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SYMPOSIUM ON SCIENTIFIC EVIDENCE

FOREWORD

NOVEL SCIENTIFIC EVIDENCE IN CRIMINAL CASES: SOME WORDS OF CAUTION

ANDRE A. MOENSSENS*

When, in 1973, in the Preface to the first edition of our book *Scientific Evidence in Criminal Cases*, we wrote that “legal proof of criminal conduct is rapidly evolving into a multidisciplinary mosaic of law, science, and technology,”¹ the authors did not necessarily foresee that the ever-expanding universe of scientific pursuits was soon to collide with the legal system in some very remarkable ways. Yet, a few such collisions were already in the making. Even as we reported in the first edition on the emerging techniques of spectrographic voice recognition (“voiceprint identification”) and on the identification of individuals by their bitemarks, battles between law and science were already being waged in these disciplines—battles on which we took differing positions.

Thus, we reported cautiously that spectrographic voice recognition offered great hope as a novel forensic science,² which was

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¹ ANDRE A. MOENSSENS ET AL., *SCIENTIFIC EVIDENCE IN CRIMINAL CASES* iii (1st ed. 1973).

² *Id.* at 521.

clearly in doubt by the time the second edition came out.³ Similarly, in one celebrated case,⁴ in which three dentists, one of whom was a forensic odontologist,⁵ identified a bitemark discovered on a victim's body as having been made by the defendant's teeth and had their conclusions contradicted by four defense forensic odontologists⁶ who not only denied that a positive identification by bitemarks was possible, but even if it were, that the evidence positively excluded the defendant as having made the impression,⁷ our 1973 edition suggested that "no published studies exist at the present time which empirically support" the science of identifying individuals by their bitemarks.⁸ In the second edition, we retained that conclusion,⁹ though by the time the 1986 edition appeared, the field of forensic odontology had adopted both the possibility of identifying human beings by their bitemarks in some cases, and had also de-

³ ANDRE A. MOENSSENS & FRED E. INBAU, *SCIENTIFIC EVIDENCE IN CRIMINAL CASES* 583 (2d ed. 1978) ("It does not appear, at this time, that there is a sufficient basis for accepting either the principle of voice uniqueness or the reliability of the art of comparing speech spectrograms."). The same conclusion was maintained in the 1986 third edition.

⁴ *People v. Milone*, 356 N.E.2d 1350 (Ill. App. Ct. 1976).

⁵ Forensic odontology is the discipline of dentists interested in forensic identifications of individuals by their teeth. While dentistry had played a role in forensics as a means to establish the identity of victims of mass disasters for many years, "forensic odontology" was recognized as a separate discipline within the American Academy of Forensic Sciences only in the early 1970s. It was not until 1977 that the Forensic Odontology Section of the Academy formed a "bitemark committee" to engage in research on the reliability of such a sub-discipline as well as to investigate methods and nomenclature, none of which had previously been submitted for approval to the practitioners in forensic odontology.

⁶ One of these defense forensic odontologists was then the president of the American Academy of Forensic Sciences, and was acknowledged by all proponents to be the scientist with experience in the greatest number of bitemarks cases.

⁷ See *Milone*, 356 N.E.2d 1350. The case was tried in 1973. The appellate court decision, to the effect that bitemark identification was "generally accepted," was surprising in the face of sharply conflicting evidence on the reliability of such techniques, and considering the bitemark in question had been termed "good" by prosecution experts and "fair to poor" by defense experts. By contrast, the California court in *People v. Marx*, 126 Cal. Rptr. 350 (Cal. Ct. App. 1975), confronted with evidence of a bitemark that was exceptionally well defined and with "distinctive teeth characteristics," held that *Frye* was not met because no showing had been made that there was indeed an established methodology for identifying persons based on bitemarks.

The *Frye* test of "general acceptance" derives from the case of *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923), rejecting the admissibility of the forerunner of our modern polygraph. The case is discussed in Professor Giannelli's article and other contributions to this Symposium. The *Frye* test of "general acceptance" was recently held to be superseded by the more liberal admissibility standard of FED. R. EVID. 702, at least for federal trials. See *Daubert v. Merrell Dow Pharmaceuticals*, 113 S. Ct. 2786 (1993).

⁸ MOENSSENS ET AL., *supra* note 1, at 582.

⁹ MOENSSENS & INBAU, *supra* note 3, at 657-58.

fined standards for the methodology to be followed.¹⁰

A number of thoughts emerge from these few preliminary ruminations. First, all of us, whether in science or in law, have to keep an open mind and remain ready to change our opinions on an issue when the developing pace of scientific progress reduces to history previously held viewpoints. Second, the foregoing examples of cases in which we first cautiously endorsed a technique that was later repudiated as scientifically unproven or, conversely, refused to endorse a new method that was later proven to have scientific support, did not prepare us for the acerbity and viciousness of the new battle over admission of evidence that was looming on the horizon of the mid-1980s. Nowhere have battles in and out of the courtroom over novel techniques been more vociferous than in the area of identifying individuals by their deoxyribonucleic acid ("DNA"). Several of the articles in this Symposium issue explore the path DNA took on its way through the courts.¹¹

In the early cases, meaningful challenges to prosecution expert testimony on the reliability of "DNA fingerprinting" were non-existent. Courts held prosecution DNA evidence admissible in state after state. As several of the contributors to this issue chronicle, in a partial reversal of judicial opinion reminiscent of the "voiceprint" experience, a slow ground swell of scientific reservations on use of population statistics resulted in a growing number of more recent court decisions denying admissibility of the evidence.

But this symposium issue is not just about DNA. Several other very significant articles on issues and techniques that are currently the subject of admissibility battles, and some controversy, are included for your thoughtful consideration. They span the gamut from social-behavioral sciences to the physical sciences. Rather than commenting on the many worthwhile and significant articles included in this special issue, I would like to suggest an overall theme that emerges from our experiences in dealing with scientific evidence for the past three decades: the existing rules of evidence do not adequately protect the courts from the use of evidence that has not yet been proven scientifically respectable and acceptable.¹²

¹⁰ ANDRE A. MOENSSENS ET AL., SCIENTIFIC EVIDENCE IN CRIMINAL CASES 755 (3d ed. 1986) [hereinafter "SCIENTIFIC EVIDENCE"].

¹¹ See elsewhere in this issue, the following articles: William Thompson, *Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the 'DNA War'*, 84 J. CRIM. L. & CRIMINOLOGY 22 (1993); Peter Neufeld, *Have You No Sense of Decency?*, 84 J. CRIM. L. & CRIMINOLOGY 189 (1993); Rockne Harmon, *Legal Criticisms of DNA Typing: Where's the Beef?*, 84 J. CRIM. L. & CRIMINOLOGY 175 (1993).

¹² This is a theme that many writers have echoed in the past. Among our contributors, Professor Giannelli is one of the most prominent to have taken this position, as his

As a consequence of the very recent holding in *Daubert v. Merrell Dow Pharmaceuticals*,¹³ which, rather than protecting the fact finding process from contamination by unreliable expert opinion, may have actually increased the likelihood of such contamination, especially in criminal cases, we would like to chronicle some reasons for strong judicial caution that is not often mentioned in the legal literature. The Supreme Court in *Daubert* did not see fit to create distinctions between proof in criminal versus civil cases, as far as reliability is concerned, even though literature and case law frequently cautioned that in criminal cases, where a person's freedom is at stake, courts ought to be more reluctant to admit evidence based on new, as yet unproven, techniques when such evidence is being offered by the prosecution.

Many reasons for such special caution have been mentioned in the legal literature, and some of the authors in this special issue refer to them, but I would like to briefly mention some reasons that one does not see often referred to. They have become even more relevant now that the Court in *Daubert* did away with the *Frye* test and embraced what has been touted as the very loose "general relevancy" test of Federal Rule of Evidence 702. In listing nine different reasons for extra caution, I do not in any way seek to create the impression that I am against scientific evidence or against crime laboratories. I have long advocated the use of scientific evidence in the truth finding process, and my experiences in forensic science since the 1950s predate even the start of my legal training in the early 1960s. But the longer one observes the disciplines of the forensic sciences, the more one has to deal with strongly conflicting emotions. On the one hand, one admires the truly revolutionary new methods that have been and are being developed. On the other hand, one remembers some horror stories of the past when too much haste in rushing new methods through the evidentiary hoops resulted in convictions on less than sound scientific bases. I urge caution because its absence is the antithesis of the scientific method;

article references. I have taken the same position on many other occasions. See, e.g., Andre A. Moenssens, *Admissibility of Scientific Evidence—An Alternative to Frye*, 25 WM. & MARY L. REV. 545 (1984), and other references in SCIENTIFIC EVIDENCE, *supra* note 10, at 5-13.

Wholesale abandonment of the *Frye* test in federal trials as a result of the United States Supreme Court's *Daubert v. Merrell Dow Pharmaceuticals*, 113 S. Ct. 2786 (1993), decision, is likely to lessen that protection even further. This author will show in a writing soon to be published that *Daubert* is not likely to improve the chances of admitting novel scientific evidence in those courts that previously followed *Frye*.

¹³ 113 S. Ct. 2786 (1993); see *supra* note 7.

lack of caution leads to grievous error that tends to bring forensic science into disrepute.

I. MOST EXPERT WITNESSES ARE TECHNICIANS

Most of the witnesses who testify as experts for the prosecution are not truly scientists, but better fit the label of "technicians."¹⁴ While their testimony as experts in areas well recognized by reliable precedent is entirely proper, they are not the type of witnesses needed to lay an adequate foundation for new scientific developments that they used, but did not empirically validate. More and more, the courts are coming to recognize that, when dealing with novel scientific issues, the foundation for admissibility and the fact of general scientific recognition "may not be established without the testimony of 'disinterested and impartial experts,' 'disinterested scientists whose livelihood was not intimately connected with the new technique.'"¹⁵

Nothing pejorative or negative is intended by the label "technician." These technicians are perfectly competent to use techniques validated by others, and properly apply them to obtain perfectly reliable results. They are not, however, the kind of experts that lawyers need in an attempt to make new law by being among the first to introduce novel expert testimony in court.

Also, some evidence examiners who qualify readily as experts nevertheless do not understand the sophisticated instrumentation that is used in crime laboratories. They have been taught to use the complex instruments, such as the infrared spectrophotometer, or

¹⁴ Most crime laboratory personnel will immediately disagree with this statement because they have been bestowed with the job title of "forensic scientists." It is in the definition of "scientist" where the misunderstanding lies. A scientist does empirical research. Starting with a theory that is postulated, the scientist then experiments to verify the validity of the theory. If the theory is not disproved after a searching inquiry and empirical testing, then comes the time to devise and build an instrument or develop a technique that will permit the theory to be applied practically in a forensic setting. If this stage is reached, the scientist conducts more tests to show there is a positive correlation between the results and the underlying theory, to demonstrate whether the effects observed are truly the result of the new technique or whether they are caused by some other, unidentified, event. These steps are not always followed in crime laboratory "research." It is not the kind of endeavor that can be easily accomplished in crime laboratories, understaffed as they are, and able to cope with an ever increasing case load only by increasing the "turn-around" time.

¹⁵ See *People v. Tobey*, 257 N.W.2d 537, 539 (Mich. 1977) (dealing with "voiceprint" identification). In a similar case, *People v. Kelly*, 549 P.2d 1240 (Cal. 1976), the California Supreme Court said that acceptance of a technique by a limited group of individuals, mostly connected with law enforcement, whose impressive credentials were those of technicians and police officers, not scientists, did not demonstrate the kind of "general acceptance" needed to validate a new technique.

the gas chromatograph, or a whole host of other delicate scientific apparatus or even "simple" breathalyzers, as "bench operators" who have only a superficial understanding of what the instrument really does, and how the read-out is generated. Again, it is entirely proper for these witnesses to testify in connection with their use of instrumentation in techniques that have been demonstrably validated in the past by true researchers and scientists, but such "bench operators" who qualify as expert witnesses are not competent to explain the instrumentation used unless it is established that they received the training and education necessary to impart a thorough understanding of the underlying theories.

II. PRO-PROSECUTION BIAS MAY IMPAIR SCIENTIFIC IMPARTIALITY

This special issue demonstrates that even where crime laboratories do employ qualified scientists, these individuals may be so imbued with a pro-police bias that they are willing to circumvent true scientific investigation methods for the sake of "making their point." Witness the examples cited of shameless circumvention of the peer review process in publishing DNA articles.¹⁶

Unfortunately, this attitude is even more prevalent among some "technicians" (non-scientists) in the crime laboratories, for whom the presumption of innocence disappears as soon as police investigative methods focus on a likely suspect. These individuals, who are frequently trained to do forensic work on the job after obtaining an undergraduate degree in chemistry or biology, are bestowed with the job title of "forensic scientist" after only a short time in their crime laboratory function. Their pro-police bias is inconsistent with being a scientist. In fact, the less of a scientific background a lab person has, the less critical that person is likely to be in terms of investigating the validity of claims made by other laboratory personnel. These are the "experts" who typically jump on the bandwagon of anything new that comes down the pike, and will staunchly advocate its reliability, even in the absence of any objective investigation and validated experimentation.

Again, many of these individuals do good work in the field in which they have been trained, but their bias is often so strongly pro-prosecution that they may lack the kind of objectivity and dispa-

¹⁶ See Neufeld, *supra* note 11, at 192-97. I have documented elsewhere attempts by law enforcement experts to stifle dissent by writing to defense lawyers and judges in cases where the defense sought to retain expert witnesses. These attempts involved discrediting potential witnesses' qualifications extra-judicially and blocking admission to membership in professional societies. See SCIENTIFIC EVIDENCE, *supra* note 10, at 674 n.60.

sionate judgment that one expects of a true scientist, be it forensic or otherwise.

III. EXPERTS TESTIFY BEYOND THE BOUNDS OF THEIR EXPERIENCE

Expert witnesses notoriously stray outside the fields of their expertise. It should be recognized, however, that frequently this is not the expert's fault because lawyers often ask questions on issues beyond the witness's experience. The opposing attorney then fails to object because neither lawyer knows any better! This problem is caused by the appalling scientific illiteracy that exists among the bar and bench.¹⁷ Juries largely share the scientific illiteracy of the legal profession. Horror stories illustrating these concepts abound. "With the backing of 'expert' testimony from a doctor and police department officials, a soothsayer who decided she had lost her psychic powers following a CAT-scan, persuaded a Philadelphia [civil] jury to award her [one] million [dollars]."¹⁸

This scientific illiteracy causes lawyers to sometimes blindly accept opinions as accurate because they are believed to be based on immutable scientific principles when, in fact, they are the purest of "evaluation" and opinion.¹⁹ Justice Hawkins, dissenting in *Hooten v.*

¹⁷ See, e.g., James Starrs, *In the Land of Agog: An Allegory for the Expert Witness*, 30 J. FORENSIC SCI. 289 (1985).

[L]awyers as a group evidence an appalling degree of scientific illiteracy, which ill equips them to educate and guide the bench in its decisions on admissibility of evidence proffered through experts. This scientific illiteracy is shared by a large segment of the trial and appellate bench; many judges simply do not understand evidence based on scientific principles; even more tragically, they overlook important attributes indicative of reliability of evidence they reject, while ascribing positive properties to other evidence they accept which that evidence simply does not possess.

SCIENTIFIC EVIDENCE, *supra* note 10, at 7 (footnote omitted).

¹⁸ Peter Huber, *Junk Science in the Courtroom*, FORBES, July 8, 1991, at 68. The same article quoted Donald Elliott, general counsel of the Environmental Protection Agency, as saying that the law "extends equal dignity to the opinions of charlatans and Nobel Prize winners, with only a lay jury to distinguish between the two." *Id.*

It should be noted that Huber's article, which in its expanded version became the book GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM (1991), has itself been criticized strongly, as mentioned in Professor Giannelli's article in this issue. Paul Gianelli, "Junk Science:" *The Criminal Cases*, 84 J. CRIM. L. & CRIMINOLOGY 105, 107 (1993). One reviewer scolded Huber for being a purveyor of junk science himself. See Jeff Lewin, *Calabresi's Revenge? Junk Science in the Work of Peter Huber*, 21 HOFSTRA L. REV. 183 (1992).

¹⁹ When confronted with their "mistake," such lawyers then begin to mistrust all experts and treat them with contempt. Much of the disenchantment between lawyers and scientists results from a mutual lack of understanding of the wide differences in approaches used by "scientists" when seeking to solve problems they face in their disciplines, and the method used by the law when a dispute ends up in court for judicial resolution. See generally Noreen L. Channels, *SOCIAL SCIENCE METHODS IN THE LEGAL PROCESS* (1985); J.D. Nyhart & Milton M. Carrow, *LAW AND SCIENCE IN COLLABORATION* (1983). See also Charles W. Ehrhardt, *The Conflict Concerning Expert Witnesses and Legal Con-*

State,²⁰ commented that it was “an astonishing indictment on the gullibility of lawyers and judges” that an incompetent person could qualify as an expert in over three hundred cases!²¹ It is largely this scientific illiteracy of lawyers that permits experts to stray beyond their fields of competence, even where they do have a recognized expertise in a given field.

What forensic pathologist, frequently called upon to deal with gunshot wounds, isn't asked questions regularly about the caliber and characteristics of weapons, even though the pathologist is not trained in firearms identification?²² By the same token, what firearms examiner isn't asked regularly about wounds resulting from firearms handling? In one case, a qualified examiner was asked whether red marks that he had observed on the shoulder of an arrestee could have come from the recoil of a rifle.²³ What qualifies a firearms examiner to give an opinion on bruises and contusions on

clusions, 92 W. VA. L. REV. 645 (1990); J.D. Nyhart & Thomas F. Jones, *What You Don't Know About Technology Can Hurt You*, 69 A.B.A. J. 1667 (1983); Thomas Nace, *Expert Evidence—Groping for Consensus in Science and Law*, TRIAL, Sept. 1992, at 59. For a basic explanation of scientific methodology, see Stephanie E. Busloff, Comment, *Can Your Eyes Be Used Against You?—The Use of the Horizontal Gaze Nystagmus Test in the Courtroom*, 84 J. CRIM. L. & CRIMINOLOGY 203 (1993).

²⁰ 492 So. 2d 948, 958 (Miss. 1986) (Hawkins, J., dissenting). The case involved the admissibility of the testimony of a graphoanalyst (a person attempting to discover the character of a person from handwriting—purportedly scientific application of graphology) testifying as a questioned document examiner on an issue of disputed authorship. The graphoanalyst-witness vaunted in *Hooten* that she had never “bothered to read any books on forensic document work, said she did not intend to, and already knew all she needed to know,” thus exemplifying, in Justice Hawkins' words, “the one sure sign of a quack: contempt for recognized authorities.” *Id.* (Hawkins, J., dissenting).

²¹ *Id.* at 958 (Hawkins, J., dissenting). The appalling fact that graphologists without training in scientific questioned document examination succeed in hoodwinking the legal profession is further exemplified by the fact that the respected publisher of the multi-volume PROOF OF FACTS recently commissioned the writing of the new chapter on questioned document examination—handwriting identification, to a graphoanalyst, Dorothy Lehman, who lacks standing in the field of forensic document examiners. See 15 AM. JUR. PROOF OF FACTS 3d *Handwriting Identification* (1992). The new chapter is supposed to supersede the previous POF article on the topic, written with the assistance of a highly respected questioned document examiner, James V. P. Conway. For commentary on and a perspective review of the POF graphology contribution by a former California crime laboratory director, see Duayne J. Dillon, *Graphology's Revenge: A Review of 'Questioned Document Examination—Identification of Handwriting on Document'*, SCI. SLEUTHING REV., Winter 1992, at 7-11. The reviewer's conclusion that the PROOF OF FACTS article contains a “magnitude of erroneous information” is all the more appalling if one considers that most trial lawyers consult PROOF OF FACTS regularly to prepare their cases!

²² In *Lee v. State*, 661 P.2d 1345, 1354 (Okla. Crim. App. 1983), the court allowed a forensic pathologist to testify on bullet caliber from a gunshot wound examination because this was within the expert's area of “professional experience.”

²³ See *People v. Lauro*, 398 N.Y.S.2d 503, 504 (N.Y. App. Div. 1977).

the human body? Again, this testimony was not objected to!²⁴

In another case, the state's chemist, who was not a pharmacologist, was allowed to testify that LSD makes one do all kinds of bizarre things, like it "made people go as far as to tear out their eyes right out of their sockets, chew off an arm, jump out of windows."²⁵ The Virginia Supreme Court reversed, but not because the opinion was beyond the training of the chemist—which it clearly was—but because the testimony was irrelevant to the charge of possession of LSD.²⁶

It is clearly the lawyer's job to know the limits of an expert's field of training in order to avoid permitting incompetent evidence into the trial record, and to assure the proper and timely objection can be made. In a DNA case, a defense attorney introduced into evidence a survey conducted by members of the American Society of Crime Laboratory Directors, which asked them if they felt that the work done by the three commercial companies in that field—Lifecodes, Cellmark, and Forensic Science Associates—was ready for casework (and presumably for admissibility). These crime laboratory directors' qualifications were never looked into; few of them were molecular biologists or geneticists; few of them were intimately familiar with what these laboratories were actually doing and had accomplished.²⁷

IV. EXPERT WITNESSES PREVARICATE ON THEIR QUALIFICATIONS

Some experts blatantly misstate and exaggerate their qualifications, to the point of perjury—a great embarrassment to the lawyers who called them as witnesses and, perhaps unknowingly, allowed perjurious statements to be used. This is true of state and federal government, as well as defense, witnesses. Many otherwise qualified experts bestow academic degrees upon themselves that they did not earn, including doctorates. Some profess to have worked in prestigious laboratories in which they never set foot!²⁸ The reported cases,

²⁴ *Id.*

²⁵ *Smith v. Commonwealth*, 292 S.E.2d 362, 363 (Va. 1982).

²⁶ *Id.* at 364.

²⁷ See *Letter to the Editor*, 34 J. FORENSIC SCI. 803, 803 (1989). Now that the crime laboratories have adopted the methods of these companies and, sometimes with simplified protocols, are duplicating their work, these same crime laboratory directors have had to do a quick about-face.

²⁸ For a veritable catalogue of some clearly documented cases including FBI and police crime laboratory "experts," see James E. Starrs, *Mountebanks Among Forensic Scientists*, in 2 FORENSIC SCIENCE HANDBOOK (Richard Saferstein ed., 1988). Examples include a phony "Dr." Milton Kline, who testified as an expert around the country, and most notably in the Ted Bundy murder prosecution in Florida. David Twedell, after having

in all likelihood, expose only the tip of an iceberg. Since busy lawyers do not routinely verify every entry in an expert's lengthy resume, most of the imposters were discovered only accidentally.²⁹ One wonders how widespread the problem is. A superficial glance at discovered cases leads us to believe that the falsification of credentials is truly a problem of national proportions. It has probably come about because experts have for so long been used to getting away with saying almost anything, since they knew lawyers did not verify credentials. In fact, crime laboratories ordinarily do not verify or check the accuracy of the statements made by their employees in the course of court testimony.

Again, to a large extent, this may be termed a failure of the legal profession to challenge expert statements routinely. Some career experts, who became part-time career witnesses, discover after years of testifying that neither the direct nor the cross examiners understand most of what they say, or only pretend to understand, and do not meaningfully challenge their statements. In time, the feeling grows that they can get away with saying almost anything on the witness stand. These experts certainly do not view "maximizing" of their qualifications with what they consider minor exaggerations to be very significant, as it does not go to the substance of their professional work.

We should by no means conclude that the entire forensic science profession is suspect. Obviously, that is not so. The vast majority testify truthfully, but the "mountebanks" are entirely too common to suggest that the chance of running into one of them is remote.

V. PROFICIENCY TESTING OF CRIME LABORATORIES: A SURPRISE

Experts and crime laboratories did not fare well in proficiency testing conducted by their own professional organization. In the

flunked out of the University of Houston, claimed to have a doctorate in geology from that school when he applied for jobs and when he testified as a government expert in the infamous Love Canal litigation. FBI Special Agent Thomas N. Curran claimed, under oath, to have a master's degree in science when he never attained any graduate degree. According to an internal FBI inquiry, Curran also committed perjury in testifying about tests he had conducted at the FBI laboratory and reported results of tests he had never conducted. Starrs, in *Mountebanks*, lists many other instances of defense and prosecution witnesses who "maximized" their educational and experience credentials.

²⁹ Kline's fake doctorate was not discovered until prosecutors in the John Lennon murder trial found his name on the list of defense witnesses and recalled that in an earlier court appearance Kline had listed, among his credentials, having been a "member of the Visiting Teaching Faculty of Forensic Hypnosis at the FBI Academy in Quantico, West [sic] Virginia."

mid-1970s, Forensic Sciences Foundation, Inc., on behalf of the American Academy of Forensic Sciences and crime laboratory directors, organized a national proficiency testing program based on voluntary participation. The unstated but avowed purpose of the program was to establish that crime laboratories were highly competent,³⁰ but the results were disappointing. For example, 71.2% of the laboratories obtained "unacceptable results" in blood typing, 34% could not match paint samples, and 50% could not identify dog hairs.³¹

Before overestimating the importance of this study as it applies to today's laboratories, it should be stressed that the results of this early proficiency test do not represent the state of affairs that exists today. As may well be imagined, the Forensic Science Foundation proficiency test was a real bombshell that caused a lot of soul-searching and induced laboratories to undertake widespread quality control improvements. Today, we clearly could not make the across-the-board statement that "crime laboratories flunk analysis," as one director said in those days.³² Serious errors of the type noted would be rare exceptions in 1993.

Yet, when it comes to "novel" techniques, caution is indicated because our technological advances continue to leap forward at an ever increasing rate, and the laboratories have been hard pressed to keep up. Who ever heard, in the 1950s, of HLA, or enzymes and proteins in blood analysis of crime scenes, or of DNA fingerprinting? Who ever dreamed of the sophisticated techniques and instrumentation that are now routinely used in crime laboratories, such as atomic absorption spectrophotometry, ion microscopy techniques, the scanning electron microscope, and gas chromatography with ion capture detection? These techniques and/or instruments did not even exist in the fifties, or, if they existed, they were not routinely used in forensic work.

The disciplines of forensic odontology, which gave birth to the still somewhat controversial bitemark identification process, and forensic anthropology, had not yet been organized as discrete bodies of scientists within the American Academy of Forensic Sciences. Even the disciplines that were already common in the early crime laboratories have grown exponentially in their capabilities. When

³⁰ This author is a past officer of the Academy, and was, by virtue of that fact, a member of the Foundation during some of the time that the proficiency testing project was undertaken.

³¹ See SCIENTIFIC EVIDENCE, *supra* note 10, at 5-7.

³² Donald Mooney, President's Address at the Annual Meeting of the International Association for Identification (July 1978).

we thought of questioned document analysis in earlier days, we were basically talking about handwriting and typewriting analysis. Today, document examiners still do that work, but their expanded horizons now also encompass sophisticated ink analysis techniques, analysis of paper and writing instruments, as well as examination of documents produced by microcomputer assisted word processing and their assorted laser, ink jet, dot matrix, and other printers.

Fingerprint techniques, among the oldest identification means still used by law enforcement today, have become far more sophisticated than they once were. Rather than just dusting with fingerprint powder and using iodine fuming and silver nitrate processing, as was done less than half a century ago, latent print searches now routinely use ninhydrin development, laser techniques, and cyanoacrylic ester fuming. Traditional classifying and filing is largely supplanted by automated filing and searching.

Crime laboratories themselves have grown from just a few dozen well equipped facilities in the late forties and early fifties to literally several hundred well equipped federal, state, and local laboratories. From a few hundred individuals who frequently testified as experts in forensic analysis, the field has now grown to literally thousands and the numbers grow daily. With this expansion of techniques, and the simultaneous growth in the numbers of places of research, we cannot ignore the fact that crime laboratories today have a great deal of difficulty staffing the many technical functions they are asked to perform. In most laboratories, there are openings at the benches and no qualified applicants for the jobs. Laboratories are forced to train individuals with only a minimum of academic credentials (an undergraduate degree) to perform sophisticated analyses and operate complex instrumentation.³³

VI. HUMAN ERROR A MORE IMPORTANT FACTOR THAN PREVIOUSLY SUSPECTED

In part because of the growth in the forensic sciences outlined above, there are more and more cases coming to light where some properly trained examiners, all of whom refer to themselves as forensic "scientists," have simply reached erroneous conclusions. Misidentifications have even occurred in disciplines as old and widely used as fingerprint identification.³⁴ Which leads us to the

³³ See Randolph Jonakait, *Forensic Sciences: The Need for Regulation*, 4 HARV. J. L. & TECH. 109, 109-116 (1991); Jay A. Siegel, *The Appropriate Educational Background for Entry Level Forensic Scientists: A Survey of Practitioners*, 33 J. FORENSIC SCI. 1065 (1988).

³⁴ See, e.g., *State v. Caldwell*, 322 N.W.2d 574 (Minn. 1982) (new trial ordered because the uncontroverted testimony of the state's fingerprint expert subsequently dis-

next logical question: how often is this *likely* to happen? We don't really know! Most of these documented cases have come to light only by accident, or after a particularly tenacious investigator revealed them. The reality of life being what it is, mistakes of this kind are not very likely to be discovered.

Because, among the great mass of criminal litigation, only a limited number of cases of documented error have come to light, we deduce therefrom that errors are rare. But that is not a very scientific conclusion or deduction. Some cynics may well suggest that the reason we do not discover errors more often is because criminal defendants rarely have the funds to conduct a meaningful challenge by hiring their own experts. The critics argue that if the results obtained by police experts were checked every time, a lot of mistakes would be discovered. Whether that is true is impossible to verify.

What is currently being discovered, however, is that a number of convictions have been based on erroneous eyewitness identification and/or erroneous traditional serology-type testimony. Ironically, it is the now beleaguered DNA technique that is said to establish the innocence of persons convicted by other, previously well established and widely accepted, scientific evidence.

There is no question that the impact of statistical calculations on the probability of an innocent match in blood analysis has a great impact on the jury. If a serologist testifies that the blood sample taken from a defendant's clothing matches that of the victim's blood, and that the probability of these same characteristics occurring in the blood of human beings is only one in 20,000, then, in the mind of the fact finder, identity has been established with as much definitiveness as science can muster. Surely, considering that viable suspects of the crime must often be limited to a smaller population group than the statistics allow for, the reasonable juror may be led to believe there is no possibility of error.

Yet, exactly the opposite seems to be coming to light in the re-

covered to have been incorrect). *Id.* at 574. For commentaries on that case, see James Starrs, *To Err Is Human, Infallibility Is Divine*, SCI. SLEUTHING NEWSL., Jan. 1983, at 1; James Starrs, *A Miscue In Fingerprint Identification: Causes and Concerns*, 12 J. POL. SCI. & ADMIN. 287 (1984); George Bonebrake, *Fabricating Fingerprint Evidence*, IDENTIFICATION NEWS, Oct. 1976, at 3 (listing 15 cases of fabricated fingerprint evidence). See also SCIENTIFIC EVIDENCE, *supra* note 10, at 461-62 n.113 (discussing the DePalma case, popularized in the READER'S DIGEST, in which a "fake" latent print remained undetected by other highly qualified experts).

These errors are, of course, not confined to the field of fingerprint identification. For example, an odontologist identified certain marks on a body as bitemarks consistent with those of the defendant's teeth until it was established by other forensic experts that the marks were post mortem abrasions without any resemblance to bitemarks. See James E. Starrs, SCI. SLEUTHING REV., Spring 1992, at 5.

testing, by DNA analysis, of the evidence in cases where persons had been previously convicted on eyewitness testimony or on traditional serology testimony. What may be gathered from the mounting evidence is that the statistical inferences drawn from serological "identifications" of the defendant as the perpetrator appear to have been accepted as proof of a uniqueness that is simply not warranted.

Despite protestations of innocence and an alibi, Leonard Calace was convicted of rape in 1986 and sentenced to twenty-five to thirty years to Dannemora prison, in New York. His accuser identified him and the jury believed her. Not until July of 1992 would Calace succeed in having the victim's blue jeans tested by DNA. "The DNA left on the girl's clothing and the DNA of Leonard Calace were not the same," said Attorney Thomas McVann.³⁵

In April of this year, Virginia Governor L. Douglas Wilder, fearing a miscarriage of justice, ordered the immediate release and pardon of Walter T. Snyder, Jr., convicted in 1986 of the rape of a neighbor in Alexandria.³⁶ John E. Klock, Alexandria's commonwealth attorney, concurred in the petition for Snyder's release. At Snyder's trial, which resulted in a conviction and a forty-five year sentence, the victim had identified him. He also had reputedly confessed several times to police, and a serologist testified that glandular material taken from the scene was "consistent with" Snyder's secretion type.³⁷ His lawyer, Peter Neufeld,³⁸ is reported to have said at the time of Snyder's release that there have been ten cases nationally in which "DNA has exonerated a suspect."³⁹ Since about thirty-five to thirty-seven percent of all DNA tests performed at the request of police clear the individuals whose DNA samples are submitted as suspects, this is likely to be a misquote. We can assume that Neufeld said that ten persons previously convicted of offenses were later cleared by a DNA retest of the evidence used to obtain an earlier conviction.

There are other well-documented cases already on the record. In 1979, an Illinois court sentenced Gary Dotson, who had steadfastly protested his innocence, to twenty-five to fifty years for the rape of a sixteen-year-old girl. Six years later, the victim, accompanied by her husband, at a press conference and before television

³⁵ Michael Ryan, *Is DNA Testing Foolproof?* PARADE MAGAZINE, Apr. 25, 1993, at 10.

³⁶ See Michael Hardy & Jamie C. Ruff, *Wilder Pardons Rape-Case Inmate*, RICHMOND TIMES-DISPATCH, Apr. 24, 1993, at A1.

³⁷ Mike Allen, *Wilder Asks Review of Rape-Case DNA Test*, RICHMOND TIMES-DISPATCH, Apr. 19, 1993 at A1.

³⁸ Peter Neufeld is a contributor to this issue. See Neufeld, *supra* note 11.

³⁹ Hardy & Ruff, *supra* note 36, at A8.

cameras, stated that she had never been raped and that she had never seen Gary Dotson—her complaint had been a panicked reaction to a fear she was pregnant. The physical evidence produced at trial and the deductions made therefrom by experts—torn clothes, bruises, cuts on her vagina and abdomen—were all self-inflicted. Despite the public outcry demanding Dotson's release, the judge who conducted the hearing decided that the "victim's" exoneration of Dotson was not credible, and he ordered Dotson remanded to the penitentiary. According to a commentator, "the firestorm of news media and public pressure" compelled Illinois Governor James R. Thompson "to conduct an extraordinary expanded clemency hearing," at the conclusion of which he "agreed with the judge's ruling but nonetheless freed Dotson 'under the circumstances.'"⁴⁰ It was only after a re-testing of the physical evidence by DNA that Dotson's innocence was established.⁴¹

Harmon mentions a recent West Virginia case,⁴² in which a person convicted on traditional serological evidence was later cleared and freed when DNA testing established that he could not have been the perpetrator. As science progresses in one area (DNA), it seems to impeach or cast doubt on the worth of another technique (serology) that has benefitted from long judicial acceptance.

VII. USE BY EXPERTS OF FRAUDULENT OR MANUFACTURED EVIDENCE

On rare occasions, highly qualified experts have been shown to

⁴⁰ Edwin Black, *Why Judge Samuels Sent Gary Dotson Back to Prison*, A.B.A. J., Sept. 1985, at 56.

⁴¹ *Free at Last*, A.B.A. J., Oct. 1989, at 19. In contrast to the cases in which DNA proof of innocence resulted in reversals, in at least one rape prosecution, the jury convicted the defendant based on the victim's eyewitness identification despite proof by an FBI expert that DNA analysis positively excluded the defendant as the semen donor. See *State v. Hammond*, 604 A.2d 793 (Conn. 1992) (cited in SCI. SLEUTHING REV., Summer 1992, at 14-15).

⁴² See Harmon, *supra* note 11, at 188. He refers to Woodall's case wherein the defendant's conviction for rape was set aside because the (former) state police serologist, Fred Zain, had identified Woodall as the rapist but six nationally renowned forensic scientists later called Zain's test results "impossible." Zain left his job in West Virginia to become a serologist for the Bexar County Medical Examiner in Texas, where he was fired just a few months ago because he had changed his testimony there, too! In a criminal trial for murder, he had identified two large blood spots on the victim's carpet as "belonging to the defendant." Later, in the course of a civil proceeding stemming from the victim's death, he testified that the blood stains were the victim's. See Stephanie Martz, *Ex-state Serologist Leaves Texas Job*, THE CHARLESTON GAZETTE, July 28, 1993, at 1A. See also, *Judge to Eye Zain's Cases*, CHARLESTON GAZETTE, June, 4, 1993, at 1A (reporting the appointment of a retired circuit court judge by the State Supreme Court of Appeals of West Virginia to head an investigation into the alleged police lab misconduct).

have manufactured evidence with which innocent individuals were "framed" and convicted.⁴³ One recent case reported that a police officer was convicted of official misconduct for falsifying breathalyzer readings and extorting money from fifteen people he detained on the basis of the falsified readings.⁴⁴ In another case, a pathologist for about forty counties in Texas was shown to have faked several hundreds of autopsies.⁴⁵

On the Sunday, March 28, 1993, CBS program, *60 Minutes*, a segment focused on David Harding, a fingerprint expert of the New York State Police who falsely testified to having found suspects' fingerprints at crime scenes in five cases and thus secured convictions. Are these isolated occurrences? Initially, the reaction of the New York State Police was that this was a lone crook, until, according to CBS, Harding also implicated Crime Scene Investigator Robert Lischansky of the State Police as having faked finding fingerprints at

⁴³ See SCIENTIFIC EVIDENCE, *supra* note 10, at 461 for references to at least 15 cases of fabricated fingerprint evidence that came to the attention of the FBI Identification Section. Other such instances are also reported in Starrs, *supra* note 28. Thomas Curran, a special agent in the FBI Laboratory's serology unit at the time of his resignation, reported the results of lab tests he did not in fact conduct. In one case, he testified that the defendant and the victim both had type O blood, but on retesting it appeared the defendant had type B blood. Other mistaken or false evidence was discovered in his case files. Delbert Lacefield, director of a forensic toxicology laboratory operated by the Federal Aviation Administration, pled guilty to falsely reporting drug test results which, in fact, had not been performed. Dennis Michaelson was an "expert" in arson investigations who testified in civil cases for insurance companies and in criminal cases for the State of Illinois. In at least two cases where he testified as a prosecution expert, he found evidence of arson when no such evidence existed. The Illinois Supreme Court placed responsibility for failing to verify Michaelson's credentials, about which he had also lied, on the prosecution, despite its ignorance of the expert's perjury. See *People v. Cornille*, 448 N.E.2d 857 (Ill. 1983).

Last year, a state police evidence technician falsely testified to having found defendant's fingerprints at a crime scene. His "find" was confirmed by another investigator. In the summer of 1992, the police evidence technician admitted that he had faked the evidence, and had done so in several cases! Larry Kutz, *Guest Editorial—A Mill Stone, Not a Mile Stone*, 43 J. FORENSIC IDENTIFICATION 1 (1993). On experts who lie, see Susan M. Kuzma, *Criminal Liability for Misconduct in Scientific Research*, 25 U. MICH. J.L. REF. 357 (1992); Carol Garcia, *Expert Witness Malpractice?*, EXPERT EVIDENCE REP., June 1990, at 267; Carol Garcia, *Expert Witness Malpractice: A Solution to the Problem of the Negligent Expert Witness*, 12 MISS. C. L. REV. 39 (1991); James Starrs, *The Misbehaving Expert—The Law Turns Turtle*, SCI. SLEUTHING REV., Spring 1993, at 1.

⁴⁴ *State v. Gookins*, 621 A.2d 968, 969-70 (N.J. Super. Ct. App. Div.), *cert. granted sub nom.*, *State v. Falcone*, 627 A.2d 1150 (N.J. 1993).

⁴⁵ Richard L. Fricker, *Pathologist's Plea Adds to Turmoil*, A.B.A. J., Mar. 1993, at 24. The subheading declares, "Discovery of possibly hundreds of faked autopsies helps defense challenges." The concluding sentence read: "We don't know how many people were unjustly convicted on this guy's testimony . . . Obviously we need to take some affirmative action. We don't know but what some innocent person was executed based on his testimony." *Id.*

crime scenes in *seventeen* cases.⁴⁶ Then, when Harding also accused his supervisors, a state police spokesman interviewed on *60 Minutes* admitted that if the supervisors were not directly involved, they were certainly guilty of failing to be aware of what was going on under their noses.

Lapses in honesty are, of course, not confined to crime laboratories. For example, in late 1992, the Richmond, Virginia, newspaper published stories about a private laboratory that is regularly asked to perform thousands of tests on water, air and soil samples for industries, military bases and homeowners to check for a variety of pollutants. These test results were then submitted to state agencies as proof of compliance with environmental regulations. It came to light that this laboratory had either falsified test results or not performed tests and fabricated the results out of thin air. State officials characterized this practice as potentially one of the largest environmental crimes in the state. After state and federal agents raided the laboratory and seized ninety-three boxes of paperwork, and during the weeks of investigation that followed, the laboratory continued as if nothing had happened!⁴⁷

Again, we cannot generalize and suspect all forensic scientists of sinister motives. I am convinced that the forensic disciplines are peopled with basically honest and straightforward, competent, experts. But that belief may lull us into a false sense of security. We are of course tempted to say, "it could never happen here" or "our people are not like that." The lawyers, judges, and department heads in all of the above cases probably believed the same thing, until the opposite was established in a court of law. And these are just some of the cases that have come to light.

The temptation to fabricate or to exaggerate certainly exists. All experts are tempted, many times during their careers, to report positive results when their inquiries came up inconclusive, or indeed to report a negative result as positive when all of the other investigative leads seem to point to the same individual. Experts can feel secure in the belief that their indiscretions will probably never come to light. Not all succumb to that temptation; in all likelihood most

⁴⁶ Lischansky is listed in the current membership directory of the prestigious International Association for Identification, the leading professional group of fingerprint experts.

In a news item, a third former member of the same police unit, a lieutenant, was reported to have been sentenced for faking fingerprint evidence. See *Former State Police Official Sentenced in Scheme*, N.Y. TIMES, Sept. 9, 1993, at B8.

⁴⁷ Mark Johnson, *Problem at Laboratory Corrected, Lawyer Says*, RICHMOND TIMES-DISPATCH, Dec. 20, 1992, at B11; Alan Cooper, *Man in Lab Case Turns Himself in—Manager is Accused of Falsifying Reports*, RICHMOND TIMES-DISPATCH, Mar. 4, 1993, at B1.

never do. The "system," however, certainly makes it possible for this to occur, because in many laboratories throughout the United States, an expert's opinion on a piece of evidence is not verified by other experts, unless she asks for such verification herself.

VIII. PROBABILITIES EVIDENCE OF DOUBTFUL RELIABILITY

Statistical estimates of the value of the expert's conclusions, if admitted in evidence, are usually terrific from the standpoint of the prosecutor, because estimates makes it appear that the odds are astronomical against the expert making a mistake and accusing the wrong person. These statistical estimates have been used freely as part of blood grouping evidence, and are also beginning to be used widely in hair comparison cases. Most other disciplines in the forensic sciences have some statistics available, and are beginning to suggest some uses for them, but the serologists and hair comparison experts—microanalysts—are the forensic persons who have been the least restrained in their use of statistics.

We have heard it said that you can always interpret statistics to justify any conclusion. That is most certainly an overstatement in forensic science, but the plain fact is that statistics are bandied about frequently in a totally irresponsible way. Experts use statistics compiled by other experts without any appreciation of whether the data base upon which the statistics were formulated fits their own local experience, or how the statistics were compiled. Sometimes these experts, trained in one forensic discipline, have little or no knowledge of the study of probabilities, and never even had a college level course in statistics.

There have been some highly celebrated cases wherein evidence of statistical probabilities was of great importance in securing the conviction. Perhaps the most prominent is the Wayne Williams murder prosecution for two of the thirty killings of black males in Atlanta. The contested scientific evidence in that case involved fiber analysis. This evidence was critical not only in connecting Williams with the two homicides with which he was charged, but also in connecting him with ten other killings, proof of which was introduced as "other acts" evidence. Although the admissibility of fiber evidence was not a novel issue, the method used by the prosecution in its attempt to show the uniqueness of the fiber evidence was new. In an article published after the trial, an FBI expert who testified at the trial wrote: "To convey the unusual nature of the Williams residential carpet, an attempt was made to develop a numerical probability—something never before done in connection with tex-

tile materials used as evidence in criminal trials.”⁴⁸

Although the defense expected to confront fiber evidence, it is not clear that they expected the evidence to be presented in statistical form. There is no way that they could have been prepared to challenge this evidence without prior knowledge of the foundational basis for the probability figure. The defendant did move for pretrial discovery of scientific reports. As anyone who has ever seen an FBI laboratory report would know, these reports would not necessarily indicate that statistical evidence would be presented. Yet, the prosecution's evidence appeared devastating. According to the dissent,⁴⁹ the prosecutor argued that there was only a 150 million probability that any other Atlanta household had the same type of bedroom and automobile floorboard carpets.⁵⁰ No meaningful defense challenge was offered.

The plain fact is that experts widely use statistics and probabilities testimony without proper validation of the underlying data. Most forensic experts who use these statistics have no idea of how the calculations were made, and are not statisticians themselves.⁵¹ After a whirlwind acceptance of DNA by the first appellate courts to confront DNA analysis evidence, including the probability studies that attempt to calculate the odds against a false match, some courts have become more cautious. This caution is not necessarily based on the legitimacy of DNA analysis (which is universally accepted), but of the use on the statistical inferences drawn therefrom, as is explored in several articles in this issue.⁵² The early rush to admissibility was sparked in large measure by the fact that the experts testifying about their analytical results were truly research scientists with doctoral degrees and impeccable educational credentials. They were employed by the private laboratories that pioneered the novel technique. The gloss began to fade as the technology transfer from research laboratories to crime laboratories began, and expert witnesses became somewhat less credentialed, and also began to change (sometimes shortcutting) operating protocols to improve

⁴⁸ Harold A. Deadman, *Fiber Evidence and the Wayne Williams Trial*, FBI L. ENFORCEMENT BULL., May 1984, at 13.

⁴⁹ *Williams v. State*, 312 S.E.2d 40, 92, 96 (Ga. 1983) (Smith, J., dissenting).

⁵⁰ *Id.* (Smith, J., dissenting).

⁵¹ Use of what has been called “trial by mathematics” is discussed in SCIENTIFIC EVIDENCE at chapters six (blood tests) and eight (hair comparisons). See also Leonard Jaffee, *Of Probativity and Probability: Statistics, Scientific Evidence, and the Calculus of Chance at Trial*, 46 U. PITT. L. REV. 925 (1985); Craig Callen, *A Brief Word On the Statistical Evidence Debate*, 66 TUL. L. REV. 1405 (1992) (referring to several other recent sources).

⁵² See *supra* note 11.

the "turn-around" time of evidence handling.⁵³

Statistical evidence is powerful in its impact, but lawyers have an obligation to carefully scrutinize its applicability when offered, to avoid irresponsible use of evidence that is often presented merely for what it does *not* purport to do: convince the jury that they can convict, secure in the knowledge that error is humanly impossible.

IX. "EXPERTS AREN'T DOING ANALYSIS, . . . COMPUTERS ARE!"

Some years ago, after a meeting of the Virginia Laboratory Advisory Board, on which I served for eight years, I met with the then Director of the State Bureau of Forensic Sciences who was about to retire. I asked him to tell me what he, in his experience, saw as a possible weakness of crime laboratory testimony in court. He said: "computers!" Computers are a little bit like statistics to crime laboratory people—they use them all the time, but they do not necessarily know how they work.

Many computer-assisted determinations in the crime laboratories use programs that were produced *outside* the laboratory. The data bases upon which the programs were fashioned were also compiled *outside* the laboratory. The users do not know exactly what is *in* the data base, other than the description given in the literature that came with the disks or the reels, or the data bases are one-line but located and compiled elsewhere.

Yet, more and more of these programs are being relied on to identify substances, especially in the drug field. In order to run an analysis, you do not need to be an expert anymore—you only need to be taught to run a sophisticated type of instrumentation that is hooked up to a computer, and then to read off the result. This retiring crime laboratory director told me, "Sometimes I wonder whether *we* are doing an analysis, or whether the computer is doing it. We're losing control over the analysis process and are giving it up to some program inside the box that we know nothing about, except in a very general sense."⁵⁴

While I am not aware of any cases wherein this has been chal-

⁵³ This trend was predicted at least two years before it became evident, in Andre Moenssens, *DNA Evidence and Its Critics—How Valid Are the Challenges?*, 31 JURIMETRICS J. 87 (1990). A recently released report of the National Academy of Sciences, entitled *DNA Technology in Forensic Sciences*, endorses the reliability, in principle, of DNA analysis, but questions the reliability of some laboratories and the undisciplined use of statistics. See Don J. DeBenedictis, *DNA Report Raises Concerns*, A.B.A. J., July 20, 1992, at 20. See also Neufeld, *supra* note 11, and Harmon, *supra* note 11, in this issue.

⁵⁴ Personal conversation with Warren Johnson, Former Director of the Virginia State Bureau of Forensic Science. See also David H. Kaye, *Computer Decision Making for the Expert Witness*, EXPERT WITNESS J., Jan. 1991, at 19.

lenged, or caused problems, it is something that lawyers should be concerned about. Clearly, there is a fundamental change taking place in the way crime laboratories obtain their results, a change that has not yet been adequately scrutinized by the law.

X. CONCLUSION

Opinion testimony by experts is extremely potent when handled properly. Novel scientific theories have an almost irresistible appeal. To handle such evidence competently, and to properly challenge its admissibility when its use is believed to be unwarranted, will require the legal profession as a whole to become more scientifically informed and astute. The articles in this special issue introduce you to critical analyses of several novel areas in the law of scientific evidence.