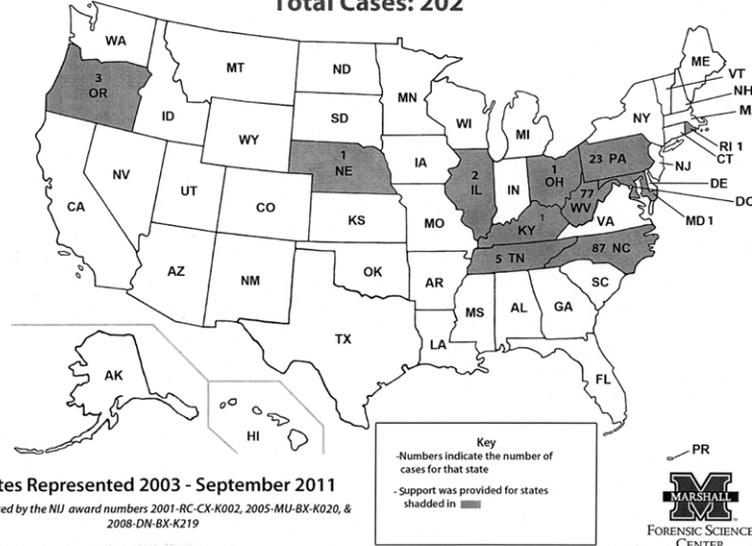


**Marshall University Forensic Science Center
NIJ Technical Assistance Program (TAP)
Total Assignments: 27**



Marshall University Forensic Science Center
Forensic Relationship/Paternity Cases

Total Cases: 202



GOVERNMENT OF THE DISTRICT OF COLUMBIA
September 21, 2010

Dr. TERRY FENGER,
Marshall University,
Forensic Science Center,
Huntington, WV.

Dear Dr. Fenger:

On behalf of the Metropolitan Police Department (MPD) of the District of Columbia, we would like to extend our gratitude and thanks to the Marshall University Forensic Science Center. Their efforts in the development and implementation of a DNA training program specifically designed for the MPD Crime Laboratory is most appreciated.

I would like to give special recognition to Mr. Jason Chute, Mr. Justin Godby, and Mr. Joshua Stewart for their time and dedication spent to personalize the training for our MPD analysts. Their positive attitudes and unselfish transfer of knowledge will have a lasting effect on the development of the careers of the MPD analysts as forensic scientists in the laboratory, and in judicial proceedings.

It is anticipated that the efforts made in this training endeavor will significantly contribute to successful outcomes in criminal investigations. We look forward to a long and lasting partnership with Marshall University and the Forensic Science Center.

Sincerely,

CATHY L. LANIER,
Chief of Police.
Metropolitan Police Department.

INTERNATIONAL ASSOCIATION FOR IDENTIFICATION
August 21, 2009

ROBERT J. GARRETT,
President,
Metuchen, NJ.

PRESIDENTIAL CITATION

The Twins Study, sponsored by the International Association for Identification, was a research effort initiated to find scientific support for the basis of biological uniqueness as regards the arrangement and occurrence of friction ridge features on the palmar surface of the human hand. It was important to establish a database which would allow researchers to examine the level of similarity which may exist between the friction ridge characteristics of people who are genetically identical. This effort required the recording of friction ridge detail and the analysis of DNA samples collected from study participants to verify monozygotic or familial origins. The DNA results represented crucial information needed to support all future research in this area.

The *Marshall University Forensic Science Center* is hereby commended and extended the gratitude of the International Association for Identification for their significant contribution to this research project. Of particular note were the efforts of *Dr. Terry Fenger*, Director of the Forensic Science Center and *Mr. Jason Chute*, DNA Technical Leader.

It is my great privilege, as President of the International Association for Identification, to offer this salutation in recognition of the center's support and cooperation in furthering scientific research in friction ridge identification.

ROBERT J. GARRETT,
President.

MARSHALL UNIVERSITY FORENSIC SCIENCE CENTER
Huntington, WV, May 2011

EXCELLENCE IN FORENSIC SCIENCE

Helping Our Nation's Crime Labs to Solve Cases and Educating Future Forensic Scientists

Vision

Marshall University Forensic Science Center strives to be a model for developing both academic and applied programs at Marshall University and throughout the nation. The faculty and staff envision taking lead roles in initiating scientific research, in advancing knowledge in forensic science, and in serving as stakeholders in the economic development of our region.

Mission

The Center's mission is to provide quality forensic science education, training for forensic science practitioners, advanced scientific analysis and innovative economic opportunity for the promotion of truth and justice in our community, state, and nation.

Academic Program

The two-year, FEPAC-accredited Master's Program in Forensic Science produces students available for internships and graduates working in state, local and Federal laboratories across the nation.

- The program offers emphases in DNA analysis, forensic chemistry, crime scene investigation and computer forensics.
- It is one of ten accredited forensic science graduate programs in the country.
- In 2009 it ranked number one in the nation for its students' overall scores on the Forensic Science Aptitude Test offered by the American Board of Criminalistics.

DNA Laboratories

- NA testing on criminal cases submitted by state and local crime labs is performed at MUFSC. The DNA laboratories are nationally accredited by FQS-I as an ISO 17025 conformant laboratory for forensic testing and DNA databasing. They are also accredited by AABB for parentage testing.

- The center is the CODIS DNA testing laboratory for the State of West Virginia and is under jurisdiction of the West Virginia State Police. CODIS (Combined DNA Index System) is the nationwide searchable database, coordinated by the FBI, that contains DNA profiles of convicted felons and case evidence.

Training Services

More than 1600 working forensic science professionals from 48 states have attended training sessions at MUFSC's nationally renowned facilities.

- *Advanced DNA Training* is provided to state and local forensic scientists under the President's DNA Initiative and Forensic Science Training, Development and Delivery Program. Trained more than: 521
- *Y-STR Training* is provided to state and local forensic scientists under the Forensic Science Training, Development and Delivery Program. Trained more than: 255
- *Forensic Paternity/Relationship Testing* is our newest training program. Trained to date: 134
- *Sexual Assault Nurse Examiners (SANE) Training* is hosted for nurses and supports community outreach to victims. Trained more than: 368
- *Specialized Training by the FBI* for law enforcement and public crime laboratory personnel is hosted by MUFSC at its crime scene house. Trained more than: 322
- The *Marshall Information Security and Digital Evidence Program* hosts seminars for law enforcement in digital evidence collection and analysis.

Research

- *Forensic Science Graduate Program students perform research* in the areas of DNA analysis, drugs, forensic chemistry, fingerprint analysis and digital forensics that assists forensic laboratories across the country.
- *Bacterial source tracking* uses new DNA technologies to rapidly identify sources of bacterial contamination in water.
- *Individualization of smokeless powders* is being conducted to assist Federal agencies in individualizing identification to establish sources and distribution networks.
- *Individualization of gasoline residues and kerosene and medium petroleum distillates* studies will develop a searchable database for those residues in fire debris.
- The Pollen Project will characterize pollen from plants in West Virginia for forensic investigations.

Projects

- *DNA testing on criminal forensic cases* is performed at MUFSC. The center provides DNA testing on forensic casework, processing and testing evidence from rape kits, paternity/relationship testing, high-volume property crimes, cold cases and convicted offender backlogs for state and local crime laboratories.
- The MUFSC serves as a *national resource for state and local forensic laboratories* in need of assistance.
- The *National Institute of Justice Technical Assistance Program* provides selected forensic laboratories assistance with validation studies performed by trained graduate students on high-tech equipment.
- The MUFSC has conducted evaluations to determine DNA testing methods for *biological medical implant samples*. Evaluations are being conducted on procedures to extract and analyze DNA in processed tissues.
- Partner in the Forensic Technology Center of Excellence for serving as the host site of the *NIJ Expert Systems Testbed (NEST) Project*, established to evaluate commercially available expert systems designed to assist in the review of DNA profiles. Demonstrations have been provided to state and local forensic DNA crime laboratory personnel. Participants in the NEST Project to date: more than 96

Digital Forensics

- *Cybercrime investigations* are conducted within the facility by a West Virginia State Police Digital Forensic Unit in conjunction with MUFSC. Cases include child exploitation, homicides, prescription fraud and illegal drug operations.
- MUFSC is a founding member of the *Appalachian Institute of Digital Evidence*, which provides educational conferences to prosecutors, judges and law enforcement, conducts research and provides public awareness.

Economic Development

- *Parentage Testing Services* provides relationship/paternity testing nationally and for immigration cases.
- *DNA Preservation and Testing Services* provides sample preservation and profile services for funeral homes.
- *Bacterial Source Tracking*, using DNA technologies, provides services to state and Federal agencies.

