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Strengthening Forensic Science in the United States: A Path Forward

Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council

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STRENGTHENING
**FORENSIC
SCIENCE**
IN THE UNITED STATES

A PATH FORWARD

Committee on Identifying the Needs of the Forensic Science Community

Committee on Science, Technology, and Law
Policy and Global Affairs

Committee on Applied and Theoretical Statistics
Division on Engineering and Physical Sciences

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Preface

Recognizing that significant improvements are needed in forensic science, Congress directed the National Academy of Sciences to undertake the study that led to this report. There are scores of talented and dedicated people in the forensic science community, and the work that they perform is vitally important. They are often strapped in their work, however, for lack of adequate resources, sound policies, and national support. It is clear that change and advancements, both systemic and scientific, are needed in a number of forensic science disciplines—to ensure the reliability of the disciplines, establish enforceable standards, and promote best practices and their consistent application.

In adopting this report, the aim of our committee is to chart an agenda for progress in the forensic science community and its scientific disciplines. Because the work of forensic science practitioners is so obviously wide-reaching and important—affecting criminal investigation and prosecution, civil litigation, legal reform, the investigation of insurance claims, national disaster planning and preparedness, homeland security, and the advancement of technology—the committee worked with a sense of great commitment and spent countless hours deliberating over the recommendations that are included in the report. These recommendations, which are inexorably interconnected, reflect the committee’s strong views on policy initiatives that must be adopted in any plan to improve the forensic science disciplines and to allow the forensic science community to serve society more effectively.

The task Congress assigned our committee was daunting and required serious thought and the consideration of an extremely complex and decentralized system, with various players, jurisdictions, demands, and limitations. Throughout our lengthy deliberations, the committee heard testimony

from the stakeholder community, ensuring that the voices of forensic practitioners were heard and their concerns addressed. We also heard from professionals who manage forensic laboratories and medical examiner/coroner offices; teachers who are devoted to training the next generation of forensic scientists; scholars who have conducted important research in a number of forensic science fields; and members of the legal profession and law enforcement agencies who understand how forensic science evidence is collected, analyzed, and used in connection with criminal investigations and prosecutions. We are deeply grateful to all of the presenters who spoke to the committee and/or submitted papers for our consideration. These experts and their work served the committee well.

In considering the testimony and evidence that was presented to the committee, what surprised us the most was the consistency of the message that we heard:

The forensic science system, encompassing both research and practice, has serious problems that can only be addressed by a national commitment to overhaul the current structure that supports the forensic science community in this 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 recommendations in this report represent the committee's studied opinion on how best to achieve this critical goal.

We had the good fortune to serve as co-chairs of the committee entrusted with addressing Congress' charge. The committee, formed under the auspices of the National Academies' Committee on Science, Technology, and Law and Committee on Applied and Theoretical Statistics, was composed of many talented professionals, some expert in various areas of forensic science, others in law, and still others in different fields of science and engineering. They listened, read, questioned, vigorously discussed the findings and recommendations offered in this report, and then worked hard to complete the research and writing required to produce the report. We are indebted to our colleagues for all the time and energy they gave to this effort. We are also most grateful to the staff, Anne-Marie Mazza, Scott Weidman, Steven Kendall, and the consultant writer, Kathi Hanna, for their superb work and dedication to this project; to staff members David Padgham and John Sislin, and editor, Sara Maddox, for their assistance; and to Paige Herwig, Laurie Richardson, and Judith A. Hunt for their sterling contributions in checking source materials and assisting with the final production of the report.

Harry T. Edwards and Constantine Gatsonis
Committee Co-chairs

Summary

INTRODUCTION

On November 22, 2005, the Science, State, Justice, Commerce, and Related Agencies Appropriations Act of 2006 became law.¹ Under the terms of the statute, Congress authorized “the National Academy of Sciences to conduct a study on forensic science, as described in the Senate report.”² The Senate Report to which the Conference Report refers states:

While a great deal of analysis exists of the requirements in the discipline of DNA, there exists little to no analysis of the remaining needs of the community outside of the area of DNA. Therefore . . . the Committee directs the Attorney General to provide [funds] to the National Academy of Sciences to create an independent Forensic Science Committee. This Committee shall include members of the forensics community representing operational crime laboratories, medical examiners, and coroners; legal experts; and other scientists as determined appropriate.³

The Senate Report also sets forth the charge to the Forensic Science Committee, instructing it to:

- (1) assess the present and future resource needs of the forensic science community, to include State and local crime labs, medical examiners, and coroners;

¹ P.L. No. 109-108, 119 Stat. 2290 (2005).

² H.R. Rep. No. 109-272, at 121 (2005) (Conf. Rep.).

³ S. Rep. No. 109-88, at 46 (2005).

- (2) make recommendations for maximizing the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public;
- (3) identify potential scientific advances that may assist law enforcement in using forensic technologies and techniques to protect the public;
- (4) make recommendations for programs that will increase the number of qualified forensic scientists and medical examiners available to work in public crime laboratories;
- (5) disseminate best practices and guidelines concerning the collection and analysis of forensic evidence to help ensure quality and consistency in the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public;
- (6) examine the role of the forensic community in the homeland security mission;
- (7) [examine] interoperability of Automated Fingerprint Information Systems [AFIS]; and
- (8) examine additional issues pertaining to forensic science as determined by the Committee.⁴

In the fall of 2006, a committee was established by the National Academy of Sciences to implement this congressional charge. As recommended in the Senate Report, the persons selected to serve included members of the forensic science community, members of the legal community, and a diverse group of scientists. Operating under the project title “Identifying the Needs of the Forensic Science Community,” the committee met on eight occasions: January 25-26, April 23-24, June 5-6, September 20-21, and December 6-7, 2007, and March 24-25, June 23-24, and November 14-15, 2008. During these meetings, the committee heard expert testimony and deliberated over the information it heard and received. Between meetings, committee members reviewed numerous published materials, studies, and reports related to the forensic science disciplines, engaged in independent research on the subject, and worked on drafts of the final report.

Experts who provided testimony included federal agency officials; academics and research scholars; private consultants; federal, state, and local law enforcement officials; scientists; medical examiners; a coroner; crime laboratory officials from the public and private sectors; independent investigators; defense attorneys; forensic science practitioners; and leadership of professional and standard setting organizations (see the Acknowledgments and Appendix B for a complete listing of presenters).

⁴ Ibid.

The issues covered during the committee's hearings and deliberations included:

- (a) the fundamentals of the scientific method as applied to forensic practice—hypothesis generation and testing, falsifiability and replication, and peer review of scientific publications;
- (b) the assessment of forensic methods and technologies—the collection and analysis of forensic data; accuracy and error rates of forensic analyses; sources of potential bias and human error in interpretation by forensic experts; and proficiency testing of forensic experts;
- (c) infrastructure and needs for basic research and technology assessment in forensic science;
- (d) current training and education in forensic science;
- (e) the structure and operation of forensic science laboratories;
- (f) the structure and operation of the coroner and medical examiner systems;
- (g) budget, future needs, and priorities of the forensic science community and the coroner and medical examiner systems;
- (h) the accreditation, certification, and licensing of forensic science operations, medical death investigation systems, and scientists;
- (i) Scientific Working Groups (SWGs) and their practices;
- (j) forensic science practices—
 - pattern/experience evidence
 - fingerprints (including the interoperability of AFIS)
 - firearms examination
 - toolmarks
 - bite marks
 - impressions (tires, footwear)
 - bloodstain pattern analysis
 - handwriting
 - hair
 - analytical evidence
 - DNA
 - coatings (e.g., paint)
 - chemicals (including drugs)
 - materials (including fibers)
 - fluids
 - serology
 - fire and explosive analysis
 - digital evidence;
- (k) the effectiveness of coroner systems as compared with medical examiner systems;

- (l) the use of forensic evidence in criminal and civil litigation—
 - the collection and flow of evidence from crime scenes to courtrooms
 - the manner in which forensic practitioners testify in court
 - cases involving the misinterpretation of forensic evidence
 - the adversarial system in criminal and civil litigation
 - lawyers' use and misuse of forensic evidence
 - judges' handling of forensic evidence;
- (m) forensic practice and projects at various federal agencies, including NIST, the FBI, DHS, U.S. Secret Service, NIJ, DEA, and DOD;
- (n) forensic practice in state and local agencies;
- (o) nontraditional forensic service providers; and
- (p) the forensic science community in the United Kingdom.

The testimonial and documentary evidence considered by the committee was detailed, complex, and sometimes controversial. Given this reality, the committee could not possibly answer every question that it confronted, nor could it devise specific solutions for every problem that it identified. Rather, it reached a consensus on the most important issues now facing the forensic science community and medical examiner system and agreed on 13 specific recommendations to address these issues.

Challenges Facing the Forensic Science Community

For decades, the forensic science disciplines have produced valuable evidence that has contributed to the successful prosecution and conviction of criminals as well as to 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 some areas of forensic science have great additional potential to help law enforcement identify criminals. Many crimes that may have gone unsolved are now being solved because forensic science is helping to identify the perpetrators.

Those advances, however, also have revealed that, in some cases, substantive information and testimony based on faulty 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.

Further advances in the forensic science disciplines 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, further improvements in forensic science practices

