

COMMENTARY ON
THE NEED FOR A RESEARCH CULTURE
IN THE FORENSIC SCIENCES

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Asked to comment on a collective discussion paper by Jennifer L. Mnookin et al., this Commentary identifies difficulties the authors encountered in defining or agreeing on the subject matter “forensic science” and its perceived deficiencies. They conclude that there is a need for a research culture, whereas this Commentary calls for the development of a forensic science culture through the development of forensic science education fed by research dedicated to forensic science issues. It is a call for a change of emphasis and, perhaps, of paradigm.

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INTRODUCTION

It is difficult for me to comment on an article written by such eminent and high-profile authors on the need for a research culture in the forensic sciences. Apparently, these authors have reached a good deal of agreement despite the fact that they represent opposite stances in the ways that they perceive the value and failures of forensic science.

They all agree that research is deeply needed, and it is difficult not to agree with them. I may nevertheless take some distance regarding what research orientations are most needed currently.

The authors also seem to agree that forensic science has suffered, and continues to suffer, from poor science, as well as substantial failures highlighted in the National Academy of Sciences (NAS) Report. Whether the NAS Report is well founded and the watershed the authors claim it to be is questionable.

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The NAS Report has certainly alerted the profession to a reality that is not rosy, even if the major problems have not been clearly identified. But proffered solutions may reflect the self-interest of a particular subsector of forensic science, rather than true advancements that will improve the field as a whole.

Although the authors claim to agree on a good deal, I came away with the feeling that the authors disagreed on almost everything. They write in clear English, but they seem to speak different languages. As my foreign mind worked to translate and analyze what it was reading, I realized that I was facing a problem of terminology, semantics, and politically correct language, as well as sector-specific research interests that may rely on public funding.

I. TERMINOLOGY AND SEMANTICS

Forensic science is often viewed from the eyes of the legal profession. Forensic scientists are proud to see themselves take such an important part in legal proceedings, failing to recognize that they're playing the tune of their masters. The legal profession need not change anything if the lawyers continue to set the tempo and scientists continue to play the tune. The first issue concerns the illusion that scientists present evidence when they really provide an evaluative opinion/statement for the prosecution or for the defense as if they were party to the matter. In such situations, scientists take sides and become advocates. If they are imprecise, they become the targets of attacks from the opposing party, and quite rightly too. This creates an interesting opportunity for those lawyers and advocates with some scientific inclination to build a reputation for special expertise. Presenting evidence for one side leads scientists to make fallacious arguments about causality.

The evaluation of forensic science data is based on detection, observations, and measurements. Data represent the observable results of an event (hypothetical and under investigation). Whether these results could be observed if one proposition for the event is true rather than another proposition is the central relevant matter on which the forensic scientist may comment. If circumstantial information and alternative explanations are known, the better interpretation may be that a particular observation is more likely than its alternative given a set of circumstances. Value judgments are only given for the observed data, not for the possible alternatives (this is the province of the court or jury). The courts may accept these judgments as evidence in favor of or against a causal relationship. Evidence can be presented as an argument in favor of a cause, whereas forensic science measures the likelihood of the observation if the cause is rightly identified.

Scientists are easily taken by surprise when stepping outside of their province to testify in court, and lawyers are very good at taking advantage of this vulnerability. Indeed, for this reason, many very competent scientists shy away from the court and its proceedings. Scientists should be comfortable with being humble about what they can offer to the justice system, even if such information provides high added value.

The second issue concerns the distinctions among forensic science professions and the authors' perception of these distinctions, which comes from an apparent misunderstanding of forensic science. According to the authors, analytical sciences are much more robust than pattern sciences. This may be an issue in academia, but I contend that analysts in chemistry or physics use tools and instruments to measure signals that extend the detection capabilities of their own senses,¹ offering results in a more or less reproducible manner. Results are usually in the form of complex matrices of numbers, but all analysts transform these data into patterns (for example, spectrograms, chromatograms, DNA electropherograms, etc.) because the human mind is usually better at analyzing patterns and distinguishing closeness or distance between them. More often than not, data treatment to obtain such patterns is opaque, and some scientists don't even understand it.

Nevertheless, analytical scientists have developed some control mechanisms, such as the distinction between signal and noise—the signal-to-noise ratio—that help determine whether a signal is meaningful, or whether it is a variation due to instrumental or system errors. This is one sector where so-called pattern analysts have not learned their lesson and may see nonexistent features in a bad quality pattern. The Mayfield case referred to in the article is a good example of such a failing. The features that analysts identified in the mark were noise! The ACE-V methodology tries to overcome this failing by determining, during the analytical phase, what feature is a signal and what feature is noise or indistinguishable from noise.

In the same discussion, nobody cringes when an analytical chemist claims that her technique is specific and that the fingerprint part of the spectrum is specific. Specificity is the ultimate value of selectivity and just another way of claiming individualization. This ultimate value can never be reached philosophically. To say otherwise is an abuse of language even if it seems to be a reasonable expression of an analyst's decision in view of the complex

1. I had an analytical chemistry course in which tasting was an analytical method, although not recommended!

combination of selective features.² Many chemists would be very uncomfortable with discussing the specificity of their results, although they are trained to compute uncertainties and do not claim zero error rates.

The third issue of terminology and semantics concerns the authors' reference to forensic science with and without an "s" at the end of "science." They sometimes hesitate when arguing about a forensic science culture, the description of forensic fields, and forensic specialties. Similarly, great difficulty is encountered when discussing these specialists. They are rarely called scientists but are instead referred to as practitioners, analysts or pattern analysts, examiners, and specialists with experience and training. I highlight these blatant hesitations because they have one cause (here I put on my advocacy jacket): Most practitioners involved in the analysis of fingerprints,³ toolmarks, and firearms marks are not scientists and have little, if any, training in science.

Looking back historically, I came across a letter between Archibald Rodolphe Reiss and Edmond Locard, two of the famous scientists at the root of the development of forensic science in the early mid-1900s.⁴ Until the 1900s, many crime laboratories around the world were using less than competent personnel in what was coined "identification bureaus." Pattern-type traces were used to prosecute criminals or support the inquiries by providing pattern evidence as a matter of almost clerical routine. This situation may look like a caricature, but many modern-day practitioners will identify with the truth in that caricature. Many police officers, seen as lacking communication skills and contact with the public (or with their colleagues) were sent to these ID bureaus, almost as a punishment, without much consideration for the potential usefulness of what they were doing. There were exceptions in some countries and police forces, and some passionate forensic specialists made great contributions because they were dealing with a mute witness that had much to say. But when

2. This decision, or leap of faith, has been discussed in a fundamental paper in 2008. See A. Biedermann et al., *Decision Theoretic Properties of Forensic Identification: Underlying Logic and Argumentative Implications*, 177 FORENSIC SCI. INT'L 120 (2008).

3. The term "mark" is used rather than "print," which reflects the inappropriate U.S. usage. A print is comparison material that reproduces as faithfully and visibly as possible the pattern from the skin. As such, it cannot be latent. It is obtained by inking or live scan. By contrast, a mark, as in toolmark, indicates the uncontrolled nature of the trace, which may be partial, distorted, imperfect, etc. CHRISTOPHE CHAMPOD ET AL., *FINGERPRINTS AND OTHER RIDGE SKIN IMPRESSIONS* 183 (2004).

4. Letter From Rodolphe Reiss to Edmond Locard (Mar. 6, 1992) (translation by author): After the War, young countries wanted at all costs to imitate older countries. Their police forces sought to imitate that of France, for example. But police forces had no specialists. They then created experts in forensic science, no good impostors who, shamelessly, executed the most difficult expertises. So, the chief of technical services of the Ministry of Interior, having taken only two college classes and a police officer's course has recently developed an important expertise in ink age determination (litigious value 20 millions). This idiot does not even know the word chemistry.

laboratories were created in the 1950s, they were usually not combined with pattern-type marks but built separately and in different law enforcement sectors. This duality is largely attenuated nowadays but still persists in many ways.

It is obvious that the authors, being close to many practitioners with little scientific training, may feel embarrassed to critique the underlying science in some of these areas, even if that is no reflection on the quality of the individuals in those positions. Addressing this last terminological problem with the profession will hopefully lead to potential solutions and future perspectives.

II. SOLUTIONS

There is no magic solution. Forensic science is essentially a research-oriented endeavor that is limited by the quality of traces criminals leave and by the lack of circumstantial knowledge. Forensic scientists are like drivers in the mist.

I contend that there is a solution that will create substantial and rapid improvements: forensic science education built on a forensic science culture. The NAS leaves this aspect in suspension, and the collective authors only considered education when revising and extending their manuscript, thus identifying the gap between practice and research.

In most countries, authorities have either used practitioners from the ranks of law enforcement or, in more technical circumstances, natural scientists were hired to create the first “real” laboratories in the 1950s. These scientists came from chemistry, physics, biology, engineering, and medicine, and were quickly confronted with difficult problems of interpretation and with the uncertain quality of crime specimens. Some made essential contributions and developed a real culture in forensic science (for example, Stuart Kind in the United Kingdom and Paul Kirk in the United States), but many labs existed within a police culture and were directed by officers who were often more concerned with their climb up the ladder of police ranks than the development of a science culture. The current situation of many forensic science practitioners is the result of a structural error due to policy and historical decisions. It is compounded by the fact that many laboratories created within law enforcement agencies have been populated by poorly paid civil servants who, if they were good scientists, quickly moved to highly paid industry positions. This development is a sad reality that has resulted in poor science performed by poorly qualified practitioners. I see this as a real problem that needs a quick response. Before we introduce structural controls like standards (often a poor replacement for competence) and ethics, forensic science needs a sound scientific structure.

Within the last fifteen years, PhDs in biochemistry have been hired to consecrate the new “gold standard” offered by DNA. Yet, a few years down the line, most DNA labs have become factories using lab technicians and delivering reports about the source of a given trace, which is clearly insufficient from a forensic science perspective. The real problems of interpreting poor quality traces and mixtures have only come to the fore in recent years. These problems have illuminated the important challenge that forensic science is facing: interpreting results in view of conflicting versions of events and activities.

In summary, forensic science has developed around practitioners with little science training and education in combination with highly specialized scientists in their own discipline. Forensic science is like a hospital serviced by clerics and nurses for most of the activities, and brain surgeons and cardiologists for highly specialized areas of medicine, but with no medical doctor in the middle.

Forensic scientists have specific questions to address related to crime and its effects. In each case, the event is unique and does not necessarily fall within well-defined categories of scientific classes or patterns. Each case is, in a way, a research problem, which needs a problem-solving approach to answering the following questions:

- (1) How do I understand the problem at hand?
- (2) How can I detect and see pertinent traces?
- (3) What is the best course of analyses to choose? (Counter to the article’s suggestions about shielding analysts from additional information, background information, hypotheses, and allegations are sorely needed to take optimal action)
- (4) What is the potential response one could expect?

In most cases, answers to these questions will eliminate many potential sources or activities (and therefore have exculpatory force); other times, they will associate potential sources and activities. This is the primary circumstance under which such data comes to court, which is why forensic science is thus seen as a prosecutor science.

Forensic science education and programs have been discussed and proposed since 1895 by Hans Gross, Paul Kirk, Archibald Rodolphe Reiss, and as late as 2003, by Robert Gaensslen and George Sensabaugh.⁵ Many of these scientists’ considerations are included in the current program at Lausanne University.⁶ The curriculum has a heavy science base (physics, mathematics, chemistry, biology),

5. George Sensabaugh & R.E. Gaensslen, *Model Standard for Forensic Science Graduate Program*, 48 J. FORENSIC SCI. 460 (2003).

6. UNIVERSITÉ DE LAUSANNE-ÉCOLE DES SCIENCES CRIMINELLES, <http://www.unil.ch/esc> (last visited Jan. 31, 2011).

with additional technological and methodological disciplines (forensic photography, microscopy, analytical chemistry). Forensic science constitutes the backbone of problem- or case-solving methodologies using crime scene approaches, personal and object identification processes, particulate/signal/pattern transfer and persistence studies, and population studies. Additionally, students follow a full course in criminal law and criminal procedure (with law students), so they understand the possibilities and limitations of their confrontation with the law and gain skills for communicating with legal professionals. After three years (BSc studies), all students complete their education with strong identification or chemical criminalistics components included in master studies (MSc, two years) completed with a research project (many of which become papers in peer-reviewed journals).⁷ PhD researchers (there are currently sixty-five at Lausanne in 2011) will then concentrate on research that will feed the understanding of fundamental issues of forensic science.⁸

CONCLUSION

It must be obvious by now that I agree with the authors that research is needed. A poor and immature profession can be the object of study, as proposed by the authors. But what will they do? Study of forensic science can identify shortcomings, such problems like bias, but it may not identify solutions so rapidly.

Research in forensic science is sorely needed, but it should address primarily forensic science questions—not questions relating to the application of chemistry, biology, statistics, or psychology. This is how a discipline is built and progresses, and this is where academics should focus their questions. Until then, forensic science will remain a second-rate scientific endeavor and will suffer from continued and justified attacks. It is time that forensic science grows as a fully recognized discipline in its own territory. It should exist on equal terms with other disciplines. It can then cross-fertilize and adopt technological developments in other scientific disciplines, which may allow it to respond to legal demands on much more solid ground.

As a final word, I would change the title of the article to *The Need for a Forensic Science Culture in Forensic Science* (without the final “s”).

7. See, e.g., Georges Pierrini, *Evaluation of Preliminary Isotopic Analysis (13C and 15N) of Explosives*, 167 FORENSIC SCI. INT'L 43 (2007).

8. See, e.g., Olivier Ribaux et al., *Intelligence-Led Crime Scene Processing, Part I: Forensic Intelligence*, 195 FORENSIC SCI. INT'L 10 (2010); Olivier Ribaux et al., *Intelligence-Led Crime Scene Processing, Part II: Intelligence and Crime Scene Examination*, 199 FORENSIC SCI. INT'L 63 (2010); REVUE INTERNATIONALE DE CRIMINOLOGIE ET DE POLICE TECHNIQUE ET SCIENTIFIQUE, Apr.–June 2009 (entire issue dedicated to current ongoing research).