Testimony of

Patrick D. Gallagher, Ph.D.
Under Secretary of Commerce for Standards and Technology
United States Department of Commerce

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Forensic Science

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Chairman Rockefeller Ranking Member Hutchison, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the importance of forensic science. The Department of Commerce's National Institute of Standards and Technology (NIST) has a long history of collaboration in the area of Forensic Science. In the fiscal year 2013 (FY 2013) budget NIST has requested $5 million for an initiative that will enable NIST to create a strategic program to broadly address the most critical issues in Forensic Science today.

NIST's Role in the Forensic Sciences

NIST was founded with a specific mission -- to define and advance a uniform, scientific, national system of measurement to support industry and other federal agencies. This system of measurement is underpinned by NIST's measurement science research. This scientific basis for accurate measurements using the most rigorous, soundly defensible, and universally accepted science gives accurate, reproducible, and reliable measurements. In this context, Forensic Science has always been part of NIST, since much of Forensic Science is about forensic measurements.

Measurement and forensic scientists are bound by mutual interests in accuracy and uncertainty, a quantifiable expression of the quality of our measurements. NIST works to resolve the uncertainty as it pertains to all types of applied sciences. Resolution of uncertainty will lead to the accuracy that is necessary in many applications, including Forensic Science. Some of the other areas NIST has measurement expertise in that have applicability in Forensic Science are dimensional analysis, chemical and material analysis, DNA, structural fire analysis, radiation signatures and digital data.

One of the founding principles for NIST is establishing traceability in the marketplace for measurement. The work NIST does with measurement standards and their traceability to NIST research provides the crucial framework for measurement.

Justice can, in some instances, quite literally hang on a single thread, or in the parlance of forensic scientists, a single fiber. Forensic scientists are under a tremendous amount of pressure to not only get it right but also to explain methodologies and results to a judge and jury. NIST can and does provide metrics to help define the resolution of methods and the veracity of the results.

The next piece of the NIST mission is our role in standards. NIST's measurement research allows NIST to inform the standards function and make sure that the standards are realistic and scientifically valid, in this case for use in labs and the field. For NIST to perform our standards role well, we must have independent measurement science research in the appropriate disciplines of forensic science.

The Past, Present and Future of Forensic Science Measurement and Standards at NIST

NIST has supported forensic science throughout our history. In fact, from 1913 until the Federal Bureau of Investigation (FBI) hired its first scientist in 1932, NIST was the nation's de facto criminal forensic science laboratory. Our involvement in the forensic sciences originates with Wilmer Souder—one of the nation's best and least known criminologists to whom the FBI turned in 1932 to help them establish their lab and train their scientists in the principles of forensic investigation.

Souder's interest in forensic science began in 1913, when famed document examiner Albert Osborn sent some precision measuring devices to NIST for calibration. By the 1930s Souder had become a pioneering expert in the identification of questioned documents, handwriting, typewriting, bullets, cartridge cases, and firearms. In his nearly 40 years at NIST, he assisted almost 1,000 federal investigations of crimes, including extortion, forgery, kidnapping, murder, bootlegging, and theft.

Perhaps most famously, Souder was among the handwriting experts whose analyses of the ransom letters helped to convict Bruno Richard Hauptmann for the kidnapping and murder of Charles Lindberg, Jr.

NIST continues this long history of work in support of law enforcement. We have worked with the Department of Justice, the Department of Homeland Security, and the Department of Defense toward the development of standards for body armor, nonlethal weapons, and explosives detection technologies, among others.

In the area of forensic science, we are perhaps best known for our work in DNA analysis. One of our researchers, John Butler, Ph.D., Leader of the Applied Genetics Group, literally wrote the book (actually, he wrote four books with another on the way) on forensic DNA typing. Butler's work, developing a new DNA analysis approach which uses small fragments of DNA, was essential in helping to identify the victims of the September 11, 2001 attacks on the World Trade Center.

NIST continues its work to further improve techniques for identifying severely degraded DNA and advance the state of the art for forensic DNA typing. NIST also produces Standard Reference Materials for calibration and quality control for forensic science and genetics laboratories throughout the United States and the world. NIST's work in genetic kinship analysis made it possible for police in California to catch a killer known as the "Grim Sleeper," who had been at large for more than 20 years.

The FBI already requires that forensic DNA labs use NIST's Standard Reference Materials (SRMs) for quality assurance before they may enter their data into the national criminal DNA database. The National Institute of Justice (NIJ) also requires that the crime laboratories it funds use these SRMs.

Many broad aspects of NIST's work have applicability in forensic science. Measurement is the comparison of a known to an unknown, and NIST's job is to supply forensic science labs with as

many knowns as possible by actively offering our measurement expertise and continually working with the community to help them do their jobs more effectively.

Some of the resources NIST has developed that are used in the field include databases such as our mass spectroscopy database and our latent print database. We also have expertise in cell phone and computer forensics, including the recovery of deleted files and logs. Additionally we have fire research and arson investigation expertise that have provided assistance in major investigations such as the World Trade Center building collapses, the Rhode Island nightclub fire, and the Chicago high-rise fire, as well as an extensive array of fire modeling software. We've been performing fire research for a very long time. We have provided guidance in fire research by initiating the compilation of best practices, resulting in the 1980 publication of the Fire Investigation Handbook, and through this publication, entered into a close partnership with the National Fire Protection Association.

NIST is working to identify sources and develop standard procedures for minimizing the chances of error in impression analysis, including fingerprints and ballistics. We also have a technical working group on biological evidence preservation.

The work done by the NIST can help to establish a more solid scientific basis for comparing samples and interpreting the types of evidence mentioned earlier. A more scientific basis for comparison will give the forensic science and law enforcement community a better understanding of how well those interpretations can be trusted. The goal is to provide a vocabulary that will help define the limits of certainty so police officers and forensic scientists can testify before a jury and say this evidence came from that suspect with a quantified confidence.

There are nearly 400 labs in the U.S. dedicated to some aspect of forensic science. These labs operate under a variety of standards, mandated at the state or local level and that may be unique to each department.

There is, of course, much to be said for expertise, but even experts can make mistakes. This is why standards are important. Standards unite our efforts and help us to speak with one voice. They bolster trust. They set a minimum level of performance, a baseline for defining success, and a vocabulary for expressing degrees of confidence with consistency and objectivity.

Measurement Science and Standards in Support of Forensic Science in FY2013

The $5 million initiative proposed in FY 2013 request will enable NIST, in coordination with DOJ, to create a strategic program to oversee and manage standard development in forensic science.

Forensic science must deal with an incredibly wide range of interdisciplinary fields, from DNA sequencing to electron microscopy to the visual matching of patterns like footprints or tool marks. Often evidence samples are degraded, incomplete, or available only in very small amounts, which also presents challenges for developing the full range of measurement tools required for ensuring confidence in results.

In 2009, a committee of the National Research Council (NRC) made a number of important recommendations for strengthening the public's trust in forensic science findings. The recommendations included strong support for improved measurement and validation methodologies, development of additional forensic science standards, and dissemination of best practices to strengthen the precision and reliability of forensic science analyses.

NIST's work in advancing forensic science led the NRC to explicitly name NIST as one of several federal agencies that should collaborate on developing new forensic science measurements and standards. Working with NIJ and other agencies through reimbursable funding, NIST has measurement science research under way in chemical, biological, radiological, and nuclear detection and analysis; fire and explosives analysis; gunshot residue, latent fingerprints, and many other areas. NIST's work in DNA profiling and testing, for example, helped establish the methods now used by all crime laboratories to match individuals to evidence samples.

With the requested $5 million initiative, NIST will be able to develop state-of the art measurement science and standards as the basis for forensic disciplines and technologies. Working with stakeholders, NIST has identified critical areas of investment that will be complementary to current research. It will also provide practitioners with analyses in disciplines that require more research in the near term, including areas in which quality control is acknowledged as the most pressing issue, and in which significant investment in human capital or equipment is necessary to make an impact. Examples of priority program areas in this new initiative include: new reference methods and technologies for understanding crime scenes and identifying criminals, including the uncertainty and standards associated with those techniques; improved calibration systems, reference materials and databases, and technology testbeds for ensuring reliable and accurate forensic science practices; and development of rigorous training programs.

A major outcome of this initiative will be to strengthen the utility and reliability of forensic science evidence in the courtroom. This work also has the potential for significant cost savings for the U.S. justice system by reducing the number of mistrials and appeals related to questions about forensic science analysis. One economic analysis of cost savings from forensic DNA testing alone estimated a cost savings of $35 for every dollar invested; the same analysis predicted that if DNA testing were fully utilized the United States could expect a $12.9 billion annual savings in prevented crime.[1]

NIST anticipates additional impacts to include new, innovative forensic science technologies; increased use of documentary standards and measurement services by the forensic science community; and the creation of reference materials, reference databases and new calibration services to improve the consistency of the implementation of forensic science across the nation.

In conclusion, public trust in the justice system relies on the validity and certainty of evidence presented to the courts. Increasingly, that evidence is gathered and analyzed with innovative

[1] Butler, John. "Fundamentals of Forensic DNA Typing," Academic Press 2009, p.261.

forensic science technologies. Any time a new technology is developed, accurate measurements, standards, and uncertainty estimates are needed to ensure that the technology works as intended.

That is where NIST's expertise in the forensic sciences is critical, and our FY13 request will build a stronger forensic science program at NIST.

Thank you again, for the opportunity to testify today, I would be happy to answer any questions you may have.

Dr. Patrick D. Gallagher, Director

Dr. Patrick Gallagher was confirmed as the 14th Director of the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) on Nov. 5, 2009. He also serves as Under Secretary of Commerce for Standards and Technology, a new position created in the America COMPETES Reauthorization Act of 2010, signed by President Obama on Jan. 4, 2011.

Gallagher provides high-level oversight and direction for NIST. The agency promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology. NIST's FY 2012 resources total $750.8 million from the Consolidated and Further Continuing Appropriations Act of 2012 (P.L. 112-55), with an estimated additional annual income of $62.7 million in service fees, and $128.9 million from other agencies. The agency employs about 2,900 scientists, engineers, technicians, support staff, and administrative personnel at two main locations in Gaithersburg, Md., and Boulder, Colo.

Gallagher had served as Deputy Director since 2008. Prior to that, he served for four years as Director of the NIST Center for Neutron Research (NCNR), a national user facility for neutron scattering on the NIST Gaithersburg campus. The NCNR provides a broad range of neutron diffraction and spectroscopy capability with thermal and cold neutron beams and is presently the nation's most used facility of this type. Gallagher received his Ph.D. in Physics at the University of Pittsburgh in 1991. His research interests include neutron and X-ray instrumentation and studies of soft condensed matter systems such as liquids, polymers, and gels. In 2000, Gallagher was a NIST agency representative at the National Science and Technology Council (NSTC). He has been active in the area of U.S. policy for scientific user facilities and was chair of the Interagency Working Group on neutron and light source facilities under the Office of Science and Technology Policy. Currently, he serves as co-chair of the Standards Subcommittee under the White House National Science and Technology Council.