

The Scientific Foundations of Forensic Science

"True science teaches us to doubt and, in ignorance, to refrain."

--Claude Bernard

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“I beseech you, ... think it possible you may be mistaken.”*

Oliver Cromwell, asking the Church of Scotland to reconsider its decision to side with the royalists instead of him. The Church did not, and Cromwell’s army invaded, and ultimately defeated, Scotland.

*Quoted in Daniel Gilbert, Book Review, *Being Wrong: Adventures in the Margin of Error* by Kathryn Schulz (2010), NY Times Book Review, July 25, 2010.*

My Main Points

"[Science is] not belief, but the will to find out."

- Anon.

- **General Observations Worth Emphasizing**

- The non-DNA forensic sciences are not monolithic and should not be treated as such.
- The scientific method does not apply similarly to all empirical subjects.

- **More Specific Observations Worth Making**

- Much of what passes in court today as forensic "science" is not science by any contemporary understanding of that term.
- There are no systemic or epistemological reasons why the hypotheses of forensic science cannot be tested in rigorous ways.
- The hypotheses of forensic science ought to be tested rigorously and should be held to the highest standards of scientific verification.

The non-DNA forensic sciences are not monolithic and should not be treated as such.

"This is a classic case of what is often called physics envy...."

--Stephen Jay Gould

- Different empirical problems require different methods and paradigms to study them.
- There are rigorous methods in physics, chemistry, biology, psychology, sociology and so on, but they are not all the same. Different theories and hypotheses permit different modes of testing.
- The forensic sciences present different challenges, and different methods might be used to study them.

Much of what passes in court today as forensic “science” is not science by any contemporary understanding of that term.

“Innocence about Science is the worst crime today.”

--Sir Charles Percy Snow

- In principle, based on statistical insights, but without statistical foundation.
- Ostensibly objective, but subjective in practice.
- Not researched by mainstream academic scientists.
- The field largely measures success by admission in court, not scientific validity.
 - *“Among existing forensic methods, only nuclear DNA analysis has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between an evidentiary sample and a specific individual or source.”*

--Strengthening Forensic Science in the United States: A Path Forward (2009).

There are no systemic or epistemological reasons why the hypotheses of forensic science cannot be tested in rigorous ways.

“[T]he criterion of the scientific status of a theory is its falsifiability, or refutability, or testability”

--Daubert (1993), quoting Karl Popper

- Most, if not all, of the hypotheses that forensic scientists claim to be valid are testable; indeed, eminently so.
- **HOWEVER**, there are few research scientists who are inclined to study forensics.
 - A fundamental shift is required, and mainstream research scientists must be encouraged (i.e., financially supported) to do research in this area.
 - The academic relevance of forensics needs to be made plain to mainstream scientists.

The hypotheses of forensic science ought to be tested rigorously and should be held to the highest standards of scientific verification.

“Reality must take precedence over public relations....”

--Richard Feynman

- In the short term, courts are likely to continue to allow forensic expertise, despite the fact that much of it is not based on methods or principles that are well validated by contemporary scientific standards.
- In the long term, as more research is conducted, courts should, and likely will, expect forensic expert opinions to be based on good science.

Conclusions

"Before I came here I was confused about this subject. Having listened to your lecture I am still confused. But on a higher level."

--Enrico Fermi

- *Daubert* ushered in the scientific revolution and it is time for forensic science to join its ranks.
- Although most practicing forensic experts are not trained to design and carry out scientific studies, they are an essential part of any well intentioned research effort. Basic collaboration is needed and ought to be encouraged.
- The transformation of the field of forensics from its largely pre-scientific contemporary state, to one guided by established methods of science, will only come about by a centralized effort. In all likelihood, only the federal government has the wherewithal to accomplish this.
- Ultimately, forensic science grounded in science will lead to better law enforcement and more just outcomes.