LETTERS

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 6 months or issues of general interest. They can be submitted by e-mail (science_letters@aaas.org), the Web (www.letter2science.org), or regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Forensic Science and Academic Science

IN HIS EDITORIAL "FORENSIC SCIENCE: Oxymoron?" (5 Dec., p. 1625), Donald Kennedy questions the scientific basis of forensic evidence examination and concludes by questioning, and prodding at, the efforts of forensic scientists to improve the reliability of forensic evidence. To some extent, the field of forensic science must acknowledge these criticisms. Overshadowing this scolding, however, is the more troubling divide between academic and forensic science that is prevalent throughout and, unfortunately, encouraged by Kennedy's Editorial. A glaring illustration of this division was the unsuccessful National Academies' project on Science, Technology and Law "to examine science and its uses in forensic examinations." A review of the members of this program reveals that not a single forensic scientist was included. Would such a project examine "science and its uses in chemistry" without a chemist? This attitude ignores the fact that, although forensic science has developed through the integration of principles from every scientific field, it has evolved into its own scientific discipline. The fact is that there is a great deal of science that cannot be packaged into standardized and verifiable techniques developed to be run by technicians. A recent example was the use of chemical microscopy to tie microscopic paint spheres found on victims' bodies to a specific manufacturer and end-use: the truck painting plant where Gary Ridgway, the Green River serial murderer, worked. Rather than have a drawn-out trial over four counts of murder based on "verified" DNA evidence, this paint evidence was significant enough to induce Ridgway to forgo a trial and admit guilt to 48 counts of murder to avoid a likely death sentence. The mystery in forensic science is not why practitioners do not want a more scientific technology for analyzing crimes, as Kennedy asks, but rather, why traditional sciences will not work with forensic science, rather than above it. Forensic science may be a redundant phrase, but it is not an oxymoron.

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Fingerprinting techniques are just some of the many areas of forensic science.

More on Molecular Electronics

TWO RECENT NEWS STORIES BY ROBERT Service ("Next-generation technology hits an early midlife crisis," 24 Oct., News Focus, p. 556; "Nanodevices make fresh strides toward reality," 21 Nov., News of the Week, p. 1310) provide the impression that the field of molecular electronics stalled and then suddenly revived. The specific contributions described in the 21 Nov. news story are just two of a large number of breakthroughs that have been reported by many research groups over the past several years. Progress in the field has been continuous and is accelerating dramatically.

The entire premise of the 24 Oct. article was based on a straw man created through inflated expectations and knocked down with rumor. Rather than being based on published material (as was the 21 Nov. story) or presentations made in public meetings, this article relied on unattributed sources and fragmentary second-hand information. There were several errors and omissions in the article that yielded a distorted view of the field.

For example, the article erroneously stated that, in 1999, the Hewlett-Packard (HP)–University of California, Los Angeles (UCLA) team tried to create "transistors that used the movements of molecules." We were not attempting to create transistors but were demonstrating the concept of two-terminal electronic-tunneling switches that could be toggled by electrical pulses. Stating that a "transistor" was a goal set false expectations for the research and the applications for which the switches were intended.

A schematic of rotaxane molecules between wires shown in the 24 Oct. news report is described by Paul Weiss as "somewhere between naïve and misleading." We note that this figure was commissioned by editors of *Science* for its 21 Dec. 2001 issue, in which molecular electronics was hailed as the breakthrough of the year. Neither Fraser Stoddart nor Jim Heath was consulted to confirm if this figure accurately depicted their research—yet this figure was by inference attributed to them. Taken out of the context originally intended by the editors of *Science*, it is easy to ridicule such a diagram.

Service also made much of a nonpublic presentation to the Defense Advanced Research Projects Agency (DARPA) contractors by Stan Williams, which included a brief description of reversible switching in one particular metal-molecule-metal system that was caused by the growth and dissolution of metallic nanoparticles. This was reported in the article as an unanticipated failure that caused Jim Heath to end his partnership with HP. This is a fabrication on the part of Service's unnamed sources, and neither Heath nor Williams was asked if this was indeed true. The UCLA, Caltech, and HP groups formed a team with a common architectural vision in 1997. As a risk minimization strategy, each partner has pursued somewhat different paths to ensure that the team is successful. We have recently reported two different 64-bit memories (*1*, *2*), which was a major aim of the DARPA program. Having two alternative and complementary approaches from which to select or blend is a major strength of the team, and just one of the reasons we continue to work together.

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Forensic Science: Oxymoron?

In detective novels and television series, criminals often get caught because they leave fingerprints at the scene. Well, art does imitate life; fingerprint analysis is widely used in U.S. courts and those of many other countries. But last year a funny thing happened to fingerprint evidence on the way to a conviction. Applying the standard set for the admissibility of scientific evidence by the U.S. Supreme Court in the 1993 Daubert case, Judge Louis Pollak ruled that an expert could not testify that the prints at a crime scene matched those of a suspect. Shock reverberated through the criminal justice community, until Judge Pollak induced a sigh of relief from district attorneys everywhere by saying that at least in this case, such testimony could be used after all.

The Supreme Court's Daubert standard has generated some ambiguity for the legal community, but the Court did list several criteria for qualifying expert testimony: peer review, error rate, adequate testing, regular standards and techniques, and general acceptance. Judge Pollak's initial finding was that the evidence flunked all but one. Some distinguished legal scholars think that he was right on that call and wrong on the second. The resulting controversy has reignited some old challenges to "forensic science."

It's not that fingerprint analysis is unreliable. The problem, rather, is that its reliability is unverified either by statistical models of fingerprint variation or by consistent data on error rates. Nor does the problem with forensic methods end there. The use of hair samples in identification and the analysis of bullet markings exemplify kinds of "scientific" evidence whose reliability may be exaggerated when presented to a jury. Some criminal defense attorneys have become concerned about the degree to which processing and enhancement of such images could mislead jurors who believe they are seeing undoctored originals. PhotoShop, after all, is everywhere.

Criminal justice agencies have been slow to adopt new scientific procedures and defensive about evaluation of their present ones. The acceptance of DNA evidence and the standardization of laboratory procedures for DNA analysis eventually broke through that barrier, well after there was convincing scientific proof of their reliability. But resistance has remained firm in other areas. For example, polygraph testing for security purposes in the U.S. Department of Energy was carefully evaluated by the National Academies and found to be defective. The department rejected that recommendation and went on testing anyhow. And despite repeated calls for accreditation and oversight, many government crime labs continue to lack either one.

In the United States, the National Academies have a project on Science, Technology, and the Law, in which I'm involved. That group, which had earlier looked at the implications of the Daubert decision and a variety of other issues, was urged to examine science and its uses in forensic examination. A project plan was developed and approved, and one private foundation made a verbal promise of support. The Department of Defense (DOD) and the Department of Justice were also approached for funding, since both have significant programs in this area that make use of forensic techniques. Ending a protracted exchange of correspondence with the Technical Support Working Group in DOD, representing both agencies, the project was dropped because the government insisted on rights of review that the Academies have, at least in the recent past, refused to grant a sponsor. And months after the foundation grant had been offered, it was withdrawn.

The Department of Justice, where the Federal Bureau of Investigation operates perhaps the most sophisticated crime laboratory in the country, is the home of the National Institute of Justice (NIJ). NIJ supports an annual Conference on Science and the Law, in which the American Association for the Advancement of Science and the Academies participate. In planning the agenda for these conferences, NIJ has regularly resisted including comprehensive evaluations of the science underlying forensic techniques.

One would have thought that the issues surrounding homeland security would have increased the government's desire to apply better science to the detection of criminal activity and the pursuit of perpetrators. And of course our society has a long-standing concern about protecting the rights of the accused. Both these public interests—security and justice—would be furthered by a more scientific and reliable technology for analyzing crimes. The mystery here is why the practitioners don't seem to want it!

Donald Kennedy
Editor-in-Chief

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