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'BADLY FRAGMENTED' FORENSIC SCIENCE SYSTEM NEEDS OVERHAUL;
EVIDENCE TO SUPPORT RELIABILITY OF MANY TECHNIQUES IS LACKING

WASHINGTON -- A congressionally mandated report from the National Research Council finds serious deficiencies in the nation's forensic science system and calls for major reforms and new research. Rigorous and mandatory certification programs for forensic scientists are currently lacking, the report says, as are strong standards and protocols for analyzing and reporting on evidence. And there is a dearth of peer-reviewed, published studies establishing the scientific bases and reliability of many forensic methods. Moreover, many forensic science labs are underfunded, understaffed, and have no effective oversight.

Forensic evidence is often offered in criminal prosecutions and civil litigation to support conclusions about individualization -- in other words, to "match" a piece of evidence to a particular person, weapon, or other source. But with the exception of nuclear DNA analysis, the report says, no forensic method has been rigorously shown able to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source. Non-DNA forensic disciplines have important roles, but many need substantial research to validate basic premises and techniques, assess limitations, and discern the sources and magnitude of error, said the committee that wrote the report. Even methods that are too imprecise to identify a specific individual can provide valuable information and help narrow the range of possible suspects or sources.

"Reliable forensic evidence increases the ability of law enforcement officials to identify those who commit crimes, and it protects innocent people from being convicted of crimes they didn't commit," said committee co-chair Harry T. Edwards, senior circuit judge and chief judge emeritus of the U.S. Court of Appeals for the District of Columbia Circuit. "Because it is clear that judicial review alone will not cure the infirmities of the forensic science community, there is a tremendous need for the forensic science community to improve."

Strong leadership is needed to adopt and promote an aggressive, long-term agenda to strengthen forensic science, the report says. To achieve this end, the report strongly urges Congress to establish a new, independent National Institute of Forensic Science to lead research efforts, establish and enforce standards for forensic science professionals and laboratories, and oversee education standards. "Much

research is needed not only to evaluate the reliability and accuracy of current forensic methods but also to innovate and develop them further," said committee co-chair Constantine Gatsonis, professor of biostatistics and director of the Center for Statistical Sciences at Brown University. "An organized and well-supported research enterprise is a key requirement for carrying this out."

To ensure the efficacy of the work done by forensic scientists and other practitioners in the field, public forensic science laboratories should be made independent from or autonomous within police departments and prosecutors' offices, the report says. This would allow labs to set their own budget priorities and resolve any cultural pressures caused by the differing missions of forensic science labs and law enforcement agencies.

The report offers no judgment about past convictions or pending cases, and it offers no view as to whether the courts should reassess cases that already have been tried. Rather, the report describes and analyzes the current situation in the forensic science community and makes recommendations for the future.

CERTIFICATION AND ACCREDITATION SHOULD BE MANDATORY

Many 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, and ensure accurate results in their practice. But there are great disparities among existing forensic science operations in federal, state, and local law enforcement agencies. The disparities appear in funding, access to analytical instruments, and availability of skilled and well-trained personnel; and in certification, accreditation, and oversight. This has left the forensic science system fragmented and the quality of practice uneven. Except in a few states, forensic laboratories are not required to meet high standards for quality assurance, nor are practitioners required to be certified. These shortcomings pose a threat to the quality and credibility of forensic science practice and its service to the justice system, concluded the committee.

Certification should be mandatory for forensic science professionals, the report says. Among the steps required for certification should be written examinations, supervised practice, proficiency testing, and adherence to a code of ethics. Accreditation for laboratories should be required as well. Labs should establish quality-control procedures designed to ensure that best practices are followed, confirm the continued validity and reliability of procedures, and identify mistakes, fraud, and bias, the report says.

Setting standards for certification and accreditation should be one of the responsibilities of the new National Institute of Forensic Science recommended in the report. The institute should work with the National Institute of Standards and Technology, government and private labs, Scientific Working Groups, and other partners to develop protocols and best practices for forensic analysis, which should inform the standards.

Existing data suggest that forensic laboratories are underfunded and understaffed, which contributes to case backlogs and makes it hard for laboratories to do as much as they could to inform investigations and avoid errors, the report says. Additional resources will be necessary to create a high-quality, self-correcting forensic science system.

EVIDENCE BASE OFTEN SPARSE, VARIES AMONG DISCIPLINES

Nuclear DNA analysis has been subjected to more scrutiny than any other forensic discipline, with extensive experimentation and validation performed prior to its use in investigations. This is not the case with most other forensic science methods, which have evolved piecemeal in response to law enforcement needs, and which have never been strongly supported by federal research or closely scrutinized by the scientific community.

As a result, there has been little rigorous research to investigate how accurately and reliably many forensic science disciplines can do what they purport to be able to do. In terms of a scientific basis, the disciplines based on biological or chemical analysis, such as toxicology and fiber analysis, generally hold an edge over fields based on subjective interpretation by experts, such as fingerprint and toolmark analysis. And there are variations within the latter group; for example, there is more available research and protocols for fingerprint analysis than for bitemarks.

Nuclear DNA analysis enjoys a pre-eminent position not only because the chances of a false positive are minuscule, but also because the likelihood of such errors is quantifiable, the report notes. Studies have been conducted on the amount of genetic variation among individuals, so an examiner can state in numerical terms the chances that a declared match is wrong. In contrast, for many other forensic disciplines -- such as fingerprint and toolmark analysis -- no studies have been conducted of large populations to determine how many sources might share the same or similar features. For every forensic science method, results should indicate the level of uncertainty in the measurements made, and studies should be conducted that enable these values to be estimated, the report says.

There is some evidence that fingerprints are unique to each person, and it is plausible that careful analysis could accurately discern whether two prints have a common source, the report says. However, claims that these analyses have zero-error rates are not plausible; uniqueness does not guarantee that two individuals' prints are always sufficiently different that they could not be confused, for example. Studies should accumulate data on how much a person's fingerprints vary from impression to impression, as well as the degree to which fingerprints vary across a population. With this kind of research, examiners could begin to attach confidence limits to conclusions about whether a print is linked to a particular person.

Disciplines that are too imprecise to identify an individual may still be able to provide accurate and useful information to help narrow the pool of possible suspects, weapons, or other sources, the report says. For example, the committee found no evidence that microscopic hair analysis can reliably associate a hair with a specific individual, but noted that the technique may provide information that either includes or excludes a subpopulation.

In addition to investigating the limits of the techniques themselves, studies should also examine sources and rates of human error, the report says. As part of this effort, more research should be done on "contextual bias," which occurs when the results of forensic analysis are influenced by an examiner's knowledge about the suspect's background or an investigator's knowledge of a case. One study found that fingerprint examiners did not always agree even with their own past conclusions when the same evidence was presented in a different context.

COURT TESTIMONY SHOULD BE GROUNDED IN SCIENCE, ACKNOWLEDGE UNCERTAINTIES

The committee was not asked to determine whether analysis from particular forensic science methods should be admissible in court, and did not do so. However, it concluded that the courts cannot cure the ills of the forensic science community. "The partisan adversarial system used in the courts to determine the admissibility of forensic science evidence is often inadequate to the task," said Edwards. "And because the judicial system embodies a case-by-case adjudicatory approach, the courts are not well-suited to address the systemic problems in many of the forensic science disciplines."

The committee also concluded that two criteria should guide the law's admission of and reliance upon forensic evidence in criminal trials: the extent to which the forensic science discipline is founded on a reliable scientific methodology that lets it accurately analyze evidence and report findings; and the extent to which the discipline relies on human interpretation that could be tainted by error, bias, or the absence of sound procedures and performance standards.

The report points out the critical need to standardize and clarify the terms used by forensic science experts who testify in court about the results of investigations. The words commonly used -- such as "match," "consistent with," and "cannot be excluded as the source of" -- are not well-defined or used consistently, despite the great impact they have on how juries and judges perceive evidence.

In addition, any testimony stemming from forensic science laboratory reports must clearly describe the limits of the analysis; currently, failure to acknowledge uncertainty in findings is common. The simple reality is that interpretation of forensic evidence is not infallible -- quite the contrary, said the committee. Exonerations from DNA testing have shown the potential danger of giving undue weight to evidence and testimony derived from imperfect testing and analysis.

STRONG, INDEPENDENT LEADERSHIP NEEDED

The existing forensic science enterprise lacks the necessary governance structure to move beyond its weaknesses, the report says. The recommended new National Institute of Forensic Science could take on its tasks in a manner that is as objective and free of bias as possible -- one with the authority and resources to implement a fresh agenda designed to address the problems found by the committee. The institute should have a full-time administrator and an advisory board with expertise in research and education, the forensic science disciplines, physical and life sciences, and measurements and standards, among other fields.

The committee carefully considered whether such a governing body could be established within an existing agency, and determined that it could not. There is little doubt that some existing federal entities are too wedded to the current forensic science community, which is deficient in too many respects. And existing agencies have failed to pursue a strong research agenda to confirm the evidentiary reliability of methodologies used in a number of forensic science disciplines.

The report was sponsored by the National Institute of Justice at the request of Congress. The National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council make up the National Academies. They are private, nonprofit institutions that provide science, technology, and health policy advice under a congressional charter. The Research Council is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering. A committee roster follows.

Copies of [STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD](#) are available from the National Academies Press; tel. 202-334-3313 or 1-800-624-6242 or on the Internet at [HTTP://WWW.NAP.EDU](http://WWW.NAP.EDU). Reporters may obtain a copy from the Office of News and Public Information (contacts listed above). In addition, a podcast of the public briefing held to release this report is available at [HTTP://NATIONAL-ACADEMIES.ORG/PODCAST](http://NATIONAL-ACADEMIES.ORG/PODCAST).

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