The Slow but Steady March Towards a More Reliable Forensic Science

Greater investments in forensic research by a widening pool of scientists spark new methods despite resistance to change.

December 7, 2022

When Henry Swofford stepped to the microphone at a gathering of forensic scientists in 2016, he surprised the audience when he announced that he had directed his investigators to no longer use the terms “identification” or “individualization” to link an item of evidence to a specific person. Investigators could no longer say that a latent fingerprint found at a crime scene was an absolute match with a suspect.

At the time Swofford was the chief of the Latent Print Branch of the Defense Forensic Science Center in Forest Park, Georgia, so his directive had immediate impact for military forensic science worldwide. His reasoning was that the identification of a specific individual based on partial and degraded impressions cannot be stated with “absolute certainty,” because scientific data do not support such claims.

Swofford’s concerns, shared by many in the forensics community, were triggered by the landmark 2009 National Research Council report, *Strengthening Forensic Science in the United States: A Path Forward.* The report was highly critical of what was passing for science in some fields of forensics and had an immediate impact on law enforcement, crime laboratories, courtrooms, and, importantly, the broader scientific community.

The efforts to improve forensic science have been significant and ongoing since the National Research Council report, but has the problem been solved? Does the forensic testimony now introduced in court rest on solid scientific ground?

Those questions imply that there is an end point to the effort to improve the science underlying forensics, said David Stoney, a leading forensic science researcher and former director of forensic sciences at the University of Illinois Chicago. “There isn’t an end point,” he said. “When we look at what we’re doing and say we’re not there yet, it suggests that things were bad and that there is a better place we want to get to, and then we’ll be done. I don’t think that is right.”

Changes on a Continuum

Stoney, who now heads Stoney Forensic, Inc. in Chantilly, Virginia, noted that the changes in forensic science are on a continuum and “the transition that was critical has already occurred. We can expect ongoing criticism and ongoing recognition of things that need to be improved, but the efforts are being made, and it’s all very, very positive.”

A key factor that has driven the paradigm shift, Stoney said, is the expansion of research from just forensic scientists to the much broader scientific community. “In the 1990s, forensic scientists were doing work in the field, but not many others,” he said. “Not many people cared about forensic science, the public wasn’t engaged with it, and certainly other scientists weren’t engaged. They viewed forensic science as merely an interesting application of science, without any intellectual foundation of its own.”

Since the beginnings of forensic science in the early 1900s, Stoney said, “it didn’t have external scrutiny and it was a profession that was being driven by practitioners in a very fragmented way.” Crime labs, even today, are run by states, counties, cities, and the private sector, with high caseloads straining their resources. As a result, “they are not a bed for the intellectual development of forensic science,” Stoney said. The resources and day-to-day demands within an individual jurisdiction determine who gets hired as crime lab director, what is considered good forensic science, and how the people do their jobs, he said.

The criticisms in the 2009 National Research Council report have been amplified by other reports and academic papers over the past decade, and much of the current criticism is coming from scientists who are now engaging with the field, Stoney said. “They are testing, doing research, and asking questions,” he said. The debate and rigor of academic science is

now influencing much of forensic science and that is the most significant change from the past, he concluded.

Where Progress Is Slow

Although change is occurring, there are two major impediments to progress. The first is a general resistance to change in the forensics community. Institutions and professions are conservative, and practitioners are used to doing things a certain way, Stoney said. The solution is "basically a matter of training the new generations [of forensic scientists] rather than expecting all of the older generation to suddenly change," he said. The second impediment is the time it is taking for the broader scientific community to fully understand forensic science; to appreciate that it is not merely an application of other scientific disciplines but one that comes with its own peculiar challenges and needs for intellectual development.

Resistance to change is apparent in a recently published survey by Swofford — now a forensic evidence consultant who has worked on several research projects supported by NIJ grants — of fingerprint examiners' attitudes toward introducing statistical and probabilistic reporting into their work. Probabilistic reporting means the experts should use statistics to estimate the uncertainty in determining if two fingerprints match.

However, Swofford found that "98 percent of respondents continue to report categorically with explicit or implicit statements of certainty," primarily because of the uncertainty revealed with probabilistic reporting. Most experts objected to defining the uncertainty of a fingerprint match for a jury because "defense attorneys would take advantage of the uncertainties," he said. Some experts acknowledged that probabilistic reporting is "scientifically more appropriate," he noted, yet defended their use of less scientific categorical reporting as meeting long-standing cultural and institutional norms.

"A majority are very adverse even to the idea of offering statistical concepts in court," Swofford said. "They view this [reporting probabilistically] as having little gain and a lot of risk, and they are bound by what they are comfortable with."

Free Fingerprint Analysis App

To assist fingerprint examiners in developing a statistical interpretation of friction ridge skin impression evidence that allows them to determine uncertainty, Swofford developed free analytical software, FRStat, which is in use at the Defense Forensic Science Center. The software has been available since 2017, he said, "but it's interesting that even when a completely free application is available, it has not received widespread adoption.

Echoing Stoney's concerns, Swofford noted that although forensic science is being advanced in the academic and general science communities, the transition to operational science in crime laboratories is slow. "So, there's something that we're missing in terms of how to transition the technology from the academic to the operational," he said.

The Federal Effort

In addition to academic and general science communities, the federal effort to move forensic science forward has been substantial. The Organization of Scientific Area Committees for Forensic Science (OSAC), administered by National Institute of Standards and Technology (NIST), was created in 2014 to address the lack of discipline-specific forensic science standards. OSAC has more than 550 members who are a mix of academic scientists, legal experts, and practitioners from crime labs. The organization has facilitated the development of many standards and is currently recommending 95 specific standards for crime labs and forensic practitioners to follow.

"We have 87 forensic science service providers who have declared to us that they've implemented some of these standards, which indicates that OSAC's efforts are having an impact," said OSAC Program Manager John Paul Jones II. The list of standards is kept up to date on the OSAC Registry, which contains standards that range from developing protocols for interpreting mixed DNA samples from several individuals to how best to collect and test impressions of footwear and tires.[1]

An ongoing concern with the standards, Jones noted, is that OSAC is not a regulatory body, and implementing the standards in a crime lab is voluntary. "We don't have the authority to require adoption," he said. "We're bringing good scientific documents to the field that could be used as anchors for crime laboratories. And their forensic practitioners are helping to build them. OSAC is not a bunch of academics sitting in a room. It is the crime lab employees who are volunteering their time to work with us, as well as academic researchers and legal experts, to write these standards."

The downside, he said, is the laboratories must have the resources to implement the standards. “When you talk with crime lab professionals, they tell you they’re constantly battling with backlogs, and almost everything they do involves analyzing evidence for pending cases.”

Crime lab managers, Jones said, ask themselves, “how do I make the time to implement these standards when I have prosecutors or investigators contacting me for results of examinations that are supposed to be completed for their court cases? And crime is still happening, which adds more casework to the pile.” The actual implementation of the standards takes time and resources, and many of the laboratories are short on both, he said.

Difficulty Setting Standards

An example of the difficulties faced in trying to set standards and get solid scientific support for forensic evidence is the seemingly straightforward calculation of an individual’s blood alcohol concentration, also known as blood alcohol level, to determine if a driver is legally intoxicated, Jones said. Calculating a driver’s blood alcohol level back to the time of the incident for comparison with the legal limit of .08% blood alcohol level is “not exactly the settled science that people might think it is,” he said. OSAC’s Forensic Toxicology Subcommittee has drafted guidelines for performing alcohol calculations based on the latest scientific information, he said, and the resulting “best practice” recommendation “is a little controversial because it may be a significant change in practice for those relying on science from 25 or 30 years ago. Our population looks different than it did back then. We’re not the same size and we also have a better understanding of which variables introduce more uncertainty into the process. We also understand how to report that more clearly.” As with much of what has been considered settled science, he said, evidence must now be looked at under a new lens as studies are completed and science evolves.

This isn’t merely an academic debate among researchers, for often the forensic evidence and expert testimony ends up in the courtroom, where judges making the rulings are often “science phobic,” said retired Indiana appeals court judge Linda Chezem. Jones’s example of shifting blood alcohol calculations points to a real-world issue that impacts the courts, she said.

Chezem said that the most common interaction individuals have with scientific standards in court are impaired driver, or DUI, cases. Yet crime labs are so overwhelmed that they “don’t have the resources to do the tests and create the lab reports. The cases back up and then the

prosecutors must cut deals because they can't get the lab reports." That has been made worse by COVID-caused delays throughout the legal system, she noted.

Impaired driver cases present another science challenge, Chezem said, caused by the legalization of marijuana in most states. Proving a driver is impaired by marijuana is a complicated issue because, despite research showing that many factors impact the correlation of THC levels in the blood to impairment, there are too many variables to define a single impairment standard in the same way it is done with alcohol. "We don't have a measured amount that proves impairment," Chezem said, "and mixing marijuana with alcohol and other substances is very common, so what do we do with that?"

Jones noted that the passage of the 2018 Farm Bill created a threshold when it defined hemp as cannabis containing less than 0.3% THC, and marijuana as any substance containing 0.3% or higher.[2]

Importance of Standards

Although the process of establishing forensic standards is complicated, it is important because the standards put pressure on crime labs to adopt them, even though they are voluntary, both Jones and Stoney said. "If the standards are there and the crime labs don't adopt them, then they have to have a response as to why they didn't," Stoney said. "The standards are here, and I think the standards will interact with the courts in a way that is very important and will drive the adoption of them by people who are testifying."

Chezem noted that most judges are open to specific, coherent presentations on science. "Judges really appreciate science delivered clearly and concisely, and not advocacy science," she said.

However, forensic scientists should keep in mind that "the legal system is one of the most conservative institutions around," Stoney said. "It's important that we use the scientific criteria for evidence, but the law has built a system that is based on personal, subjective human judgment. So, I can testify, and the jury can decide they didn't like the way I looked or responded to questions and dismiss me entirely."

"To be acceptable, the forensic science must be as good as it can be, our explanations must be understandable, and our processes must be convincing," Stoney said. "It is our

responsibility to bring this to the courts, so the standards should be developed and met." But in the end, he concluded, "the courtroom is not a scientific arena."

Notes

[note 1] "OSAC Standards and Guidelines," *National Institute of Standards and Technology*, last updated February 26, 2019.

[note 2] Walter B. Wilson; Aaron A. Urbas, Ph.D.; Frances Scott, Ph.D., "Study Reveals Inaccurate Labeling of Marijuana as Hemp," October 17, 2022

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Date Published: December 7, 2022

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