Overview of the NAS Report on Forensic Science in the U.S.

Forensic Science in Iowa: Impact of the National Academy of Sciences Report

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Overview

- Issues with forensic science
- Origin and purpose of the report
- Major findings
- Recommendations
- Importance of report
Issues with forensic science

• At its best, forensic sciences can be used to exclude the innocent from conviction of a crime, indict the actual perpetrator of a crime, and improve public safety

• However, since 1992, 259 wrongfully convicted people have been exonerated by DNA evidence

• Invalid and improper forensic science was unveiled as the second greatest contributor to wrongful convictions overturned by DNA testing
Issues with forensic science

In an Innocence Project review of 137 wrongful convictions in which forensic evidence was presented and trial transcripts could be obtained, 60% involved invalid forensic testimony. These cases involved 72 forensic analysts from 52 different labs, across 25 states.

<table>
<thead>
<tr>
<th>Type of Forensic Analysis</th>
<th>Cases with trial transcripts</th>
<th>Cases involving invalid science testimony</th>
<th>Percentage of cases with trial transcripts involving invalid science testimony</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serology</td>
<td>100</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Hair comparison</td>
<td>65</td>
<td>25</td>
<td>38</td>
</tr>
<tr>
<td>Soil comparison</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fingerprint comparison</td>
<td>13</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Bite mark comparison</td>
<td>6</td>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td>Shoe print comparison</td>
<td>3</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>DNA testing</td>
<td>11</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Voice comparison</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1: Invalid Forensic Science Testimony by Type of Analysis
Issues with forensic science

- These only represent known exonerations by DNA testing
- Difficult to gauge wrongful convictions based on disciplines such as ballistics where DNA evidence is not available
Issues with forensic science: Where’d you grow up?

- DNA and toxicology have sound scientific underpinnings
- They “grew up” in the laboratory under heavy scrutiny
  - Lab procedures specified and validated
  - Reliable and repeatable standards exist for analysis, interpretation, and reporting
  - Error rates investigated and quantified
Issues with forensic science: Where’d you grow up?

- Only after development in clinical settings was DNA applied in forensic setting

- Body of literature in respected journals over many years supported accuracy of DNA before it moved into courtroom

- Recognition that many other forensic assays “grew up” in the courtroom
Origin and purpose of report

- NAS established in 1863 by Lincoln

- Mandate is to "investigate, examine, experiment, and report upon any subject of science or art" when called upon by the government

- Members are scholars engaged in scientific research
Origin and purpose of report

- NAS has addressed forensics in the past:
  - 1979 report critical of sound spectography, or “voiceprint”
  - 1990s reports on DNA evidence
  - 2003 report urging exclusion of polygraph
  - 2004 report critical of comparative bullet lead analysis (CBLA); FBI discontinued next year
Origin and purpose of report

- In 2006 Congress appropriated funds to thoroughly study the fundamental underpinnings of forensic science and its applications in our criminal justice system.

- A blue-ribbon panel was formed which included scientists, academics, a retired federal judge, and other notable experts.

- Held public hearings and gathered comprehensive research on forensic disciplines over eighteen months.

- *Strengthening Forensic Science in the United States: A Path Forward* was released in February 2009.
Major findings

- Fragmentation of forensic science system
- Lack of uniformity in admission and use of scientific evidence
  - Differing standards by jurisdiction
  - Deference to trial courts
Major findings

Judge Harry T. Edwards, Co-Chair of the NAS Committee, before the Senate Judiciary Committee, March 18, 2009:

- Paucity of scientific research on validity and reliability of forensic disciplines and quantifiable measures of uncertainty
- Lack of autonomy of crime labs
- Lack of mandatory accreditation of labs, certification of practitioners
- Failure to use standard terminology in reporting, testifying
- Lack of oversight
- Shortage of adequate training and continuing education for practitioners
Major findings

- “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.” (NAS Report, page S-5)

- “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.” (NAS Report, page S-6)

- “A body of research is [also] required to establish the limits and measures of performance and to address the impact of sources of variability and potential bias.” (NAS Report, page S-6)
Major findings: Areas reviewed

- Biological Evidence
- Controlled Substances
- Friction Ridge Analysis
- Other Pattern Evidence – shoeprints, tire tracks
- Toolmarks and Firearms Identification
- Hair and Fiber Evidence
- Questioned Documents
- Paint and Coatings Evidence
- Explosives and Fire Debris
- Forensic Odontology
- Bloodstain Pattern Analysis
Major findings: Hair comparison

- “No scientifically accepted statistics exist about the frequency with which particular characteristics of hair are distributed in the population. There appear to be no uniform standards on the number of features on which hairs must agree before an examiner may declare a “match.” (p. 5-25)

- “The committee found no scientific support for the use of hair comparisons for individualization in the absence of nuclear DNA. Microscopy and mtDNA analysis can be used in tandem and may add to one another’s value for classifying a common source, but no studies have been performed specifically to quantify the reliability of their joint use.” (p. 5-26)
Major findings: Fiber comparisons

“Fiber examiners agree, however, that none of these characteristics is suitable for individualizing fibers (associating a fiber from a crime scene with one, and only one, source) and that fiber evidence can be used only to associate a given fiber with a class of fibers.” (p. 5-26)
Major findings: Bitemark comparisons

- “Although the methods of collection of bite mark evidence are relatively noncontroversial, there is considerable dispute about the value and reliability of the collected data for interpretation. Some of the key areas of dispute include the accuracy of human skin as a reliable registration material for bite marks, the uniqueness of human dentition, the techniques used for analysis, and the role of examiner bias.”

- “Although the majority of forensic odontologists are satisfied that bite marks can demonstrate sufficient detail for positive identification, no scientific studies support this assessment, and no large population studies have been conducted. In numerous instances, experts diverge widely in their evaluations of the same bite mark evidence, which has led to questioning of the value and scientific objectivity of such evidence.”
“Bite mark testimony has been criticized basically on the same grounds as testimony by questioned document examiners and microscopic hair examiners. The committee received no evidence of an existing scientific basis for identifying an individual to the exclusion of all others.” (p. 5-37)
Major findings: Shoeprint comparisons

- “…it is difficult to avoid biases in experience-based judgments, especially in the absence of a feedback mechanism to correct an erroneous judgment.” (p. 5-17)

- “…critical questions that should be addressed include the persistence of individual characteristics, the rarity of certain characteristic types, and the appropriate statistical standards to apply to the significance of individual characteristics.” (p. 5-18)
Major findings: Friction ridge analysis

- “ACE-V provides a broadly stated framework for conducting friction ridge analyses. However, this framework is not specific enough to qualify as a validated method for this type of analysis. ACE-V does not guard against bias; is too broad to ensure repeatability and transparency; and does not guarantee that two analysts following it will obtain the same results.” (p. 5-12)

- “Errors can occur with any judgment-based method, especially when the factors that lead to the ultimate judgment are not documented. Some in the latent print community argue that the method itself, if followed correctly (i.e., by well-trained examiners properly using the method), has a zero error rate. Clearly, this assertion is unrealistic…” (p. 5-13)
Major findings: Friction ridge analysis

- “Uniqueness does not guarantee that prints from two different people are always sufficiently different that they cannot be confused or that two impressions made by the same finger will also be sufficiently similar to be discerned as coming from the same source.” (p. 5-13)

- “None of these variabilities—of features across a population of fingers or of repeated impressions left by the same finger—has been characterized, quantified, or compared.” (p. 5-13)
Major findings: Conclusions

• “...judicial review, by itself, will not cure the infirmities of the forensic science community.” (p.7)

• “I think the most important part of our committee’s report is its call for real science to support the forensic disciplines.” (p.7)

• “The best science is conducted in a scientific setting as opposed to a law enforcement setting.” (p.10)
Major findings: Conclusions

- Recognition that adversarial process not suited to the task of finding scientific truth

- “Upstream” changes needed – most criminal cases resolved by plea agreement

- Criminal investigations should begin with solid science to avoid erroneous focus on wrong suspect
Recommendation 1

Create a National Institute of Forensic Science (NIFS).

The primary recommendation of the NAS report is the creation of an independent, science-based federal agency with strong ties to state and local forensic entities, but not in any way committed to an existing system or part of a law enforcement agency. All of the subsequent recommendations are tied to this initial provision.
Recommendation 2
Establish Standard Terminology

NIFS should establish standard terminology for laboratory reports and court testimony.
Recommendation 3
Support scientific research on forensic practices

NIFS should competitively fund peer-reviewed research on the accuracy, reliability and validity of forensic science disciplines and quantify the uncertainty of disciplines.
Recommendation 4
Ensure independence of forensic labs

NIFS should allocate incentive grants to ensure that forensic science examinations have independence from (or have autonomy within) the law enforcement community.
Recommendation 5
Research ways to minimize bias

NIFS should support research programs on human observer bias and sources of human error in forensic examinations.
Recommendation 6
Set standards for forensic practice

NIFS should coordinate the National Institute of Standards and Technology (NIST) and the Scientific Working Groups at the FBI in efforts to develop tools for measurement, validation, reliability, information sharing and proficiency testing in forensic science; and also to establish protocols for forensic examinations, methods and practices.
Recommendation 7
Require accreditation and certification

Laboratory accreditation and individual certification of forensic science professionals should be mandatory. NIFS should use standards set by the International Organization for Standardization (ISO) as a reference.
Recommendation 8
Quality assurance and quality control

Forensic laboratories should establish routine yet rigorous quality assurance and quality control procedures to ensure the accuracy of all forensic work.
Recommendation 9
Code of ethics

NIFS should establish a national code of ethics for all forensic science disciplines and should encourage all individual forensic societies to adopt a professional code of ethics.
Recommendation 10
Education and training

Students in the physical and life sciences should be encouraged to pursue graduate studies to improve and develop applicable research methodologies in forensic science through scholarship and grant programs administered by NIFS. Continuing legal education programs for law students, practitioners and judges should also be established and supported.
Recommendation 11
Medicolegal death investigations

The coroner system should be eliminated, and NIFS should be provided with funds to establish a medical examiner system. This system should be supported through funding for forensic pathology education and research, accreditation of medical examiner offices and ensuring that all autopsies are performed or supervised by a board-certified forensic pathologist.
Recommendation 12
Interoperability of fingerprint databases

Congress should authorize the funds needed for NIFS to launch a new effort to achieve nationwide interoperability for fingerprint data (such as Automated Fingerprint Identification Systems).
Recommendation 13
Homeland security and forensics

Congress should provide funding to NIFS to bring the Centers for Disease Control, FBI, forensic scientists and crime scene investigators together for potential roles as first responders in counterterrorism preparedness.
Recommendations: Critical role of NIFS

- Key to reform is creation of NIFS
- Primary role in implementing Recommendations 2-13
## Recommendations: the response

<table>
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<tr>
<th>NAS Recommendation</th>
<th>NDAA</th>
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<td>Political Non-starter</td>
<td>Yes – if advisor only and FS</td>
<td>No -- admissibility rests with judge</td>
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Importance of report

- Authority and reputation of NAS

- Provides path forward for national and state reform

- Reference for understanding forensic science in context of scientific community

- Good source of literature demonstrating problems with forensic sciences
Importance of report: Uses

- Policy
  - Potential Congressional action to implement report’s recommendations
  - Basis for advocating for state forensic commissions or advisory boards

- Litigation
  - Scientifically based government report
  - Impact on “battle of experts”
Importance of report: Emphasizes common goals

- Unquestionable integrity of convictions where forensic science is a contributing factor
- Accurate criminal investigations and prosecutions
- Identify the true perpetrator
- Truly innocent to remain free
- Public faith in criminal justice and improving public safety
Innocence Project of Iowa

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