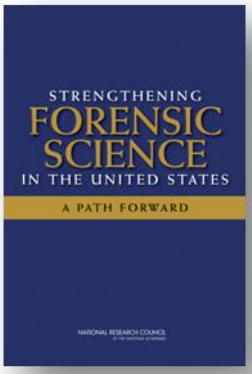
THE NATIONAL ACADEMIES
REPORT IN BRIEF

STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES
A PATH FORWARD (2009)



For decades, the forensic sciences have produced valuable evidence that has contributed to the successful prosecution and conviction of criminals as well as the exoneration of innocent people. Over the last two decades, advances in some forensic science disciplines, especially the use of DNA technology, have demonstrated that the forensic sciences have great additional potential to help law enforcement identify criminals. Many crimes that may have gone unsolved are now being solved because the forensic sciences are helping to identify the perpetrators.

Those advances, however, also have revealed that, in some cases, evidence and testimony based on faulty or unsubstantiated forensic science analyses may have contributed to wrongful convictions of innocent people. This fact has demonstrated the potential danger of giving undue weight to evidence and testimony derived from imperfect testing and analysis. Moreover, imprecise or exaggerated expert testimony has sometimes contributed to the admission of erroneous or misleading evidence.

Numerous professionals in the forensic science community and the medical examiner system have worked for years to achieve excellence in their fields, aiming to follow high ethical norms, develop sound professional standards, ensure accurate results in their practice, and improve the processes by which accuracy is determined. Although the work of these dedicated professionals has resulted in significant progress in the forensic sciences in recent decades, major challenges still face the forensic science community. It is therefore unsurprising that the Science, State, Justice, Commerce, and Related Agencies Appropriations Act of 2006 authorized "the National Academy of Sciences to conduct a study on forensic science that, among other things would, "assess the resent and future resource needs of the forensic science community," "make recommendations for maximizing the use of forensic technologies and techniques," "make recommendations for programs that will increase the number of qualified forensic scientists and medical examiners," and "disseminate best practices and guidelines evidence to help ensure quality and consistency in the use of forensic technologies and techniques." These are among the pressing issues facing the forensic science community. The best professionals in the forensic science disciplines invariably are hindered in their work because these and other problems persist.

The length of the congressional charge and the complexity of the material under review made the committee's assignment difficult. In undertaking its assignment, the committee first had to gain an understanding of the various disciplines within the forensic science community, as well as the community's history, its strengths and weaknesses, and the roles of the people and agencies that constitute the community and make use of its services. In so doing, the committee was able to better comprehend some of the major problems facing the forensic science community and the medical examiner system. A brief review of some of these problems is illuminating.

Disparities in the Forensic Science Community

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, availability of skilled and well-trained personnel, certification, accreditation, and oversight. As a result, it is not easy to generalize about current practices within the forensic science community. It is clear, however, that any approach to overhauling the existing forensic system needs to address and help minimize the community's current fragmentation and inconsistent practices.

While the vast majority of criminal law enforcement is handled by state and local jurisdictions, these entities often are sorely lacking in the resources (money, staff, training, and equipment) necessary to promote and maintain strong forensic science laboratory systems. By comparison, federal programs are much better funded and staffed than are state and local programs. It is also noteworthy that the resources, extent of services, and amount of expertise that medical examiners and forensic pathologists can provide varies widely in different jurisdictions. As a result, the depth, reliability, and overall quality of forensic evidence available to the legal system varies substantially across the country.

Lack of Mandatory Standardization, Certification, and Accreditation

The fragmentation problem is compounded because operational principles and procedures for many forensic disciplines are not standardized or embraced, either among or within jurisdictions. There is no uniformity in certification of forensic practitioners, nor in 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, 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 (e.g., Scientific Working Group, or SWG standards), they often are vague and not enforced in any meaningful way. In short, the quality of forensic practice in most disciplines varies greatly due to 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 and its service to the justice system.

The Broad Range of Forensic Disciplines

There is wide unevenness across forensic science disciplines with regard to techniques, methodologies, reliability, types and numbers of errors, research, general acceptability, and published material. Some of the forensic disciplines are laboratory based (e.g., nuclear and mitochondrial DNA analysis, toxicology and drug analysis); others are based on expert interpretation of observed patterns (e.g., fingerprints, writing samples, tool marks, bite marks, and specimens such as hair). The "forensic science community," in turn, consists of a host of practitioners, including scientists (some with advanced degrees) in the fields of chemistry, biochemistry, biology, and medicine; laboratory technicians; crime scene investigators; and law enforcement officers. There are critical differences in training and expertise of personnel and procedures followed between forensic laboratory work and crime scene investigations. There are also sharp distinctions between forensic practitioners who have been trained in chemistry, biochemistry, biology, and medicine (and who bring these disciplines to bear in their work) and technicians who lend support to forensic science enterprises. There also is substantial evidence indicating that the level of scientific development of the field and its evaluation varies substantially among the forensic disciplines.

Problems Relating to Interpretation of Forensic Evidence

Often in criminal prosecutions and civil litigation, forensic evidence is offered to support conclusions about "individualization" (sometimes referred to as "matching" a specimen to a particular individual) or about classification of the source of the specimen into one of several categories. 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. In terms of scientific basis, the analytically based disciplines generally hold a notable edge over disciplines based on expert interpretation. There are important variations among the disciplines relying on expert interpretation, however. For example, there are more established protocols and available research for fingerprint analysis than for the analysis of bite marks. There are also significant variations within each discipline. For instance, not all fingerprint evidence is equally valuable, because the true value of the evidence is determined by the quality of the latent fingerprint image. These disparities between and within forensic disciplines highlight a major problem in the forensic science community: The simple reality is that interpretation of forensic evidence is not invariably infallible. Quite the contrary. Although research has been done in some disciplines, there is a notable dearth of peer-reviewed, published studies establishing the scientific bases and validity of many forensic methods. Until the necessary work is performed to quantify a forensic method and ensure that examiners are using the method correctly and consistently, the method cannot be validated.

The Need for Research to Establish Limits and Measures of Performance

In evaluating the accuracy of a forensic analysis, it is crucial to clarify the type of question the analysis is attempting to address. Thus, although some techniques may be too imprecise to permit accurate identification of a specific individual, they may still provide useful and accurate information about questions of classification. For example, microscopic hair analysis may provide reliable evidence on some genetic characteristics of the individual from which the specimen was taken, but may not be able to reliably match the specimen with a specific individual. However, the definition of the appropriate question is only a first step in evaluating the performance of a forensic technique. A body of research is required to establish limits and measures of performance and to address the impact of sources of variability and potential bias. Such research is sorely needed but seems to be lacking in most of the forensic disciplines based on subjective assessment of matching characteristics. These disciplines need to develop rigorous protocols to guide these subjective interpretations and pursue equally rigorous research and evaluation programs.

The Admission of Forensic Science Evidence in Litigation

Forensic science experts and evidence are used routinely in the service of the criminal justice system. In order for qualified forensic science experts to testify competently about forensic evidence, they must first find the evidence in a usable state and properly preserve it. A latent fingerprint that is badly smudged when found cannot be usefully saved, analyzed, or explained. An inadequate drug sample may be insufficient to allow for proper analysis. And, DNA tests performed on a contaminated or otherwise compromised sample cannot be used reliably to identify or eliminate an individual as the perpetrator of a crime. These are important matters having to do with the proper processing of forensic evidence. The law's greatest dilemma in its heavy reliance on forensic evidence, however, concerns the question of whether—and to what extent—there is *science* in any given forensic science discipline.

There are two very important questions that *should* underlie the law's admission of and reliance upon forensic evidence in criminal trials: 1) the extent to which a particular forensic discipline is founded on a reliable scientific methodology that gives it the capacity to accurately analyze evidence and report findings, and 2) the extent to which practitioners in a particular forensic discipline rely on human interpretation that could be tainted by error, the threat of bias, or the absence of sound operational procedures and robust performance standards. These questions are significant. Thus, it matters a great deal whether an expert is qualified to testify about forensic evidence and whether the evidence is sufficiently reliable to merit a fact finder's reliance on the truth that it purports to support. Unfortunately, these important questions do not always produce satisfactory answers in judicial decisions pertaining to the admissibility of forensic science evidence proffered in criminal trials.

The vast majority of the reported opinions in criminal cases indicate that trial judges rarely exclude or restrict expert testimony offered by prosecutors; most reported opinions also indicate that appellate courts routinely deny appeals contesting trial court decisions admitting forensic evidence against criminal defendants.

Given these realities, there is a tremendous need for the forensic science community to improve. Judicial review, by itself, will not cure the infirmities of the forensic science community. With more and better educational programs, accredited laboratories, certified forensic practitioners, sound operational principles and procedures, and serious research to establish the limits and measures of performance in each discipline, forensic science experts will be better able to analyze evidence and coherently report their findings in the courts. The present situation, however, is seriously wanting, both because of the limitations of the judicial system and because of the many problems faced by the forensic science community.

Political Realities

Finally, throughout its deliberations, the committee remained mindful of the fact that Congress cannot directly fix all of the deficiencies in the forensic science community. In other words, to the extent that forensic science methods, programs, and evidence are within the regulatory province of state and local law enforcement entities or covered by statutes and rules governing state judicial proceedings, Congress may have only limited *direct* authority to effect change. Under our federal system of government, Congress cannot act with a free hand to amend state criminal codes, rules of evidence, and statutes governing civil actions; nor may it easily and directly regulate local law enforcement practices, state and local medical examiner units, or state policies covering accreditation of crime labs and certification of forensic practitioners.

Congress' authority to act is significant, however. Forensic science programs in federal government entities are funded by congressional appropriations. If these programs are required to operate pursuant to the highest standards, they will provide an example for the states. More importantly, Congress can promote "best practices" and strong educational, certification, accreditation, ethics, and oversight programs in the states by offering funds that are contingent on meeting appropriate standards of practice. There is every reason to believe that offers of federal funds with "strings attached" can effect significant change in the forensic science community, because so many state and local programs are presently suffering for want of adequate resources. In the end, however, the committee recognized that state and local authorities must be willing to enforce change if it is to happen.

In light of the foregoing issues, the committee exercised caution before drawing conclusions and avoided being too prescriptive in its recommendations. It also recognized that, given the complexity of the issues and the political realities that may pose obstacles to change, some recommendations will have to be implemented creatively in order to be effective.

Major Findings and Recommendations

Although congressional action will not remedy all of the deficiencies in forensic science methods and practices, it is clear that truly meaningful advances will not come without significant concomitant leadership from the federal government. The forensic sciences presently are an assortment of methods and practices, used in both public and private arenas. They exhibit wide variability in capacity, oversight, staffing, certification, and accreditation across federal and state jurisdictions. Too often they have inadequate educational programs, and they typically lack mandatory and enforceable standards, founded on rigorous research and testing, certification requirements, and accreditation programs. Additionally, forensic science and forensic pathology research, education, and training lack strong ties to our research universities and national science assets.

In addition to the problems emanating from the fragmentation of the forensic science community, the most recently published Bureau of Justice Statistics (BJS) Census of Crime Laboratories describes an unacceptable case backlog in state and local crime laboratories. The most recently published BJS Special Report of Medical Examiners and Coroners' Offices also depicts a system with disparate and often inadequate educational and training requirements, resources, and capacities—in short, a system in need of significant improvement. Additional resources surely will be necessary to create high quality, self-correcting systems. However, simply increasing the staff within existing crime laboratories and medical examiners' offices is only part of the solution. What is also needed is an upgrading of systems and organizational structures, better training, the widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. The forensic

science community and the medical examiner system must be upgraded if forensic practitioners are to be expected to serve the goals of justice.

A strong push and sustained leadership from the federal government is needed to help cure the ills of the forensic science community and medical examiner system, and then to sustain their robustness. In the United States, the development of scientific research, training, technology, and databases associated with DNA analysis have resulted from substantial and steady federal support for academic research and programs employing techniques for DNA analysis. The same must occur with all worthy forensic disciplines if they are to achieve the degrees of reliability needed to serve the goals of justice. While the FBI and National Institute of Justice have supported some research in forensic science, the level of support has been far from generous and well short of what is necessary for the forensic science community to establish strong links with a broad base of major research universities. In addition, the forensic science community lacks a venue to strategically plan and implement standards and protocols that can be used in monitoring compliance. As noted above, the benefits that will flow from a strong, independent, centralized, and well-funded federal program to support and oversee the forensic sciences in this country are clear: The nation will 1) bolster its ability to pursue fruitful law enforcement in local, state, and federal jurisdictions; 2) improve its ability to effectively respond to, attribute, and prosecute threats to homeland security; and 3) reduce the likelihood of convictions resting on inaccurate data.

In short, to more fruitfully serve the American public and the goals of justice, the now badly fragmented forensic science community needs support and direction from a strong, independent entity in the federal government. Such an entity can adopt and promote an aggressive, long-term agenda to help refine the forensic sciences, by calling public attention to the strengths and limitations of forensic science methodologies, channeling resources to achieve meaningful advances in forensic science practices, creating appropriate incentives for jurisdictions to adopt and adhere to best practices, and promulgating necessary sanctions to discourage bad practices. The next step in the evolution of the forensic sciences is necessary, but it is not inevitable. To institutionalize best scientific practice in the forensic disciplines, clear direction must be provided at the national level.

In sum, the committee believes that a new entity is needed to support and oversee the forensic science community and it must meet the following minimum criteria:

- It must have a culture that is strongly rooted in science.
- It must have strong ties to the academic research and teaching communities.
- It must have strong ties to the national research communities (including federal laboratories).
- It must have strong ties to the professional organizations within the forensic science community
- It must not be in any way beholden to the existing system, but should be informed by the experiences of the existing system.
- It must not be part of a law enforcement agency.
- It must have funding, independence, and sufficient prominence to raise the profile of the forensic sciences and push effectively for improvements.
- It must be led by persons who are skilled in standard setting, managing accreditation and testing processes, and rulemaking/oversight/sanctions.

No federal agency presently exists that meets all of these criteria. With the establishment of the National Institute for Forensic Sciences, the Nation will see further advances in the forensic science disciplines, which will serve three important purposes. First, further improvements will assist law enforcement officials in the course of their investigations to identify perpetrators with higher reliability. Second, any improvements in the forensic sciences will undoubtedly enhance the Nation's ability to address the needs of homeland security. Third, further improvements in forensic science practices should reduce the risk of wrongful convictions.

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For More Information

Copies of *Strengthening Forensic Science in the United States: A Path Forward* are available from the National Academies Press; call (800) 624-6242 or visit the NAP Web site at *www.nap.edu*. For more information concerning this project, contact Anne-Marie Mazza (amazza@nas.edu) or visit the Policy and Global Affairs Web site at *www.nationalacademies.org/pga*.