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Scientific Evidence in Criminal Prosecutions

Paul C. Giannelli

THE TWENTY-FIRST ANNUAL KENNETH J. HODSON LECTURE SCIENTIFIC EVIDENCE IN CRIMINAL PROSECUTIONS*

PAUL C. GIANNELLI**

It is an honor to have been invited to give the Kenneth J. Hodson Lecture in Criminal Law. I had the privilege of serving under General Hodson while on active duty. My talk today is about scientific evidence, and it is based on my research in this area.

I. Increased Use of Scientific Evidence

Scientific and expert evidence is playing an ever-increasing and far more important role in criminal prosecutions than in the past.

A. Notorious Trials

A quick look at well-publicized trials over the past decade illustrates this point. In his book on the Claus von Bulow prosecution, Alan Dershowitz wrote, "At bottom the case against Claus von Bulow was a scientific case. It would have to be refuted by scientific evidence."[1] Similarly, the trial of Ted Bundy, the serial killer, involved the use of hypnotically-refreshed testimony and bite mark evidence.[2] Fiber evidence proved critical in the trial of Wayne Williams for the murder of two of the thirty young black males killed in Atlanta in the late 1970's.[3] Pathology and serology

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**Albert J. Weatherhead III and Richard W. Weatherhead Professor of Law, Case Western Reserve University.

[1]A. DERSHOWITZ, REVERSAL OF FORTUNE: INSIDE THE VON BULOW CASE 105 (1986); *see also* State v. von Bulow, 475 A.2d 995 (R.I.), *cert. denied*, 469 U.S. 875 (1984).

[2]Bundy v. State, 471 So. 2d 9, 18-19 (Fla. 1985), *cert. denied*, 479 U.S. 894 (1986); Bundy v. State, 455 So. 2d 330, 348 (Fla. 1984), *cert. denied*, 476 U.S. 1109 (1986); *see also* R. LARSEN, BUNDY: THE DELIBERATE STRANGER (1986); S. MICHAUD & H. AYNESWORTH, THE ONLY LIVING WITNESS (1983).

[3]Williams v. State, 251 Ga. 749, 312 S.E.2d 40 (1984); *see also* Deadman,

testimony played a pivotal role in the trial of Jean Harris for the murder of Dr. Tarnower, the Scarsdale Diet doctor.[4] The forensic analysis of physical evidence was "at the core of the case" against Dr. Jeffrey MacDonald at Fort Bragg.[5] In addition, "fingerprint, shoeprint, and ballistics evidence" was admitted in the "Night Stalker" serial murder prosecution.[6]

More recent examples can be taken from the December 23, 1991, issue of *Time* magazine. One article on the assassination of President Kennedy, sparked by the movie *JFK*, discussed the "magic-bullet" theory—a theory which questioned whether the same bullet could have struck both President John F. Kennedy and Texas Governor John Connally. The article states that "[n]eutron activation tests indicate that the fragments in Connally's wrist did come from the bullet in question."[7]

Another story in the same issue concerned the recent Florida trial of William Kennedy Smith for rape. The article pointed out that during the investigation, the victim "passed two polygraph tests and a voice-stress analysis."[8] That article, however, neglected to mention that most courts exclude polygraph evidence as unreliable, and virtually every reported case on voice-stress analysis has rejected it as invalid.[9]

Fiber Evidence and the Wayne Williams Trial (Part I), 53 F.B.I. L. ENFORCEMENT BULL. 12 (Mar. 1983); Deadman, *Fiber Evidence and the Wayne Williams Trial (Conclusion)*, 53 F.B.I. L. ENFORCEMENT BULL. 10 (May 1984).

[4]People v. Harris, 84 A.D.2d 63, 445 N.Y.S.2d 520 (1981), *aff'd*, 456 N.Y.2d 694, 442 N.E.2d 1205 (1982), *cert. denied*, 460 U.S. 1047 (1983). Eight pathologists testified; 20% of the trial was devoted to cutaneous histology. *See* Ackerman, *The Physician as Expert Witness: Is Peer Review Needed?*, I GENERICS 37, 52 (Dec. 1985) ("The role of cutaneous histology in the trial of Jean Harris and its implications for medicine and the law in America should be of concern to the community of physicians"); TIME, Mar. 1, 1982, at 90 ("At the trial of Jean Harris last year [the expert] tried to persuade the jury—unsuccessfully—that blood marks jibed with Harris's claim that the shooting of Dr. Herman Tarnower occurred accidentally during a struggle"); *see also* S. ALEXANDER, VERY MUCH A LADY: THE UNTOLD STORY OF JEAN HARRIS AND DR. HERMAN TARNOWER (1983); J. DAVID, SCARSDALE MURDER (1981).

[5]J. MCGINNISS, FATAL VISION 264 (1983). MacDonald was convicted for killing his wife and two children. *See* United States v. MacDonald, 456 U.S. 1 (1982); United States v. MacDonald, 688 F.2d 224 (4th Cir. 1982), *cert. denied*, 459 U.S. 1103 (1983); United States v. MacDonald, 779 F.2d 962 (4th Cir. 1985), *cert. denied*, 479 U.S. 813 (1986).

[6]Harris, *Night Stalker Convicted of 13 Murders*, U.P.I., Sept. 21, 1989.

[7]Corliss, *Who Killed J.F.K.?*, TIME, Dec. 23, 1991, at 68; *see also* Weisburg v. U.S. Dep't of Justice, 438 F. Supp. 492, 499-503 (D.D.C. 1977) (Freedom of Information Act request for lab results on Kennedy assassination).

[8]Booth, *Palm Beach Trial: The Case That Was Not Heard*, TIME, Dec. 23, 1991, at 38.

[9]*See* P. GIANNELLI & IMWINKELRIED, SCIENTIFIC EVIDENCE, ch. 8 (1986).

B. Lack of Scientific Evidence

Indeed, reliance on scientific proof has become so common that its *absence* in a particular case becomes noteworthy. A 1990 news account of the Central Park jogger case commented, "Among the defense's strongest points in attacking the prosecution's case was the surprising absence of physical evidence—no weapons, no blood stains, no strands of hair, no pieces of skin, no footprints link any of the teenagers to the crimes."[10]

Another illustration is the recent acquittal of El Sayyid Nosair for the assassination of Rabbi Meir Kahane, the founder of the Jewish Defense League. Apparently, nobody saw the actual shooting. Witnesses, however, saw the defendant with a gun in the same room where the shooting occurred, heard at least one shot, and saw the defendant run from the scene. When the defendant was shot and apprehended nearby, a gun was found next to him. All this occurred within minutes of the shooting. Most prosecutors would consider this a powerful case. An alternate juror explained the jury's reasoning as follows:

> [Two shots were heard] but only one bullet was found and it was not tested for hair, blood or other indications that it had passed through the rabbi's neck, the fatal wound.
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> ... [T]he prosecution had offered no evidence of Mr. Nosair's fingerprints on the gun, no paraffin tests that might have shown Mr. Nosair fired it, and no evidence showing the bullet's trajectories.[11]

C. Variety of Techniques

We are not only using scientific proof more, but also relying on a wider variety of techniques. Neutron activation, atomic absorption, electrophoretic blood testing, scanning electron microscopy, mass spectrometry, and gas chromatography are but a few of the techniques now used in criminal prosecutions. Other examples include sound spectrometry (voiceprints), psycholinguistics, remote electromagnetic sensing, and horizontal gaze nystagmus. Even fingerprint identification has moved into the high-tech age with laser technology for visualizing latent prints and computers for far more powerful searching capability. In addition, the last decade

[10] Sherman, *Technology Emotion Key in Jogger Case*, NAT'L L.J., Aug. 20, 1990, at 8; *see also* N.Y. TIMES, Aug. 20, 1990, at B4 ("The youths claimed not to have penetrated the jogger, and there was no clear physical proof that they had").

[11] McFadden, *For Jurors, Evidence in Kahane Case Was Riddled With Gaps*, N.Y. TIMES, Dec. 23, 1991, at B1, col. 2.

has seen an increased reliance on social science research—often called syndrome evidence. For example, evidence of battered wife syndrome, rape trauma syndrome, and child sexual abuse accommodation syndrome now frequently is admitted at trial.

II. Reasons for This Development

Several factors may have contributed to this increased use of scientific evidence.

A. Research Funding

At one time, funding for forensic science research was substantial. The creation of the Law Enforcement Assistance Administration (LEAA) in 1968 undoubtedly played a significant role. In the 1970's, the LEAA underwrote a number of research projects designed to encourage the forensic application of scientific knowledge; the admissibility of some techniques can be traced directly to this research. Voiceprint analysis is the best example.[12] Other funded projects dealt with blood analysis,[13] blood flight characteristics,[14] trace metal detection,[15] and polygraphy.[16] Currently, the Federal Bureau of Investigation (FBI) is spending a considerable amount of resources on the forensic application of deoxyribonucleic acid (DNA).

B. Supreme Court Influence

Several writers have found a different reason. They attribute the expanded use of scientific evidence to Supreme Court decisions of the 1960's, in which the Warren Court severely restricted the acquisition of evidence for criminal cases via traditional crime-solving techniques, such as interrogations and lineups.[17] For example, commentators have written *"Miranda, Gideon, Escobedo,*

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[12] NATIONAL INSTITUTE OF LAW ENFORCEMENT & CRIMINAL JUSTICE, VOICE IDENTIFICATION RESEARCH (1972) (submitted to LEAA by Michigan State Police) [hereinafter VOICE IDENTIFICATION RESEARCH].

[13] B. CULLIFORD, THE EXAMINATION AND TYPING OF BLOODSTAINS IN THE CRIME LABORATORY (1971).

[14] NATIONAL INSTITUTE OF LAW ENFORCEMENT & CRIMINAL JUSTICE, TRACE METAL DETECTION TECHNIQUE IN LAW ENFORCEMENT (Oct. 1970).

[15] D. RASKIN ET AL., VALIDITY AND RELIABILITY OF DETECTION OF DECEPTION (1978).

[16] *Id.*

[17] *See* Kelley, *Foreword* to R. FOX & C. CUNNINGHAM, CRIME SCENE SEARCH AND PHYSICAL EVIDENCE HANDBOOK at iii (1973); Fong, *Criminalistics and the Prosecutor*, *in* THE PROSECUTOR'S DESKBOOK 547 (P. Healy & J. Manak eds. 1971).

and several other cases of similar import, indirectly created an entirely new approach to criminal investigation. This has been particularly true with regard to the use and application of the various forensic sciences...."[18] In 1972, an appellate judge wrote, "In this day and age ... where recent decisions of the United States Supreme Court establish stringent guidelines in the investigative, custodial and prosecutional areas a premium is placed upon the development and use of scientific methods of crime detection."[19]

There is some suggestion in the Supreme Court's cases that supports this view. For example, in one case the Court wrote, "Modern community living requires modern scientific methods of crime detection lest the public go unprotected."[20] In *Escobedo* the Court wrote,

> We have learned the lesson of history, ancient and modern, that a system of criminal law enforcement which comes to depend on the "confession" will, in the long run, be less reliable and more subject to abuses than a system which depends on extrinsic evidence independently secured through skillful investigation.[21]

Interestingly, while the Court was erecting constitutional barriers to the use of confessions and lineups, it was removing Fourth and Fifth Amendment obstacles to the use of scientific evidence. The most important case was *Schmerber v. California*.[22] The Court, in an opinion by Justice Brennan, held that the privilege against compulsory self-incrimination applied only to testimonial evidence, and not to physical evidence. Therefore, the police could extract blood from Schmerber for blood-alcohol analysis without violating the Fifth Amendment privilege. This ruling also meant that law enforcement officials could compel a suspect to provide handwriting exemplars, fingerprints, and voice exemplars—and now biological samples for DNA testing—without running afoul of the Self-Incrimination Clause.[23]

Several Fourth Amendment cases also had an impact on the use of scientific evidence. In *Warden v. Hayden*[24] the Supreme Court overruled its prior cases, which had prohibited the seizure of

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[18]Fox et al., *The Criminalistics Mission: A Comment*, *in* LEGAL MEDICINE ANNUAL 1 (C. Wecht ed. 1972).

[19]Worley v. State, 263 So. 2d 613, 616 (Fla. Dist. Ct. App. 1972) (concurring opinion).

[20]Breithaupt v. Abram, 352 U.S. 432, 439 (1957).

[21]Escobedo v. Illinois, 378 U.S. 478, 488-89 (1964).

[22]384 U.S. 757 (1966).

[23]*See* P. GIANNELLI & E. IMWINKELRIED, *supra* note 9, ch. 2.

[24]387 U.S. 294 (1967) (Brennan, J.).

"mere evidence." Under the "mere evidence" rule, the police could seize only contraband, instrumentalities of a crime, or fruits of a crime. Most scientific evidence would have been "mere evidence" and thereby excluded under this rule.

The Warren Court also was the first Court to sanction stop-and-frisk procedures by the police.[25] Later, in *Davis v. Mississippi*,[26] Justice Brennan suggested that the seizure of a person, on less than probable cause, for the purpose of obtaining fingerprints may not violate the Fourth Amendment under certain circumstances.[27] This dictum led to the adoption in a number of jurisdictions of what are known as "nontestimonial identification" procedures. Under these provisions, a suspect judicially may be ordered to provide handwriting, voice, and fingerprint exemplars—and perhaps biological samples for DNA testing—based on reasonable suspicion, rather than on probable cause.[28]

C. The Technological Age

I am not sure, however, that either of these reasons—research funding or Supreme Court decisions—explains fully the increased use of scientific evidence. The answer may be more basic. That a society so dependent on science and technology should turn to such knowledge as a method of proof should not be very surprising. With computer technology running our businesses, magnetic resonance imaging aiding medicine, and the marvel of twentieth-century technology—*Nintendo*—captivating our kids, no one should be very surprised to see DNA evidence in the courtroom.

D. Reliability

In addition, it is the perceived reliability of scientific proof that makes it so attractive and explains its increased use. Fingerprints are simply more reliable than many eyewitness identifications. Lawyers and juries know this. A 1974 survey of

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[25] Terry v. Ohio, 392 U.S. 1 (1968).

[26] 394 U.S. 721, 727 (1969); *see also* Hayes v. Florida, 470 U.S. 811 (1985) (noting the *Davis* dictum).

[27] Later cases by the Court also facilitated the use of scientific evidence. In United States v. Dionisio, 410 U.S. 1 (1973), and United States v. Mara, 410 U.S. 19 (1973), the Court held that physical characteristics, such as handwriting and the sound of a person's voice, fell outside the Fourth Amendment's protection against unreasonable searches and seizures. The Court also held that the compelled production of voice and handwriting exemplars pursuant to a grand jury subpoena did not constitute a seizure of the person within the meaning of the Fourth Amendment.

[28] P. GIANNELLI & E. IMWINKELRIED, *supra* note 9, ch. 2.

1363 judges and lawyers throughout the United States found that "[s]eventy-five percent ... stated that they believed judges accord scientific evidence more credibility than other evidence, and 70 percent believed that juries also find scientific evidence more credible."[29] A more recent survey of jurors reported, "About one quarter of the citizens who had served on juries which were presented with scientific evidence believed that had such evidence been absent, they would have changed their verdicts from guilty to not guilty."[30]

III. Novel Scientific Evidence

The first article that I wrote on scientific evidence concerned the admissibility of novel scientific evidence—that is, scientifically-based evidence that had not yet been admitted in court.[31] That article critiqued the two major evidentiary tests on the issue. The first test is based on *Frye v. United States*[32] and requires the basis of expert testimony to be generally accepted by the scientific community. Under this standard, it is not enough that a qualified expert—or even several experts—testifies that a particular technique is valid. *Frye* imposes a special burden—"general acceptance" in the field.

The alternative approach is what I have described as the relevancy test, which can be traced to Professor McCormick.[33] Under this test, the evidence need not be "generally accepted." It need only be relevant, which in this context means reliable. The critical difference between these two tests is that *Frye* is more conservative—something its detractors lament and its supporters applaud.

This issue remains critical today in the DNA cases. A recent Second Circuit opinion, *United States v. Jakobetz*,[34] in January 1992, rejected the *Frye* test and admitted DNA. Interestingly, five months earlier, the Fifth Circuit not only had reaffirmed *Frye* in *Christophersen v. Allied-Signal Corp.*,[35] but also had applied it in

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[29] M. SAKS & R. VAN DUIZEND, THE USE OF SCIENTIFIC EVIDENCE IN LITIGATION 5-6 (1983).

[30] Peterson et al., *The Uses and Effects of Forensic Science in the Adjudication of Felony Cases*, 32 J. FORENSIC SCI. 1730, 1748 (1987).

[31] Giannelli, *The Admissibility of Novel Scientific Evidence:* Frye v. United States, *a Half-Century Later*, 80 COLUM. L. REV. 1197 (1980).

[32] 293 F. 1013 (D.C. Cir. 1923).

[33] C. MCCORMICK, EVIDENCE 363-64 (1954).

[34] United States v. Jakobetz, 955 F.2d 786 (2d Cir. 1992).

[35] 939 F.2d 1106 (5th Cir. 1991), *cert. denied*, 112 S. Ct. 1280 (1992).

a civil case; this was a major expansion.[36] A proposed amendment to Federal Evidence Rule 702, which is presently under consideration, would adopt a compromise position, requiring expert testimony to be based on information that is "reasonably reliable."

In my article, I criticized both tests; but then I proposed an alternate, yet restrictive, test. In a criminal case, the prosecution should be required to satisfy a high burden of proof when offering novel scientific evidence. Some examples illustrate why.

A. The Paraffin Test

The paraffin test is a gunshot residue (GSR) test designed to detect the presence of nitrates on the hands of a person suspected of firing a rifle or handgun. Nitrates come from smokeless powder—the propellant in modern ammunition—and often are deposited on the hand from the backblast of gases that escape during discharge. Paraffin was used to remove the residues. Knowing whether someone had recently fired a weapon is often significant in suspected suicides, self-defense, and other cases.

The "paraffin test" first was introduced into this country in the 1930's and was adopted quickly by law enforcement agencies.[37] A 1935 article in the *F.B.I. Law Enforcement Bulletin* spoke of the "current widespread use" of this test.[38] The first reported case admitting evidence based on the paraffin test was decided in 1936,[39] and other cases followed this precedent.[40]

The first comprehensive study of the paraffin test, however, was not published until 1967—thirty years after the first court case.[41] From that study, we learned that many common substances other than gunshot residues contain nitrates. "[R]ust,' colored fingernail polishes, residue from evaporated urine, soap and tap water" all tested positive.[42] In short, the test was nonspecific.

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[36] 1 D. LOUISELL & C. MUELLER, FEDERAL EVIDENCE 853 (1977) ("The *Frye* standard ... is rarely applied in civil litigation").

[37] Matthews, *The Paraffin Test*, 102 AMERICAN RIFLEMAN 20 (1954).

[38] *Diphenylamine Test for Gun Powder*, 4 F.B.I. L. ENFORCEMENT BULL. 5 (1935). Diphenylamine was the reagent used in the test.

[39] Commonwealth v. Westwood, 324 Pa. 289, 188 A. 304 (1936).

[40] *See* P. GIANNELLI & E. IMWINKELRIED, *supra* note 9, at 413 (listing cases).

[41] An earlier but smaller study was published in 1955. Turkel & Lipman, *Unreliability of Dermal Nitrate Test for Gunpowder*, 46 J. CRIME, CRIMINOLOGY & POLICE SCI. 281, 282 (1955).

[42] Cowan & Purdon, *A Study of the "Paraffin Test,"* 12 J. FORENSIC SCI. 19, 23 (1967).

Why did so much time pass before conducting this study? Why did courts continue to admit this evidence, even after the publication of this study?

B. Voiceprints

My second example is voiceprint evidence, which confronted the courts in the 1970's. A voiceprint was used to identify a speaker's tape-recorded voice by means of sound spectrometry. Voiceprint evidence was admitted readily after the publication of a 1972 Michigan State University study, which was funded by the Law Enforcement Assistance Administration.[43] In that study, 34,992 experimental trials, involving 250 male speakers and twenty-nine examiners were conducted over a two-year period. False identifications occurred in approximately six percent of the trials that most closely resembled the forensic situation. The error rate is reduced to approximately two percent if the trials in which the examiners expressed "uncertainty" about their conclusions are eliminated.

Dr. Oscar Tosi, who supervised this study, testified that the error rate would be "negligible" in a real-life situation.[44] Based on this study, many courts admitted voiceprint evidence. Other courts disagreed, and a war over admissibility was waged for most of the decade.[45] In 1979, the National Academy of Sciences published its report on the subject. The report raised significant doubts about voiceprint identifications. One passage stated,

> Estimates of error rates now available pertain to only a few of the many combinations of conditions encountered in real-life situations. These estimates do not constitute a generally adequate basis for a judicial or legislative body to use in making judgments concerning the reliability and acceptability of aural-visual voice identification in forensic applications.[46]

As with the paraffin test, the court cases came first and *then* the independent scientific report followed.

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[43] VOICE IDENTIFICATION RESEARCH, *supra* note 12.

[44] People v. Law, 40 Cal. App. 3d 69, 78, 114 Cal. Rptr. 708, 713 (1974).

[45] P. GIANNELLI & E. IMWINKELRIED, *supra* note 9, at 322-23 (listing cases).

[46] NATIONAL ACADEMY OF SCIENCES, ON THE THEORY AND PRACTICE OF VOICE IDENTIFICATION 60 (1979).

C. Hypnotically-Refreshed Testimony

In the 1980's, the major dispute involving the admissibility of scientific evidence concerned the testimony of witnesses whose memories had been refreshed by hypnosis. Finding the evidence reliable, numerous courts admitted hypnotically-refreshed testimony.[47] Some of these courts said that hypnosis was merely another way to refresh memory. Other courts, however, rejected this evidence, holding that its use is so fraught with danger that a witness becomes *incompetent* once hypnotized.[48]

In 1985, the American Medical Association issued a report that seriously questioned the accuracy of this type of testimony. The report stated,

> Review of the scientific literature indicates that when hypnosis is used to refresh recollection, one of the following outcomes occurs: (1) hypnosis produces recollections that are not substantially different from nonhypnotic recollections; (2) it yields recollections that are more inaccurate than nonhypnotic memory; or, most frequently, (3) it results in more information being reported, but these recollections contain both accurate and inaccurate details. When the third condition results, the individual is less likely to be able to discriminate between accurate and inaccurate recollections. There are no data to support a fourth alternative, namely, that hypnosis increases remembering of only accurate information.[49]

Again, the same pattern reappears. Long after the battle over admissibility had erupted in the courtroom, an independent group of experts issued a report on the subject. Should not the report come *before* the admission of the evidence?

IV. Reliability of Routine Procedures

Now I would like to turn to expert testimony based on "routine" procedures.

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[47] *See* P. GIANNELLI & E. IMWINKELRIED, *supra* note 9, ch. 12 (listing cases).

[48] *Id.*

[49] American Medical Association Council on Scientific Affairs, *Scientific Status of Refreshing Recollection by the Use of Hypnosis*, 253 JAMA 1918, 1921 (1985).

A. Fingerprints

As illustrated by several fingerprint cases, even the most basic techniques are subject to error. For example, in *Imbler v. Craven*,[50] the expert failed to observe an exculpatory fingerprint in a murder case in which the death penalty was imposed. In another murder case, *State v. Caldwell*,[51] the court wrote, "The fingerprint expert's testimony was damning—and it was false."[52]

B. Firearms Identification

In February 1989, the Los Angeles Police arrested Rickey Ross for the murder of three prostitutes. An expert who was the head of the Department's Firearms Identification Division made a *positive* identification after comparing the murder bullets and a bullet fired from Ross's nine-millimeter Smith & Wesson. One of the defense attorneys later admitted, "I suppose I was like the average citizen. They said it was a match, I thought it was like a fingerprint."[53] Based on the same evidence, however, a defense expert reached the opposite conclusion—that is, Ross's gun could *not* have fired the fatal bullets. Two independent experts came to yet another conclusion—namely, insufficient evidence existed to draw any conclusions. The case against Ross was dropped.

This was not the first time that the Los Angeles crime laboratory had stumbled. A prior misidentification occurred in the investigation of Sirhan Sirhan for the assassination of Bobby Kennedy.

> In [*People v. Sirhan*,] seven independent examiners were appointed by the presiding judge of the Superior Court of Los Angeles County to reexamine the purported firearms bullet comparison post trial. The examiners were unanimous in their findings that the identification testified to at the grand jury indictment and in the trial were misrepresented in that the purported identification of bullets lodged in victim Kennedy ... with Sirhan's gun

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[50]298 F. Supp. 795 (C.D. Cal. 1969), *aff'd*, 424 F.2d 631 (9th Cir.), *cert. denied*, 400 U.S. 865 (1970).

[51]322 N.W.2d 574 (Minn. 1982).

[52]*Id.* at 586; *see also* Starrs, *A Miscue in Fingerprint Identification: Causes and Concerns*, 12 J. POLICE SCI. & ADMIN. 287 (1984).

[53]Baker & Lieberman, *Faulty Ballistics in Deputy's Arrest; Eagerness to "Make" Gun Cited in LAPD Lab Error*, L.A. TIMES, May 22, 1989, at 1, col. 1; Freed, *LAPD Probing What Went Wrong With Ballistics Tests on Ross' Gun*, L.A. TIMES, May 16, 1989, at 26, col. 1.

> were nonexistent. In both of these cases discovery and cross examination were lacking.[54]

In a third case, *In re Kirschke*,[55] the firearms identification expert made a conclusive identification. On appeal, the court concluded that the expert had "negligently presented false demonstrative evidence in support of his ballistics testimony."[56]

C. Proficiency Testing

Unfortunately, these cases do not represent isolated mistakes. A limited, but nevertheless revealing, survey of lawyers and scientists associated with the American Academy of Forensic Sciences identified "competency" as the most significant ethical problem in the field.[57] Other problems considered significant in the survey included "the failure of scientists to express both the strengths and weaknesses of their data, giving opinions which exceed the limits of their data, and a failure to remain objective in their evaluation of evidence and delivery of testimony."[58]

Moreover, proficiency test results of many common laboratory examinations are disturbing. Seventy-one percent of the crime laboratories tested provided unacceptable results in a blood test, 51.4% made errors in matching paint samples, 35.5% erred in a soil examination, and 28.2% made mistakes in firearms identifications.[59] A review of five handwriting comparison proficiency tests showed that, at best, "[d]ocument examiners were correct 57% of the time and incorrect 43% of the time."[60] One of the authors of a major proficiency test commented,

> In spite of being a firm advocate of forensic science, I must acknowledge that a disturbingly high percentage of laboratories are not performing routine tests competently .... The startling conclusions from that research led to some efforts to improve conditions in the laboratories,

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[54] Bradford, *Forensic Firearms Identification: Competence or Incompetence*, 5 FORUM 14 (1978).

[55] 53 Cal. App. 3d 405, 125 Cal. Rptr. 680 (1975), *cert. denied*, 429 U.S. 820 (1976).

[56] *Id.* at 408, 125 Cal. Rptr. at 682.

[57] Peterson & Murdock, *Forensic Sciences Ethics: Developing an Integrated System of Support and Enforcement*, 34 J. FORENSIC SCI. 749, 751 (1989).

[58] *Id.* at 752.

[59] J. PETERSON ET AL., CRIME LABORATORY PROFICIENCY TESTING RESEARCH PROGRAM 251 (1978).

[60] Risinger et al., *Exorcism of Ignorance as a Proxy For Rational Knowledge: The Lessons of Handwriting Identification "Expertise,"* 137 U. PA. L. REV. 731, 748 (1989).

> but these encounter institutional inertia against reform.[61]

Consequently, "[a]t present, forensic science is virtually unregulated—with the paradoxical result that clinical laboratories must meet higher standards to be allowed to diagnose strep throat than forensic labs must meet to put a defendant on death row."[62] In a recent article on crime laboratories, Professor Jonkait concluded,

> All available information indicates that forensic science laboratories perform poorly.... Current regulation of clinical labs indicates that a regulatory system can improve crime laboratories.... [F]orensic facilities should at least be required to undergo mandatory, blind proficiency testing, and the results of this testing should be made public.[63]

This information about the reliability of routine tests should affect a number of legal issues—for example, (1) whether our current rules on pretrial discovery are adequate,[64] and (2) whether laboratory reports should be admitted into evidence in lieu of expert testimony.[65]

V. Fraud, Perjury, and Misconduct

A. Experts

In a number of cases, experts have gone beyond negligence. For example, a surprising number of expert witnesses have lied about their credentials.[66] In one case, an FBI serologist testified that he had a master's degree in science, "whereas in fact he never

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[61] *Symposium on Science and the Rules of Legal Procedure*, 101 F.R.D. 599, 645 (1984) (remarks of Professor Joseph Peterson). For a more detailed discussion of proficiency testing, see Saks, *Prevalence and Impact of Ethical Problems in Forensic Science*, 34 J. FORENSIC SCI. 772, 775-78 (1989) (reviewing proficiency testing results) ("Perhaps the major lessons to be drawn from this are that errors are indeed made and that there is a wide range of interlaboratory variation").

[62] Lander, *DNA Fingerprinting On Trial*, 339 NATURE 501, 505 (1989).

[63] Jonakait, *Forensic Science: The Need for Regulation*, 4 HARV. J. L. & TECH. 109, 191 (1991).

[64] *See* Giannelli, *Criminal Discovery, Scientific Evidence. and DNA*, 44 VAND. L. REV. 791 (1991).

[65] Giannelli, *The Admissibility of Laboratory Reports in Criminal Trials: The Reliability of Scientific Proof*, 49 OHIO ST. L.J. 671 (1988).

[66] *See* Saks, *Prevalence and Impact of Ethical Problems in Forensic Science*, 34 J. FORENSIC SCI. 772 (1989) (listing other cases); Annotation, *Perjury or Wilfully False Testimony of Expert Witness as Basis for New Trial on Ground of Newly Discovered Evidence*, 38 A.L.R.3d 812 (1971).

attained a graduate degree."[67] In another case, the death penalty was vacated when evidence was discovered that a prosecution expert, who "had testified in many cases," had lied about her professional qualifications. "[S]he had never fulfilled the educational requirements for a laboratory technician."[68] Other examples include a serologist who testified falsely about his academic credentials;[69] a psychologist who was convicted of perjury for claiming, during the Ted Bundy trial, that he had a doctorate degree;[70] an arson expert who testified falsely about his academic credentials;[71] a lab technician convicted of perjury for misrepresenting his educational background;[72] and a lab analyst who pleaded guilty to eight counts of falsification for misstating his academic credentials.[73]

Perhaps the most striking illustration is a firearms expert who took some credit for "the development of penicillin, the 'Pap' smear, and to top it all off, the atomic bomb."[74] Professor Starrs, who has examined these cases in depth, has proposed discovery as the remedy for this type of fraud.[75]

Another type of misconduct is illustrated by the "Maguire Case" in Great Britain. The Maguires were accused of possessing an explosive as part of the Irish Republican Army's terrorism campaign. The prosecution relied on scientific evidence. Professor Starrs has provided us with the following summary:

> The government built its case on the traces of [nitroglycerine] under the fingernails of six of the defendants and on the plastic gloves belonging to Mrs. Maguire. "The evidence was almost entirely scientific." ... The prosecution made much of the fact that [thin layer chromatography] will identify [nitroglycerine] to the exclusion of other substances, explosive and non-explosive. The tests were said to be as conclusive and irrefutable as fingerprints. The entire underpinnings for

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[67]Doepel v. United States, 434 A.2d 449, 460 (D.C. App.), *cert. denied*, 454 U.S. 1037 (1981).

[68]Commonwealth v. Mount, 435 Pa. 419, 422, 257 A.2d 578, 579 (1969).

[69]Maddox v. Lord, 818 F.2d 1058, 1062 (2d Cir. 1987).

[70]Kline v. State, 444 So. 2d 1102 (Fla. Dist. Ct. App. 1984).

[71]People v. Alfano, 95 Ill. App. 3d 1026, 1028-29, 420 N.E.2d 1114, 1116 (1983).

[72]State v. Elder, 199 Kan. 607, 433 P.2d 462 (1967).

[73]State v. DeFronzo, 59 Ohio Misc. 113, 116, 394 N.E.2d 1027, 1030 (C.P. 1978).

[74]Starrs, *Mountebanks Among Forensic Scientists*, *in* 2 FORENSIC SCIENCE HANDBOOK 1, 7, 20-29 (R. Saferstein ed. 1988).

[75]*Id.* at 31.

> this assertion was proved not only to be scientifically false but also known to be so by all concerned parties and scientists by the trial's eleventh hour discovery of an intra-[lab] memorandum dated six months prior to the Maguires' arrest.[76]

Another example occurred in 1970, when a federal grand jury in Chicago investigated the deaths of Black Panther leaders in a police raid. The grand jury report noted that the "testimony of the firearms examiner that he could not have refused to sign what he believed was an inadequate and preliminary report on pain of potential discharge is highly alarming. If true, it could undermine public confidence in all scientific analysis performed by this agency."[77]

B. Attorneys

Attorneys also have misused expert and scientific evidence. Perhaps the most flagrant abuse was the prosecutor in *Miller v. Pate*.[78] A prosecution expert had testified that stains on underwear shorts were type-A blood, which matched the defendant's blood type. The prosecutor waived the "bloody" shorts in front of the jury in closing argument. Later proceedings established that the stains were paint—not blood—and that the prosecutor knew this fact at the time of trial.

Another type of prosecutorial misconduct involves improper attempts to pressure experts into changing or modifying their opinions. In a recent case involving a federal grand jury, the Supreme Court noted that the "District Court further concluded that one of the prosecutors improperly argued with an expert witness during a recess of the grand jury after the witness gave testimony adverse to the government."[79]

A different type of misconduct is illustrated by the controversial Sacco and Vanzetti case. Sacco and Vanzetti were charged with murder during a payroll robbery in 1921. Many believe their executions resulted more from their foreign statuses and "radical" beliefs than from the cogency of the evidence presented against

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[76] Starrs, *The Forensic Scientist and the Open Mind*, 31 J. FORENSIC SCI. SOC'Y 111, 141-42 (1991) (citing May et al., Interim Report on the Maguire Case, London: HMSO (12 July 1990)).

[77] Bradford, *Problems of Ethics and Behavior in the Forensic Sciences*, 21 J. FORENSIC SCI. 763, 767 (1976) (quoting U.S. Dist. Ct., N.D. Ill., E. Div., *Report of January 1970 Grand Jury* 121).

[78] 386 U.S. 1 (1967).

[79] Bank of Nova Scotia v. United States, 487 U.S. 250 (1988).

them. Firearms identification evidence was critical. Professor Morgan has commented on this issue.

> On October 23 Captain Proctor made an affidavit indicating that he had repeatedly told [the prosecutor] that he would have to answer in the negative if he were asked whether he had found positive evidence that the fatal bullet had been fired from Sacco's pistol. The statement which Proctor made on the witness stand was: "My opinion is that it is consistent with being fired by that pistol."[80]

If this passage is true, then the prosecution intentionally misled the jury.

VI. Problem Areas

In researching scientific evidence issues, a number of recurring problems have tended to surface. I will mention several such issues, though I am sure more exist.

A. Technology Transfer

One of the attacks on DNA evidence has focused on the issue of "technology transfer"—that is, DNA has been used in scientific research for a number of purposes, but not for the purpose for which it is being used in criminal trials. The argument is quite simple. Specifically, just because DNA is valid for some purposes does not necessarily mean that it is valid for a different purpose.

This is a recurring issue in the forensic sciences. For example, the American Medical Association had recognized hypnosis as an accepted medical technique for psychotherapy, treatment of psychosomatic illnesses, and amnesia.[81] In this context, hypnosis can be "therapeutically useful, [and yet] it need not produce historically accurate memory."[82] The use of hypnosis to refresh recollection at trial is a very different thing because its use depends on whether it can produce accurate memory.

Similarly, the initial research on rape trauma syndrome was developed to aid rape victims. "[R]ape trauma syndrome was not devised to determine the 'truth' or 'accuracy' of a particular past event—*i.e.*, whether, in fact, a rape in the legal sense occurred—

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[80] L. JOUGHIN & E. MORGAN, THE LEGACY OF SACCO & VANZETTI 15 (1948).

[81] Council on Mental Health, *Medial Use of Hypnosis*, 168 JAMA 186 (1958).

[82] State v. Mack, 292 N.W.2d 764, 768 (Minn. 1980).

but rather was developed by professional rape counselors as a therapeutic tool, to help identify, predict and treat emotional problems experienced by the counselor's clients or patients."[83]

This research still, however, may be useful in a criminal trial. Rape trauma syndrome evidence may be helpful if the defendant suggests to the jury that the conduct of the victim after the incident—such as a delay in reporting the assault—is inconsistent with the claim of rape. In this situation, "expert testimony on rape trauma syndrome may play a particularly useful role by disabusing the jury of some widely held misconceptions about rape and rape victims, so that it may evaluate the evidence free of ... popular myths."[84]

B. Subjectivity

A number of routine forensic techniques are essentially subjective. Firearms identification is an example. Even though based on objective data—such as striation marks on a bullet—the conclusion about a match comes down to the examiner's subjective judgment. Questioned documents, bite marks, and even fingerprints fall into the same category.

Subjectivity also may be a problem when instrumentation is used. For example, the polygraph technique—although employing an instrument—involves a large dose of subjectivity. Indeed, some courts have rejected polygraph results because of this factor. According to one court, the polygraph technique "albeit based on a scientific theory, remains an art with unusual responsibility placed on the examiner."[85] Another court spoke of the "almost total subjectiveness surrounding the use of the polygraph and the interpretation of the results."[86] The use of DNA evidence also involves subjectivity if a "match" is declared based only on "eyeballing" the autorads.[87]

I do not equate "subjective" with "bad" or "invalid." As I noted before, fingerprints are—in this sense—subjective, but they are also very reliable. Subjectivity, however, necessarily means that

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[83]People v. Bledsoe, 36 Cal. 3d 236, 249-50, 681 P.2d 291, 300, 203 Cal. Rptr. 450, 459 (1984).

[84]*Id.* at 247-48, 681 P.2d at 298, 203 Cal. Rptr. at 457.

[85]People v. Anderson, 637 P.2d 354, 360 (Colo. 1981).

[86]People v. Monigan, 72 Ill. App. 3d 87, 98, 390 N.E.2d 562, 569 (1979).

[87]*See* Thompson & Ford, *DNA Typing: Acceptance and Weight of the New Genetic Identification Tests*, 75 VA. L. REV. 45, 88 (1989) ("There are currently no formal standards for determining what constitutes a match between two DNA prints. Whether a match is declared between two prints is a subjective judgment for the forensic expert").

room for disagreement exists—specifically, the greater the subjectivity, the greater the chance for error.

C. Statistical Evidence

In contrast to the "subjective" techniques, a number of techniques are based upon statistics. As one commentator has noted, "The results of forensic tests are often meaningful only if they are accompanied by statistical data."[88] Neutron activation, electrophoretic blood testing, and DNA are examples.

Often, this type of evidence can be misused. If, for example, the expert testifies that the perpetrator and the defendant share a blood type found in five percent of the population, a juror might conclude that a ninety-five-percent chance exists that the defendant is guilty.[89] Such a conclusion would not be warranted. If a million people lived in the city where the crime occurred, 50,000 people would share this blood type. Can the defense then argue that the probability of guilt is therefore one in 50,000? This is also misleading.[90]

These are relatively easy issues compared to the problems with DNA evidence, over which some scientists argue that the loci used in the analysis have not been proved to be independent. If they are not independent, then the product rule cannot be used to compute an overall probability.

Let me simply conclude first by saying that lawyers must understand probabilistic reasoning, and second by citing an article by Professor McCord, entitled "A Primer for the Nonmathematically Inclined on Mathematical Evidence in Criminal Cases: *People v. Collins* and Beyond."[91]

D. Misleading and Ambiguous Conclusions

Pay close attention to an expert's conclusion. As mentioned earlier, the firearms identification expert in the Sacco and Vanzetti case testified that the bullet was "consistent with" having been fired by Sacco's gun. Apparently, the defense counsel and judge

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[88] Thompson, *Are Juries Competent to Evaluate Statistical Evidence?*, 52 LAW & CONTEMP. PROBS. 9 (1989).

[89] *Id.* at 25.

[90] *Id.* at 31.

[91] McCord, *A Primer for the Nonmathematically Inclined on Mathematical Evidence in Criminal Cases:* People v. Collins *and Beyond*, 47 WASH. & LEE L. REV. 741 (1990); *see also* Mark & Workman, *Pitfalls of Statistics, Part I*, 6 SPECTROSCOPY 42 (1991).

believed that a positive identification was being made. It was not. Hundreds or thousands of weapons may have fired that bullet.

Experts in the neutron activation cases have testified that (1) samples "were of the same type and same manufacture";[92] (2) hair samples "came from the same source";[93] (3) blood analysis revealed a "match of the materials";[94] (4) samples had a "common origin or source";[95] and (5) hair samples "were identical and probably came from the same person."[96] What does this testimony mean? Might not a jury believe that a positive identification is being made?

E. Destruction of Evidence and Chain of Custody

In researching cases on chain of custody issues, I came across a surprising number of cases in which evidence was lost or destroyed. A review of the cases reveals that drugs, bullets, blood, urine, and trace metal detection results, as well as physical evidence of arson, rape, and homicide, have not been preserved for examination or retesting.[97]

Perhaps the most bizarre illustration is *People v. Morgan*,[98] in which a severed fingertip was found at the scene of a homicide. It was not the victim's. Through insightful police work—that is, looking for someone with a missing fingertip—Morgan *sans* fingertip became a suspect. The defense moved pretrial to examine the fingertip. The fingertip, however, could not be located. Accordingly, the Colorado Supreme Court held that the prosecution could not use the fingertip evidence at trial. The court does not tell us what happened, but a news report does. The refrigerator in which the evidence was stored apparently was not cold enough to prevent decay and the police refused to move the fingertip to the refrigerator in which they stored their "brown bag lunches." Accordingly, "someone—the police haven't been able to determine who—threw the fingertip away."[99]

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[92]United States v. Stifel, 433 F.2d 431, 436 (6th Cir. 1970), *cert. denied*, 401 U.S. 994 (1971).

[93]People v. Collins, 43 Mich. App. 259, 264, 204 N.W.2d 290, 293 (1972).

[94]State v. Stout, 478 S.W.2d 368, 368 (Mo. 1972).

[95]State v. Coolidge, 109 N.H. 403, 421, 260 A.2d 547, 560 (1969), *rev'd on other grounds*, 404 U.S. 443 (1972).

[96]Ward v. State, 427 S.W.2d 876, 884 (Tex. Crim. App. 1968).

[97]*See* P. GIANNELLI & E. IMWINKELRIED, *supra* note 9, at 108-09 (collecting cases).

[98]199 Colo. 237, 606 P.2d 1296 (1980).

[99]Moya, *The Case of the Missing Fingertip*, NAT'L L.J., Dec. 21, 1981, at 11.

VII. Conclusion

In conclusion, let me make two points. First, despite my criticisms today about how scientific evidence often is misused in the courtroom, I am a strong proponent of scientific proof. It is often better than eyewitness testimony and credibility battles—the "he said, she said" testimony often encountered in rape trials. Moreover, an innocent person may be exonerated because of scientific evidence.

Second, problems with experts are not new. In 1843, an English judge wrote that "skilled witnesses come with such a bias in their minds to support the case in which they are embarked that hardly any weight should be given to their evidence."[100] In 1899, the Minnesota Supreme Court observed that "[t]here is hardly anything, not palpably absurd on its face, that cannot now be proved by some so-called 'expert.'"[101]

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[100]Tracy Peerage Case, 10 Cl. & F. 154, 191 (1984).

[101]Keegan v. Minneapolis & St. Louis R.R. Co., 76 Minn. 90, 95, 78 N.W. 965, 966 (1899).