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REGULATING CRIME LABORATORIES: THE IMPACT OF DNA EVIDENCE

*Paul C. Giannelli, J.D., M.S.**

INTRODUCTION

One of the most trenchant criticisms of crime laboratories was made in 1991 by Professor Randolph Jonakait in his multi-pronged attack on forensic science.¹ He argued that the “[c]urrent regulation of clinical labs indicates that a regulatory system can improve crime laboratories.”² This critique was

* Albert J. Weatherhead III & Richard W. Weatherhead Professor of Law, Case Western Reserve University. University of Virginia, J.D. 1970, LL.M. 1975; George Washington University, M.S. Forensic Science, 1973.

¹ See Randolph N. Jonakait, *Forensic Science: The Need for Regulation*, 4 HARV. J. L. & TECH. 109 (1991). Before Jonakait wrote on the subject, only a few articles appeared in the legal literature, and they were quite favorable. See Irving C. Stone, *Capabilities of Modern Forensic Laboratories*, 25 WM. & MARY L. REV. 659, 674 (1984) (“This Article has demonstrated the ability of forensic science laboratories to provide useful, accurate information in a variety of areas.”); Marion E. Williams, *The FBI Laboratory—Its Availability and Use by Prosecutors from Investigation to Trial*, 28 U. KAN. CITY L. REV. 95 (1960) (“These examinations are based on sound scientific principles, far from the scene of the crime, by experts dedicated to the principle of reporting fact regardless of whether they may convict the guilty or acquit the innocent.”). See also Paul L. Kirk, *The Interrelationship of Law and Science*, 13 BUFF. L. REV. 393 (1963) (explaining the role of forensic science in the legal system). For a more recent article by a criminalist, see Henry C. Lee, *Forensic Science and the Law*, 25 CONN. L. REV. 1117, 1124 (1993) (“Perhaps the most important issue in forensic science is the establishment of professional standards.”).

² Jonakait, *supra* note 1, at 191. Clinical labs are regulated under the Clinical Laboratory Improvement Amendments of 1988, Pub. L. No. 100-

largely ignored by the forensic science community, as was another unfavorable legal commentary published about the same time.³ Nevertheless, a far more powerful engine for reform was on the horizon—DNA technology. In the same year that Jonakait published his article, molecular biologist Eric Lander, who got caught up in the DNA evidence debates, wrote: “At 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.”⁴

Part I of this article traces the history of crime laboratories in this country, from their creation in California in the 1920s to their nationwide expansion in the 1930s to their explosive growth at the end of the century. Part II then discusses two significant developments, the advent of proficiency testing and the establishment of the first voluntary laboratory accreditation program. The introduction of DNA evidence and its impact on forensic science and crime laboratories in particular is examined in Part III. Next, Part IV discusses the American Bar Association (ABA) initiatives regarding the regulation of crime laboratories — the adoption of recommendations emanating from the ABA Committee on Innocence and the subsequent promulgation of Criminal Justice Standards for DNA Evidence.

578 (1988), 42 U.S.C. § 263a (2004).

³ See D. Michael Risinger et al., *Exorcism of Ignorance as a Proxy For Rational Knowledge: The Lessons of Handwriting Identification “Expertise,”* 137 U. PA. L. REV. 731, 738 (1989) (“Our literature search for empirical evaluation of handwriting identification turned up one primitive and flawed validity study from nearly 50 years ago, one 1973 paper that raises the issue of consistency among examiners but that presents only uncontrolled impressionistic and anecdotal information not qualifying as data in any rigorous sense, and a summary of one study in a 1978 government report. Beyond this, nothing.”) (citations omitted).

⁴ Eric S. Lander, *DNA Fingerprinting On Trial*, 339 NATURE 501, 505 (1989).

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I. A BRIEF HISTORY

It should come as no surprise that a society as dependent on science as ours would turn to that discipline to solve crimes. Forensic laboratories were first introduced as reform efforts, providing a reliable alternative to the vagaries of eyewitness testimony and the “third degree” abuses used in eliciting confessions. Nevertheless, their history is checkered, with periods of rapid growth, followed by years of neglect. Moreover, their place in the police organizational structure remains ambivalent, and their function in the adversary system is often problematic.

A. The Early Laboratories

In 1923, Los Angeles established the country’s first crime laboratory.⁵ August Vollmer, sometimes known as the “father” of modern policing in America,⁶ created the laboratory during his brief tenure as Chief of Police in Los Angeles. As the first police chief in Berkeley, Vollmer had used scientists on several

⁵ See RICHARD SAFERSTEIN, *CRIMINALISTICS: AN INTRODUCTION TO FORENSIC SCIENCE* 6 (5th ed. 1995) (“The oldest forensic laboratory in the United States is that of the Los Angeles Police Department, created in 1923 by August Vollmer, a police chief from Berkeley, California.”). There is some dispute about which lab was established first. V.A. Leonard states that Vollmer first created a lab at Berkeley. V.A. LEONARD, *THE POLICE OF THE TWENTIETH CENTURY* 141 (1964). Professor Thornton disagrees. See John I. Thornton, *Criminalistics: Past, Present and Future*, 11 *LEX ET SCIENTIA* 1, 23 (1975) (“In 1923, Vollmer served as Chief of Police of the City of Los Angeles for a period of one year. During that time, a crime laboratory was established at his direction.”). Some commentators cite Chicago as the initial lab. *E.g.*, Charles M. Wilson, *Crime Detection Laboratories in the United States*, in *LAW, MEDICINE, SCIENCE, AND JUSTICE* 464 (Larry Baer ed., 1964), reprinted in *FORENSIC SCIENCE: SCIENTIFIC INVESTIGATION IN CRIMINAL JUSTICE* 96, 98 (Joseph L. Peterson ed., 1975). This is also incorrect. See Thornton, *supra*, at 24.

⁶ http://en.wikipedia.org/wiki/August_Vollmer (last visited Sept. 21, 2006).

occasions to investigate crimes,⁷ and in 1916, he helped found the first School of Criminology at the University of California, at Berkeley.⁸ By 1930, the L.A. Sheriff's Department had set up a lab to serve the unincorporated areas of Los Angeles County, and in 1931, a statewide laboratory was opened in Sacramento under the auspices of the Bureau of Criminal Identification and Investigation. San Francisco followed suit later that year.⁹

Another early lab, operated by the Chicago police, traced its roots to the infamous 1929 St. Valentine's Day Massacre where five gangsters and two acquaintances were gunned down.¹⁰ The Massacre attracted national attention, in part, because some of the perpetrators wore police uniforms and fled in a "squad" car. Many suspected police involvement in the planning and execution of the Massacre.¹¹ A "blue ribbon" coroner's jury, empanelled to investigate the crime, contacted Colonel Calvin Goddard, who maintained an independent firearms laboratory in New York, to analyze the crime scene bullets and cartridge cases.¹² Goddard tested and excluded all police-issued Thompson

⁷ For example, Vollmer enlisted the services of a professor of chemistry in a poisoning case in 1907 and later used a microscopist in a different case, both from the University of California. Thornton, *supra* note 5, at 22.

⁸ See Berkeley Police Dep't History, <http://www.ci.berkeley.ca.us/police/history/history.html> (last visited Sept. 21, 2006).

⁹ Thornton, *supra* note 5, at 23-24. See also David Q. Burd, *The Laboratory Section of the California State Bureau Criminal Identification and Investigation*, 43 J. CRIM. L., CRIMINOLOGY & POLICE SCI. 829, 829 (1953) ("In [1931], one civil service position of Chemist and Ballistics Expert was established, and some new equipment was obtained.").

¹⁰ See Calvin Goddard, *The Valentine Day Massacre: A Study in Ammunition-Tracing*, 1 AM. J. POLICE SCI. 60, 60 (1930).

¹¹ *Id.* at 76 ("Since two of the members of the execution squad had worn police uniforms, and since it had been subsequently intimated by various persons that the wearers of the uniforms might really have been policeman rather than disguised gangsters, it became a matter of no little importance to ascertain, if possible, whether these rumors had any foundation in fact.").

¹² Goddard, often credited as the "father" of firearms identification, was responsible for much of the early work on the subject. See Calvin Goddard, *Scientific Identification of Firearms and Bullets*, 17 J. CRIM. L., CRIMINOLOGY & POLICE SCI. 254 (1926).

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submachine guns as the murder weapons and months later matched the bullets to two machine guns seized from the home of Fred Burke, a suspect in the killings.¹³ It was later learned that a rival gang, headed by Al Capone, instigated the murders.¹⁴ A member of the coroner's jury was so impressed with Goddard's work that he offered to fund a crime lab—The Scientific Crime Laboratory of Chicago.¹⁵ As part of this endeavor, Goddard traveled to Europe to learn about the continental forensic system.¹⁶

“The laboratory, with Col. Goddard as its first director, was established at the Law School of Northwestern University, in 1929-30. John Henry Wigmore, Dean of the Law School, was responsible for this site.”¹⁷ Given Goddard's background, the lab's cases “were heavily biased toward firearms identification, with considerably less emphasis placed on trace evidence, blood, and other areas.”¹⁸ The city took over the laboratory in 1938.¹⁹

J. Edgar Hoover began the Federal Bureau of Investigation

¹³ See Goddard, *supra* note 10, at 76-77.

¹⁴ See Lee Bey, *Crime Lab Heads Into History: For 56 Yrs., Venerable Facility Has Helped Cops Solve Cases*, CHICAGO SUN-TIMES, Jan. 10, 1994, at 15 (“Chicago might not have been the first city with a crime lab if Al Capone hadn't ordered the St. Valentine's Day Massacre in 1929.”); Jim Ritter, *St. Valentine's Hit Spurred Creation of Nation's First Lab*, CHICAGO SUN-TIMES, Feb. 9, 1997, at 40 (“Sixty-eight years ago this Friday, Al Capone's hit men dressed as cops and gunned down seven men in the Clark Street headquarters of rival mobster Bugs Moran.”).

¹⁵ See JOE NICKELL & JOHN F. FISCHER, *CRIME SCIENCE: METHODS OF FORENSIC DETECTION* 13 (1999) (“Perhaps the first truly significant crime laboratory that could be called a national lab was the Scientific Crime Detection Laboratory, which began at Chicago in 1929. . . .”).

¹⁶ See Calvin Goddard, *Scientific Crime Detection Laboratories in Europe*, 1 AM. J. POLICE SCI. 13, 15 (1930) (“My provisional opinion that the United States is, for the most part, immeasurably behind Europe in scientific methods of crime detection was completely confirmed.”).

¹⁷ Wilson, *supra* note 5, at 467.

¹⁸ Thornton, *supra* note 5, at 25.

¹⁹ *Id.* at 26 (“In 1938 the laboratory was transferred to the Chicago Police Department in return for a payment of \$25,000 to Northwestern University.”). The Chicago lab was taken over by the Illinois State Police in 1996. See Bey, *supra* note 14.

(“FBI”) crime laboratory in 1932. Hoover, the FBI director, was intrigued with the idea of creating a lab and so he sent an agent, Charles Appel, in 1931 to attend a training course offered at Goddard’s lab.²⁰ At its inception, the FBI lab had firearms identification (“ballistics”) and fingerprint examiners.²¹ “During its first month of service, the FBI Laboratory examiners handled 20 cases. In its first full year of operation, the volume increased to a total of 963 examinations. By the next year that figure more than doubled.”²² Handwriting comparisons, the examination of various types of trace evidence (e.g., hairs, fibers, soils), and serological testing of blood and semen would be added later.²³

During this time, several sensational cases highlighted the value of forensic evidence. The Sacco and Vanzetti trial in 1921 was one of the first cases to use firearms identification evidence,²⁴ and the extensive use of handwriting comparison

²⁰ Thornton, *supra* note 5, at 25.

²¹ At that time, it was called the Criminological Laboratory. By 1933, it was known as the Technical Laboratory. Ten years later it was renamed the FBI Laboratory. FEDERAL BUREAU OF INVESTIGATION, U.S. DEP’T OF JUSTICE, FBI LABORATORY 3 (1981).

²² Anniversary Report, *40 Years of Distinguished Scientific Assistance to Law Enforcement*, FBI LAW ENFORCEMENT BULL. 4 (Nov. 1972).

²³ *Id.* at 6, 25.

²⁴ Sacco and Vanzetti were charged with murder during a payroll robbery in 1921. Many believe their executions resulted more from their foreign status and “radical” beliefs as anarchists than from the cogency of the evidence presented against them. The presentation of the firearms identification evidence in that case remains problematic. Professors Joughin and Morgan 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.”

G. LOUIS JOUGHIN & EDMUND M. MORGAN, *THE LEGACY OF SACCO & VANZETTI* 15 (1948). See also James E. Starrs, *Once More Unto the Breech: The Firearms Evidence in the Sacco and Vanzetti Case Revisited*, Parts I & II, 31 J. FORENSIC SCI. 630, 1050 (1986). The case was also one of the first

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testimony at the Lindbergh kidnapping trial in 1935 solidified the role of the crime lab in the criminal justice system.²⁵ As one commentator noted, Bruno Hauptmann's conviction and execution for the Lindbergh kidnapping and murder, "on the basis of circumstantial scientific evidence, created landmarks in scientific crime detection, in the utilization of forensic scientists, and in the courtroom presentation of scientific and demonstrative evidence."²⁶

Crime laboratories soon sprang up in other large cities²⁷ but not without some disquietude.²⁸ As one scholar observed, "Most

to raise the issue of the eyewitness misidentification. See FELIX FRANKFURTER, *THE CASE OF SACCO AND VANZETTI* 30 (1927) ("What is the worth of identification testimony even when uncontradicted? The identification of strangers is proverbially untrustworthy.").

²⁵ State v. Hauptmann, 180 A. 809 (N.J. 1935).

²⁶ Michael Baden, *Plenary Session: The Lindbergh Kidnapping Revisited: Forensic Sciences Then and Now*, 28 J. FORENSIC SCI. 1035 (1983). See also D. Michael Risinger et al., *supra* note 3, at 770-71 (Albert Osborn, one of the seven handwriting experts who testified against Hauptmann, "became a kind of public hero, and the validity of 'scientific' handwriting identification when practiced by a 'competent' practitioner became public knowledge, which like much public knowledge, turns out to be not so clearly right.").

²⁷ See Joseph L. Peterson, *The Crime Lab*, in THINKING ABOUT POLICE 184, 185 (Carl Klockars ed., 1983) ("[T]he Chicago Crime Laboratory has the distinction of being one of the oldest in the country. Soon after, however, many other jurisdictions also built police laboratories in an attempt to cope with the crimes of violence associated with the 1930s gangster era.").

²⁸ Joseph Nicol wrote :

After the early 1930s, crime laboratories were established in rapid fashion until nearly all states and the major cities had some facility for examining evidence. Not all laboratories were properly founded. No model existed and the development depended upon local whim and resources. For reasons of local pride, some departments created laboratories by the device of a name on the door. In many places, what may be called a crime laboratory is in fact a small step beyond a latent fingerprint and photographic set-up, adequate for evidence collection but unsuited by equipment and staff to engage in the analysis and evaluation of evidence.

Joseph D. Nicol, *Present Status of Criminalistics*, in LAW ENFORCEMENT, SCIENCE & TECHNOLOGY 245 (S.A. Yefsky ed., 1967). See also Thornton,

laboratories owe their existence, not to a progressive attitude on the part of police administrators, but because the police agencies inaugurating laboratory services were shamed into it by adverse publicity or the threat of it.”²⁹

B. Laboratory Expansion

From 1970 to 1980, the number of laboratories doubled, from about 100 to more than 200, with statewide systems becoming more common.³⁰ “During this period, Supreme Court decisions restricting police interrogation practices, the President’s Crime Commission Report and advice to police to place greater reliance on physical evidence, the creation of the Law Enforcement Assistance Administration (LEAA) and the availability of federal monies, the drug abuse explosion, and the upsurge in violent crime were all factors that stimulated the growth of laboratories.”³¹ Expansion, however, brought its own

supra note 5, at 27 (noting that “all too often the laboratory was poorly conceived, poorly equipped, and poorly staffed”); Wilson, *supra* note 5, at 464 (“The historical picture of crime detection laboratories in the United States is rather discouraging when viewed factually.”).

²⁹ Thornton, *supra* note 5, at 27.

³⁰ See Jan S. Bashinski & Joseph L. Peterson, *Forensic Sciences, in LOCAL GOVERNMENT: POLICE MANAGEMENT* 559, 561 (4th ed. William Geller & Darrel Stephens eds., 2004) (“Until 1970, most crime laboratories were located in cities and counties, but in the 1970s and 1980s, statewide systems of crime laboratories became popular. More than a dozen states (including California, Florida, Illinois, Michigan, New Jersey, New York, and Texas) adopted such configurations to deliver scientific services to medium- and small-size communities not already served by local laboratories. These statewide systems now act in tandem with municipal and county facilities in many states and provide the great bulk of service to state and local law enforcement agencies.”) Many states established their laboratories statutorily. See, e.g., IOWA CODE ANN. § 691.1 (West 1997); KAN. STAT. ANN. § 21-2502 (1997); LA. REV. STAT. ANN. § 40:2261 (1997); MONT. CODE ANN. § 44-3-301 (1997); N.D. CENT. CODE § 19-01-10 (1997); OHIO REV. CODE ANN. § 307.75 (West 1997); TENN. CODE ANN. § 38-6-103 (1982); TEX. REV. CIV. CODE ANN. art. 4413(14) (1997); VA. CODE ANN. § 2.1-426 (1998); WIS. STAT. ANN. § 165.75 (West 1997).

³¹ Joseph L. Peterson et al., *The Capabilities, Uses, and Effects of the*

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problems. It occurred “without the benefit of national planning or direction. The newly formed laboratories and existing laboratories continued to suffer from the same old problems: lack of coordination, unqualified personnel, and the absence of uniform standards and procedures to guide the analysis and interpretation of evidence.”³²

C. Crime Commissions

At the incipient stages of this expansion, two different presidential crime commissions reviewed the status of forensic laboratories, thus providing additional perspectives on their development. In 1967, President Johnson’s Crime Commission made the following observation:

The crime laboratory has been the oldest and strongest link between science and technology and criminal justice. Because of this tradition, and because the best laboratories, such as the FBI’s, are well advanced, the Science and Technology Task Force did not devote major attention to criminalistics.³³

The Task Force’s “impression” that forensic science was not in need of serious attention, according to one commentator, “astounded most practicing criminalists,” and was due, in part,

Nation’s Criminal Laboratories, 30 J. FORENSIC SCI. 10, 11 (1985).

³² Peterson, *supra* note 27, at 185. See also Thornton, *supra* note 5, at 29-30 (“A few laboratories in the country are adequately supported, but most have some deficiency in equipment, staff, physical plant, or position in an agency structure.”).

³³ INSTITUTE FOR DEFENSE ANALYSES, TASK FORCE REPORT: SCIENCE AND TECHNOLOGY: A REPORT TO THE PRESIDENT’S COMM’N ON LAW ENFORCEMENT AND ADMINISTRATION OF JUSTICE 17-18 (1967). See also PRESIDENT’S COMM’N ON LAW ENFORCEMENT AND ADMINISTRATION OF JUSTICE, THE CHALLENGE OF CRIME IN A FREE SOCIETY 255 (1967) (repeating the Task Force’s conclusions). According to Professor Kirk, “Criminalistics has been defined as that profession and scientific discipline directed to the recognition, identification, individualization and interpretation of physical evidence through the application of the natural sciences to law and science matters.” Kirk, *supra* note 1, at 394.

to “the treacle which emanated from the FBI laboratory for several decades.”³⁴ At about the same time, another practitioner noted that “criminalistics is poorly equipped to deal with the enlarged responsibilities which have been so quickly thrust upon it.”³⁵

Interestingly, a different Commission Task Force, one on the police, painted a somewhat different picture: “Proximity, timeliness, and quality are the most important measures of laboratory service. Some local police forces fail on all three counts because they do not perform scientific evaluations requiring sophisticated analysis, or fail to provide for tests.”³⁶ The Commission did acknowledge that “the great majority of police department laboratories have only minimal equipment and lack highly skilled personnel able to use the modern equipment now being developed.”³⁷ As a remedy, the Commission recommended the establishment of regional laboratories and the expansion of research activities.³⁸

In 1974, President Nixon’s Crime Commission also addressed the subject, observing that “[t]oo many police crime laboratories have been set up on budgets that preclude the recruitment of qualified professional personnel” and “[t]oo often the laboratory is not considered a primary budget item and is one of the first units to suffer when budgets are trimmed. Such practices relegate the crime laboratory to an inferior position among other support services.”³⁹ This last point raised an important issue—a lab’s placement in a police department’s

³⁴ Thornton, *supra* note 5, at 30.

³⁵ Wilkaan Fong, *Criminalistics and the Prosecutor*, in PRACTICING LAW INSTITUTE, THE PROSECUTOR’S SOURCEBOOK 323 (James George & Ira Cohen eds., 1969).

³⁶ TASK FORCE REPORT: THE POLICE 91 (1967). The Report added: “The cost of staffing a laboratory facility capable of handling all needs of a police department is considerable, and a complete program is beyond the financial ability of most departments.” *Id.* at 92.

³⁷ PRESIDENT’S COMM’N, *supra* note 33, at 255.

³⁸ *Id.*

³⁹ NATIONAL ADVISORY COMM’N ON CRIMINAL JUSTICE STANDARDS AND GOALS, REPORT ON POLICE 304-05 (1974).

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organizational structure.⁴⁰ “Many laboratories are situated in a position in an agency structure where the laboratory director reports to a police officer who lacks understanding of the criminalistics function.”⁴¹

The Commission noted, as did its predecessor, that the cost of operating a crime lab was “perhaps beyond the financial capabilities of most police agencies.”⁴² Nevertheless, it found that “most police agencies were unwilling to give up their laboratories, even when they were not used effectively.”⁴³

D. 1983 Survey

A survey of crime labs in 1983 provides a snapshot of the organization and practices of the more than 300 labs operating at that time.⁴⁴ Approximately 80 percent of the laboratories were situated within law enforcement and public safety agencies, with the remaining labs located in medical examiners’ offices, prosecutors’ offices, scientific/public health agencies, and other public or private institutions.⁴⁵ “Fifty-seven percent of the

⁴⁰ One commentator states that the top laboratories are characterized by the following attributes:

they (1) report to someone close to chief executive level in the host agency,” (2) are “accredited,” (3) “measure . . . and respond . . . to customer needs while maintaining scientific integrity,” and (4) have “a significant proportion (at least 25%) of [their] operating budget devoted to quality assurance and training.

W.J. Tilstone, *Organization of Laboratories*, in 1 *ENCYCLOPEDIA OF FORENSIC SCIENCES* 68, 73 (Jay A. Seigel et al. eds., 2000).

⁴¹ Thornton, *supra* note 5, at 36.

⁴² NATIONAL ADVISORY COMMISSION, *supra* note 39, at 305.

⁴³ *Id.* at 301.

⁴⁴ Joseph L. Peterson et al., *The Capabilities, Uses, and Effects of the Nations’s Criminal Laboratories*, 30 *J. FORENSIC SCI.* 10 (1985). The survey was based on a compilation of 319 federal, state, and local crime laboratories. Each received a copy of an eight-page questionnaire. “The response rate was 82% (260/319) with a total of 257 usable questionnaires.” *Id.* at 11.

⁴⁵ *Id.*

responding laboratories would only examine evidence submitted by law enforcement officials.”⁴⁶ Of the laboratories surveyed, over 90 percent examined drugs, while more than 75 percent analyzed semen, bloodstains, fibers, hairs, accelerants, paint, and toolmarks.⁴⁷ Over half performed firearms, glass, alcohol, explosives, and fingerprints examinations, while less than half evaluated questioned documents, gunshot residues, voiceprints, or toxicological samples.⁴⁸ The survey also revealed that, on average, laboratory examiners testified in eight percent of the drug prosecutions (ranging from 0 to 86 percent) and in 10 percent of criminalistics cases (ranging from 0 to 87 percent). In other words, government experts were rarely challenged. Moreover, “[o]n the average, examiners conferred with prosecutors in 57 percent of cases, but with defense attorneys only 13 percent of the time.”⁴⁹

E. 2002 Survey

Nearly two decades later a second survey of laboratories, conducted by the Bureau of Justice Statistics, revealed that there were now 351 publicly funded forensic laboratories in the United States⁵⁰—more than three times the number that existed in 1967. These included 203 state or regional, 65 county, 50 municipal, and 33 federal labs.⁵¹ The size of the laboratories

⁴⁶ *Id.* at 13.

⁴⁷ *Id.* at 14-15.

⁴⁸ *Id.*

⁴⁹ *Id.* at 15-16. A later investigation attempted to gauge the impact of labs on the justice system, finding that approximately “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.” Joseph L. Peterson et al., *The Use and Effects of Forensic Science in the Adjudication of Felony Cases*, 32 J. FORENSIC SCI. 1730, 1748 (1987).

⁵⁰ Joseph L. Peterson & Matthew J. Hickman, *Census of Publicly Funded Forensic Crime Laboratories, 2002*, BUREAU OF JUSTICE STATISTICS BULL. (Feb. 2005).

⁵¹ *Id.* at 1.

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varied considerably. “A typical laboratory in 2002 had 2 managers, 2 secretaries or clerks, 12 analysts, and 2 technicians. The median laboratory operating budget in 2002 was \$1.3 million.”⁵² In contrast, the FBI Laboratory, the largest publicly funded forensic laboratory in the country, had 585 full-time employees as of January 2004, more than twice the size of the next largest publicly funded crime lab.⁵³ In addition to the FBI facility,⁵⁴ federal laboratories are operated by the Drug Enforcement Administration, Internal Revenue Service, Postal Inspection Service, Secret Service, Bureau of Alcohol, Tobacco and Firearms, Customs Service, and the military.⁵⁵ The federal laboratories often provide their services to state law enforcement agencies. The services of the FBI Laboratory, for instance, are “available without charge to all duly constituted state, county, and municipal law enforcement agencies of the United States and its territorial possessions.”⁵⁶ Approximately half of all the lab requests in 2002 were for drug examinations.⁵⁷ In contrast, only

⁵² *Id.*

⁵³ *Id.* at 11.

⁵⁴ The new FBI Lab at Quantico, Virginia, was dedicated in 2003. At a cost of over \$150 million, it took four years to build. *See generally Modern Marvels: FBI's Crime Lab* (The History Channel 2004) (discussing the historical and recent advancements of the FBI crime lab); DAVID FISHER, *HARD EVIDENCE: HOW DETECTIVES INSIDE THE FBI'S SCI-CRIME LAB HAVE HELPED SOLVE AMERICA'S TOUGHEST CASES* (1995) (discussing the FBI Lab's successes).

⁵⁵ Paul C. Giannelli, *Ake v. Oklahoma: The Right to Expert Assistance in a Post-Daubert, Post-DNA World*, 89 CORNELL L. REV. 1305, 1328-29 (2004) (citing cases in which experts from these labs testified).

⁵⁶ 28 C.F.R. § 0.85(g) (2006) (authorizing the FBI lab “to provide, without cost, technical and scientific assistance . . . , for all duly constituted law enforcement agencies, . . . which may desire to avail themselves of the service”). “It is quite common to find FBI or other federal experts testifying in state criminal proceedings about a diverse array of forensic procedures, including the analysis of drugs, blood, hair, fibers, firearms, fingerprints, gunshot residues, shoeprints, voice comparisons, and the like.” Giannelli, *supra* note 55, at 1329-30 (footnotes omitted).

⁵⁷ Peterson & Hickman, *supra* note 50, at 1.

2 percent involved DNA.⁵⁸ Only 52 percent had resources dedicated to training, and a mere 12 percent had resources for research.⁵⁹

Questions persisted, however. A 1997 needs assessment of the California state-run system “found major problems in several of the system’s laboratory facilities, including safety concerns, overcrowding, and the potential for cross-contamination of evidence,” and a 1998 state audit “found that the majority of crime laboratories operated by local law enforcement agencies in that state greatly needed new facilities and equipment and that their quality assurance and training programs were hampered by a lack of funding.”⁶⁰

II. NOTABLE DEVELOPMENTS

During the late 1970s and early 1980s, there were two developments that would have profound effects on crime labs—the introduction of proficiency testing in forensic science and the creation of a voluntary laboratory accreditation program. The first highlighted serious shortcomings in the operation of some laboratories and the performance of some examiners. The second represented the first attempt at the self-regulation of laboratories.

A. *The Advent of Proficiency Testing*

In 1978, the results of the first Laboratory Proficiency Testing Program, sponsored by the Law Enforcement Assistance Administration (LEAA), were reported.⁶¹ Over 200 crime laboratories participated in this program, which involved such common forensic examinations as firearms, blood, drug, and

⁵⁸ *Id.* at 6.

⁵⁹ *Id.* at 1.

⁶⁰ Bashinski & Peterson, *supra* note 30, at 563.

⁶¹ JOSEPH L. PETERSON ET AL., CRIME LABORATORY PROFICIENCY TESTING RESEARCH PROGRAM (1978).

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trace evidence analyses.⁶² Seventy-one percent of the crime laboratories tested provided unacceptable results in a blood test, 51.4 percent made errors in matching paint samples, 35.5 percent erred in a soil examination, and 28.2 percent made mistakes in firearms identifications.⁶³ The Report concluded: “A wide range of proficiency levels among the nation’s laboratories exists, with several evidence types posing serious difficulties for the laboratories”⁶⁴ Thus, although some laboratories performed exceptionally well, the performance of others was disturbing: “65 percent of the laboratories had 80 percent or more of their results fall into the acceptable category. At the other end of the spectrum, 3 percent of laboratories had less than 50 percent of their responses considered acceptable.”⁶⁵ Similarly, certain types of examinations caused few problems, whereas others produced very high rates of “unacceptable proficiency.”⁶⁶ Unacceptable proficiency was most often attributed to: (1) misinterpretation of test results due to carelessness or inexperience; (2) failure to employ adequate or appropriate methodology; (3) mislabeling or contamination of primary standards; and (4) inadequate databases or standard spectra.⁶⁷

Given these results, one would have expected the implementation of fairly extensive reforms. However, “[t]he startling conclusions from that research led to some efforts to

⁶² *Id.* at 1-2.

⁶³ *Id.* at 251.

⁶⁴ *Id.* at 3.

⁶⁵ Peterson, *supra* note 27, at 195.

⁶⁶ The number of laboratories responding ranged from a low of 65 to a high of 205. An unacceptable response did not necessarily mean an incorrect one. Other reasons for an unacceptable designation included a correct response for the wrong reason, an unsupported, inclusive response, multiple responses, and incomplete responses. *Id.* at 188-91.

⁶⁷ PETERSON ET AL., *supra* note 61, at 258. Professor Peterson, one of the report’s authors, later 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, as shown by our proficiency testing.” *Symposium on Sci. and the Rules of Legal Procedure*, 101 F.R.D. 599, 645 (1983) (remarks of Professor Joseph L. Peterson).

improve conditions in the laboratories, but these encounter[ed] institutional inertia against reform.”⁶⁸ In sum, widespread reform (e.g., mandatory accreditation of laboratories and certification of examiners) failed to materialize.⁶⁹ Yet, from this time forward proficiency testing would be part of the forensic lexicon.⁷⁰

B. The Creation of ASCLD/LAB

The proficiency testing results, however, did provide the impetus for the formation of the American Society of Crime Lab Directors/Laboratory Accreditation Board (ASCLD/LAB) in

⁶⁸ *Symposium, supra* note 67, at 645 (remarks of Professor Joseph L. Peterson). For a more detailed discussion of proficiency testing, see Michael J. Saks, *Prevalence and Impact of Ethical Problems in Forensic Science*, 34 J. FORENSIC SCI. 772, 778 (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.”).

⁶⁹ Accreditation focuses on the laboratory, while certification focuses on the individual examiner.

Unlike most other scientific professions, the criminalistics (crime laboratory) field is without procedures to assess and recognize members of the profession who have satisfied minimum criteria for practicing in their forensic specialty. . . . [G]uidelines were presented to the nation’s crime laboratory personnel for approval in the form of a referendum in the fall of 1979. The subsequent response, unfortunately, was distinctly negative; the certification referendum was defeated by a two-to-one margin. Consequently, at the present time, the criminalistics profession is without any minimum standards regarding who is qualified to practice in the field.

Peterson, *The Crime Lab, supra* note 27 at 197.

⁷⁰ See Joseph L. Peterson et al., *The Feasibility of External Blind DNA Proficiency Testing. 1. Background and Findings*, 48 J. FORENSIC SCI. 21 (2003); Joseph L. Peterson & Penelope N. Markham, *Crime Laboratory Proficiency Testing Results, 1978-1991, I: Identification and Classification of Physical Evidence*, 40 J. FORENSIC SCI. 994 (1995); Joseph L. Peterson & Penelope N. Markham, *Crime Laboratory Proficiency Testing Results, 1978-1991, II: Resolving Questions of Common Origin*, 40 J. FORENSIC SCI. 1009 (1995).

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1981, a second noteworthy development. Its purpose was to establish an accreditation program for public and private crime laboratories.⁷¹ Requirements include ensuring the integrity of evidence, adhering to valid and generally accepted procedures, employing qualified examiners, and operating quality assurance programs—i.e., proficiency testing, technical reviews, audits, and corrective action procedures.⁷²

Although it has been criticized as being too closely tied to the laboratories it accredits,⁷³ this criticism is overblown and ASCLD/LAB has been one of the most effective reform mechanisms in forensic science over the last two decades.⁷⁴ Only 10 percent of laboratories pass muster on the first inspection. Moreover, in 1993, ASCLD/LAB provided the review of the misconduct in the Fred Zain case,⁷⁵ and in 2005, it issued a critical report of the Virginia state lab in the Earl Washington case.⁷⁶ Regrettably, accreditation is voluntary, and

⁷¹ Bashinski & Peterson, *supra* note 30, at 578.

⁷² *Id.*

⁷³ See Janine Arvizu, *Shattering the Myth: Forensic Laboratories*, 24 THE CHAMPION 18, 20 (May 2000) (“The ASCLD/LAB is essentially a trade organization of crime laboratory directors. The membership of the ASCLD/LAB delegate assembly consists solely of the laboratory directors of ASCLD accredited laboratories.”); Maurice Possley et al., *Scandal Touches Even Elite Labs: Flawed Work, Resistance to Scrutiny Seen Across U.S.*, CHI. TRIB., Oct. 21, 2004, at C1 (“I believe they are more of a fraternal organization than an authoritative scientific body.”; quoting James Durkin, a former Cook County prosecutor and former Republican state representative).

⁷⁴ This is not to say the ASCLD/LAB program could not be improved. For example, its governing board could be expanded to include outside scientists from academia and representatives from the legal community, including the defense bar, and it may be that some of its accreditation requirements should be raised.

⁷⁵ See *infra* text accompanying notes 117-19 (discussing Zain’s misconduct).

⁷⁶ See ASCLD/LAB LIMITED SCOPE INTERIM INSPECTION REPORT: COMMONWEALTH OF VA. DIV. OF FORENSIC SCI. CENTRAL LABORATORY (April 9, 2005). See generally MARGARET EDDES, AN EXPENDABLE MAN, THE NEAR-EXECUTION OF EARL WASHINGTON JR. (2003) (examining the Washington case); Eric M. Freedman, *Earl Washington’s Ordeal*, 29 HOFSTRA L. REV. 1089 (2001).

while numerous labs have been accredited, many have not.⁷⁷

III. DNA PROFILING

The advent of DNA profiling in 1985 revolutionized forensic science.⁷⁸ One court called DNA evidence the “single greatest advance in the search for truth . . . since the advent of cross-examination.”⁷⁹ Even its early critics acknowledged that

⁷⁷ In 2002, the President of the American Academy of Forensic Sciences wrote:

Unfortunately, while the ASCLD/LAB program has been successful in accrediting over 200 Laboratories, a large number of forensic laboratories in the U.S. remain unaccredited by any agency. A similar situation exists with death investigation agencies accredited by the National Association of Medical Examiners (NAME); forty such medical systems have been accredited, covering only 25% of the U.S. population. The same dichotomy exists in certification programs for the practicing forensic scientist, even though forensic certification boards for all the major disciplines have been in existence for over a decade. . . . Why have forensic laboratories and individuals been so reluctant to become accredited or certified?

Graham R. Jones, *President's Editorial—The Changing Practice of Forensic Science*, 47 J. FORENSIC SCI. 437, 438 (2002).

⁷⁸ In 1985, Dr. Alec Jeffreys of the University of Leicester, England, recognized the utility of DNA profiling in criminal cases. See OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS, *GENETIC WITNESS: FORENSIC USES OF DNA TESTS 8* (1990) [hereinafter OTA REPORT]. Its first use in American courts occurred in 1986. *Id.* at 14. The first appellate case, *Andrews v. State*, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988) *review denied*, 542 So. 2d 1332 (Fla. 1989) held that DNA evidence was admissible. By January 1990, forensic DNA analysis had been admitted into evidence “in at least 185 cases by 38 States and the U.S. military.” OTA REPORT, *supra*, at 14.

⁷⁹ *People v. Wesley*, 533 N.Y.S.2d 643, 644 (Co. Ct. 1988) (internal quotation marks omitted). The popular press trumpeted DNA evidence as “foolproof.” *DNA Prints: A Foolproof Crime Test*, TIME, Jan. 26, 1987, at 66. See also Arastasia Toufexis, *Convicted by Their Genes: A New Forensic Test is Revolutionizing Criminal Prosecutions*, TIME, Oct. 31, 1988, at 74. Moreover, the private DNA laboratories, Lifecodes and Cellmark, promoted DNA's use by claiming that it had “the power to identify one individual in

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“[a]ppropriately carried out and correctly interpreted, DNA typing is possibly the most powerful innovation in forensics since the development of fingerprinting in the last part of the 19th Century.”⁸⁰ No other technique had been as complex or so subject to rapid change. New DNA technologies were introduced at the trial level as cases litigating the older procedures worked their way through the appellate court system.⁸¹ As one

the world’s population” and “the chance that any two people will have the same DNA print is one in 30 billion.” Peter J. Neufeld & Neville Colman, *When Science Takes the Witness Stand*, SCI. AM., May 1990, at 46, 50. “Cellmark entitled one of its informational brochures *DNA FingerprintingSM, The Ultimate Identification Test.*” Dan Burk, *DNA Identification: Possibilities and Pitfalls Revisited*, 31 JURIMETRICS J. 53, 85 n.119 (Fall 1990).

⁸⁰ Richard C. Lewontin & Daniel L. Hartl, *Population Genetics in Forensic DNA Typing*, 254 SCIENCE 1745, 1746 (1991). A National Academy of Sciences report echoed this sentiment: “DNA analysis is one of the greatest technical achievements for criminal investigation since the discovery of fingerprints.” NATIONAL RESEARCH COUNCIL, *THE EVALUATION OF FORENSIC DNA EVIDENCE* 73 (1996) [hereinafter NRC II].

⁸¹ The initial technique, Restriction Fragment Length Polymorphism (RFLP) analysis by gel electrophoresis, was soon supplanted by Polymerase Chain Reaction (PCR)-based methods involving the DQ-alpha locus, “polymarkers,” and the D1S80 locus. These, in turn, were replaced by Short Tandem Repeats, the current procedure. See 2 PAUL C. GIANNELLI & EDWARD J. IMWINKELRIED, *SCIENCE EVIDENCE* ch. 18 (3d ed. 1999) (discussing admissibility of DNA evidence). In addition to nuclear DNA analysis, courts have admitted evidence based on mitochondrial DNA (mtDNA) sequencing, as well as DNA analyses of animals, plants, and the HIV virus. See *United States v. Boswell*, 270 F.3d 1200, 1205 (8th Cir. 2001) (comparing swine blood); *State v. Bogan*, 905 P.2d 515, 520 (Ariz. Ct. App. 1995) (tree); *State v. Schmidt*, 699 So. 2d 448, 452-56 (La. Ct. App. 1997) (admitting expert testimony that HIV viruses from two persons were “closely related” using phylogenetic analysis and statistical testing in a case regarding attempted murder by injection of HIV virus). Finally, the use of DNA databases for “cold hits” presents additional evidentiary issues. See *People v. Johnson*, 43 Cal. Rptr. 3d 587, 600 (Cal. Ct. App. 2006) (“[T]he fact that many profiles have been searched increases the probability of finding a match, so that conceptually, the more populated the database, the less impressive the match. Appellant contends that there is broad scientific consensus concerning the need to determine differently the statistical significance of profile matches in a cold hit case versus a confirmation case, but says that the means of determining the statistical value of a cold hit ‘is a

prosecutor observed, DNA evidence “raised issues at the cutting edge of modern law and science.”⁸²

The power of DNA analysis, however, could only be harnessed by introducing scientific methodologies into the crime lab, the lack of which became apparent in some of the early evidentiary hearings.⁸³ As a result of these challenges, New York became the first state to regulate its crime labs.⁸⁴ In addition, the potential for DNA databases produced the first federal legislation regulating forensic science—the DNA Identification Act of 1994.⁸⁵ Finally, as innocent convicts were exonerated by DNA and released from prison, reformers began to cast a critical eye on the forensic techniques that led to some of these wrongful incarcerations, often finding traditional forensic techniques deficient, especially when compared with DNA profiling.⁸⁶

A. Admissibility Wars

Early cases accepted DNA without question. There was no defense expert in *Andrews v. State*,⁸⁷ the first reported appellate case considering the admissibility of DNA evidence. Nor was there a defense expert in *Spencer v. Commonwealth*,⁸⁸ the first DNA execution case.⁸⁹ At trial, the prosecution experts “testified unequivocally that there was no disagreement in the scientific community about the reliability of DNA print

matter of continuing and strident debate.”).

⁸² HARLAN LEVY, *AND THE BLOOD CRIED OUT: A PROSECUTOR’S SPELLBINDING ACCOUNT OF THE POWER OF DNA* 21 (1996).

⁸³ See *infra* text accompanying notes 92-102.

⁸⁴ See *infra* text accompanying notes 113-16.

⁸⁵ See *infra* text accompanying notes 109-12.

⁸⁶ See *infra* text accompanying notes 117-27.

⁸⁷ 533 So. 2d 841 (Fla. Dist. Ct. App. 1988).

⁸⁸ 384 S.E.2d 785, 792 (Va. 1989).

⁸⁹ See *Murderer Put to Death in Virginia: First U.S. Execution Based on DNA Tests*, N.Y. TIMES, Apr. 28, 1994, at A19 (reporting Spencer’s execution).

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testing”⁹⁰ and claimed that there was “no dissent whatsoever in the scientific community.”⁹¹ This bit of self-deception was soon shattered. In a landmark case, *People v. Castro*,⁹² the court wrote: “In a piercing attack upon each molecule of evidence presented, the defense was successful in demonstrating to this court that the testing laboratory failed in its responsibility to perform the accepted scientific techniques and experiments.”⁹³ *Castro* involved a 14-week evidentiary hearing with a 5,000-page transcript.⁹⁴ In an unusual occurrence, the prosecution and defense experts met without the attorneys and issued a joint statement, including the following: “[T]he DNA data in this case are not scientifically reliable enough to support the assertion that the samples . . . do or do not match. If this data were submitted to a peer reviewed journal in support of a conclusion, it would not be accepted. Further experimentation would be required.”⁹⁵ One scholar summed it up this way:

The substance of the preliminary hearing in *Castro* stands for the idea that the standards of *research scientists* ought to be the standards of *forensic science*—an idea that, if taken to its logical extreme, could make many kinds of commonly-used forensic evidence, from fingerprint identifications to expert document examination to ballistics analysis inadmissible in court until additional research is done to establish the validity of the claims to which forensic experts routinely testify.⁹⁶

Castro was not alone.⁹⁷ In *United States v. Yee*,⁹⁸ the first

⁹⁰ *Spencer*, 384 S.E.2d at 792.

⁹¹ *Id.* at 797.

⁹² 545 N.Y.S.2d 985 (Sup. Ct. 1989).

⁹³ *Id.* at 996.

⁹⁴ *Id.* at 986.

⁹⁵ Lander, *supra* note 4, at 504.

⁹⁶ Jennifer L. Mnookin, *People v. Castro: Challenging the Forensic Use of DNA Evidence*, in EVIDENCE STORIES 207, 209 (Richard Lempert ed., 2006).

⁹⁷ The Office of Technology Assessment report also recognized that [s]erious questions are raised . . . about how best to ensure that

DNA case involving the FBI's profiling system, an extensive six-week admissibility hearing was held. Each side had retained exceptional attorneys who had access to impressive expert witnesses.⁹⁹ *Yee* was a major test for DNA evidence, and it passed. Nevertheless, parts of the magistrate's report were troublesome. The magistrate wrote that "the FBI program of proficiency testing has serious deficiencies, even without consideration of the troubling hint in the record of an impulse at one point to destroy some of the small amount of test data that had been accumulated earlier."¹⁰⁰ In another passage, he wrote: "I do not either disregard or discount the accuracy of many of the criticisms about the remarkably poor quality of the FBI's work and infidelity to important scientific principles."¹⁰¹ The FBI's top DNA scientist, Dr. Bruce Budowle, would later acknowledge the shortfalls of DNA evidence when first introduced:

The initial outcry over DNA typing standards concerned laboratory problems: poorly defined rules for declaring a match; experiments without controls; contaminated probes and samples; and sloppy interpretation of autoradiograms. Although there is no evidence that these technical failings resulted in any wrongful convictions, the lack of standards seemed to

any particular *test result* is reliable. These questions focus on data interpretation, how to minimize realistic human error, and the appropriate level of monitoring to ensure quality. Such questions, which stem from actual court cases, underscore the need to develop both technical and operational standards now.

OTA REPORT, *supra* note 78, at 83 (emphasis in original).

⁹⁸ 134 F.R.D. 161 (N.D. Ohio 1991), *aff'd sub nom.*, United States v. Bonds, 12 F.3d 540 (6th Cir. 1993).

⁹⁹ The prominent experts for the prosecution included Dr. Thomas Caskey of Baylor University and Dr. Kenneth K. Kidd of Yale University. Dr. Richard C. Lewontin of Harvard University and Dr. Daniel Hartl, then of Washington University, were defense experts. Dr. Eric Lander served as a court appointed expert. *See id.*

¹⁰⁰ *Id.* at 208.

¹⁰¹ *Id.* at 210.

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be a recipe for trouble.¹⁰²

The DNA admissibility wars highlighted the need for a more scientific approach to forensic evidence.¹⁰³ The National Academy of Sciences issued two reports on the subject, noting the importance of certain practices: “No laboratory should let its results with a new DNA typing method be used in court, unless it has undergone . . . proficiency testing via blind trials.”¹⁰⁴ The initial skirmishes over laboratory protocols regarding DNA quickly gave way to fights over statistical interpretation and population genetics.¹⁰⁵ These challenges had a salutary effect.¹⁰⁶

¹⁰² Eric S. Lander & Bruce Budowle, *DNA Fingerprinting Dispute Laid to Rest*, 371 NATURE 735, 735 (Oct. 27, 1994). See also JAMES D. WATSON & ANDREW BERRY, *DNA: THE SECRET OF LIFE* 273 (2004) (“Initially, when DNA fingerprinting was done in forensic laboratories without special expertise in handling and analyzing DNA, critical mistakes were not uncommon.”). Watson, along with Francis Crick, discovered the double helix structure of DNA. *Id.* at 11-12.

¹⁰³ See William C. Thompson, *Evaluating the Admissibility of New Genetic Identification Tests: Lessons From the DNA ‘War,’* 84 J. CRIM. L. & CRIMINOLOGY 22 (1993).

¹⁰⁴ NATIONAL RESEARCH COUNCIL, *DNA TECHNOLOGY IN FORENSIC SCIENCE* 55 (1992) [hereinafter NRC I REPORT]. As requested by the FBI, a second report followed. See NRC II, *supra* note 80, at v-vii. The second report also recommended proficiency testing. See *id.* at 88 (Recommendation 3.2: “Laboratories should participate regularly in proficiency tests, and the results should be available for court proceedings.”).

¹⁰⁵ See Leslie Roberts, *Fight Erupts Over DNA Fingerprinting*, 254 SCIENCE 1721, 1721 (Dec. 20, 1991) (noting that “a half-dozen courts recently refused to admit DNA evidence on the grounds that the probability calculations are not generally accepted”); see also Ranajit Chakraborty & Kenneth K. Kidd, *The Utility of DNA Typing in Forensic Work*, 254 SCIENCE 1735, 1735 (Dec. 20, 1991) (acknowledging inconsistencies in DNA data, while expressing the opinion that DNA fingerprinting still yields “a meaningful estimate” that a jury can rely on).

¹⁰⁶ See MIKE REDMAYNE, *EXPERT EVIDENCE AND CRIMINAL JUSTICE* 204 (2001) (The British “Forensic Science Service adopted a method of calculating DNA match probabilities that had been proposed by statisticians associated with the defence side of the DNA dispute.”). See also Jennifer L. Mnookin, *Fingerprint Evidence in an Age of DNA Profiling*, 67 BROOK. L. REV. 13, 70 (2001) (“[W]hile it is easy to disparage ‘battles of the experts’ as expensive, misleading, and confusing to the factfinder, these battles may

Even the DNA proponents subsequently conceded that “most would now agree that this extended debate has been good for the science.”¹⁰⁷

It was not long before commentators were asking why such procedures were not applied in other forensic fields.¹⁰⁸ In short, DNA analysis became the gold standard against which other forensic sciences would be measured.

B. 1994 Federal Legislation

The passage of the landmark DNA Identification Act of 1994¹⁰⁹ represented the first federal attempt to regulate a crime lab procedure. It authorized the creation of a national database for the DNA profiles of convicted offenders as well as a database for crime scene profiles: the Combined DNA Index System (CODIS). Bringing CODIS online was a monumental endeavor, and its successful operation required an effective quality assurance program. As one government report noted, “the integrity of the data contained in CODIS is extremely

also reveal genuine weaknesses in proffered expert knowledge.”).

¹⁰⁷ IAN W. EVETT & BRUCE S. WEIR, INTERPRETING DNA EVIDENCE: STATISTICAL GENETICS FOR FORENSIC SCIENTISTS xiv (1998). See also Richard Lempert, *Comment: Theory and Practice in DNA Fingerprinting*, 9 STATISTICAL SCI. 255, 258 (1994) (“[I]n this instance the importation of legal adversariness into the scientific world has spurred both valuable research and practical improvements in the way DNA is analyzed and presented.”).

¹⁰⁸ See Michael J. Saks & Jonathan J. Koehler, *What DNA “Fingerprinting” Can Teach the Law About the Rest of Forensic Science*, 13 CARDOZO L. REV. 361, 372 (1991) (“[F]orensic scientists, like scientists in all other fields, should subject their claims to methodologically rigorous empirical tests. The results of these tests should be published and debated. Until such steps are taken, the strong claims of forensic scientists must be regarded with far more caution than they traditionally have been.”). See also Mnookin, *supra* note 96, at 43 (“One consequence of DNA profiling and its admissibility into court is that it has opened the door to challenging fingerprinting.”); Sandy L. Zabell, *Fingerprint Evidence*, 13 J.L. & POL’Y 143, 143 (2005) (“DNA identification has not only transformed and revolutionized forensic science, it has also created a new set of standards that have raised expectations for forensic science in general.”).

¹⁰⁹ 42 U.S.C. § 14131(a) & (c) (2000).

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important since the DNA matches provided by CODIS are frequently a key piece of evidence linking a suspect to a crime.”¹¹⁰ The statute created a DNA Advisory Board (DAB) to assist in promulgating quality assurance standards.¹¹¹ The Act also required proficiency testing for analysts in the FBI as well as those in labs participating in the national database or receiving federal funding.¹¹²

C. New York Statute

In the same year that Congress enacted DNA legislation, New York became the first state to regulate its forensic laboratories.¹¹³ The New York statute established a Commission on Forensic Science,¹¹⁴ which is authorized (1) to develop minimum standards and a program of accreditation for all state laboratories, (2) to establish minimum qualifications for laboratory directors and other personnel, and (3) to approve

¹¹⁰ OFFICE OF INSPECTOR GEN., U.S. DEP’T OF JUSTICE, AUDIT REPORT, THE COMBINED DNA INDEX SYSTEM ii (2001).

¹¹¹ 42 U.S.C. § 14131(a) (2000). The legislation contained a sunset provision; DAB would expire after five years unless extended by the Director of the FBI. 42 U.S.C. § 14131(b) (2000). The FBI had established the Technical Working Group on DNA Analysis Methods (TWGDAM) in 1988 to develop standards. TWGDAM functioned under DAB. It was renamed Scientific Working Group on DNA Analysis Methods (SWGAM) in 1999 and replaced the DAB when the latter expired. *See* NORAH RUDIN & KEITH INMAN, AN INTRODUCTION TO FORENSIC DNA ANALYSIS 180 (2d ed. 2002).

¹¹² 42 U.S.C. § 14132(b)(2) (2006) (external proficiency testing for CODIS participation); *id.* at §14133(a)(1)(A) (2006) (FBI examiners). DAB Standard 13 implements this requirement. DNA ADVISORY BOARD STANDARD 13 (1998). The Justice for All Act, enacted in 2004, amended the statute, requiring all DNA labs to be accredited within two years “by a nonprofit professional association of persons actively involved in forensic science that is nationally recognized within the forensic science community” and to “undergo external audits, not less than once every 2 years, that demonstrate compliance with standards established by the Director of the Federal Bureau of Investigation.” 42 U.S.C. § 14132(b)(2) (2006).

¹¹³ N.Y. EXEC. LAW § 995b (McKinney 2006) (requiring accreditation by the state Forensic Science Commission).

¹¹⁴ N.Y. EXEC. § 995-a (McKinney 1996).

forensic laboratories for the performance of specific forensic methodologies.¹¹⁵ Significantly, research scientists and the defense bar were represented on the Commission.¹¹⁶

D. DNA Exonerations

DNA technology had an additional effect on the regulation of forensic science, one emanating from its power to exonerate the innocent. One of the first defendants to be freed was Glen Woodall,¹¹⁷ whose exoneration triggered an investigation of the West Virginia State Police Crime Laboratory,¹¹⁸ a process that

¹¹⁵ See Michael Saks et al., *Model Prevention and Remedy of Erroneous Convictions Act*, 33 ARIZ. ST. L.J. 669, 698-703 (2001) (discussing Commission on Forensic Science Services).

¹¹⁶ N.Y. EXEC. § 995-a (McKinney 1996). The commission has fourteen members. The commissioner of the division of criminal justice services is the chair. The commissioner of the department of health or a designee is an ex-officio member. Twelve members are appointed by the governor: (1) one is a chair of the N.Y. state crime laboratory advisory committee; (2) one is a director of a N.Y. forensic laboratory; (3) one is the director of the office of forensic services; (4) two are scientists with experience in laboratory standards or quality assurance regulation and monitoring, appointed upon recommendation of the commissioner of health; (5) one is a representative of a law enforcement agency, appointed upon the recommendation of the commissioner of criminal justice services; (6) one is a representative of prosecution services, appointed upon the recommendation of the commissioner of criminal justice services; (7) one is a representative of the public criminal defense bar, appointed upon the recommendation of an organization representing public defense services; (8) one is a representative of the private criminal defense bar, appointed upon the recommendation of an organization of such bar; (9) two are members-at-large, one of whom is appointed upon the recommendation of the temporary president of the senate and the other upon the recommendation of the speaker of the assembly; and (10) one is an attorney or judge with a background in privacy issues and biomedical ethics, appointed upon the recommendation of the chief judge of the court of appeals. *Id.*

¹¹⁷ See EDWARD CONNORS ET AL., NAT'L INST. JUSTICE, CONVICTED BY JURIES, EXONERATED BY SCIENCE: CASE STUDIES IN THE USE OF DNA EVIDENCE TO ESTABLISH INNOCENCE AFTER TRIAL 74-76 (1996) (National Institute of Justice report documenting twenty-eight exoneration cases).

¹¹⁸ See George Castelle, *Lab Fraud: Lessons Learned from the Fred Zain*

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revealed the laboratory malfeasance of Fred Zain. Zain's acts of misconduct included:

(1) overstating the strength of results; (2) overstating the frequency of genetic matches on individual pieces of evidence; (3) misreporting the frequency of genetic matches on multiple pieces of evidence; (4) reporting that multiple items had been tested, when only a single item had been tested; (5) reporting inconclusive results as conclusive; (6) repeatedly altering laboratory records; (7) grouping results to create the erroneous impression that genetic markers had been obtained from all samples tested; (8) failing to report conflicting results; (9) failing to conduct or to report conducting additional testing to resolve conflicting results; (10) implying a match with a suspect when testing supported only a match with the victim; and (11) reporting scientifically impossible or improbable results.¹¹⁹

The Zain affair illustrated the importance of written protocols, accurate lab notes, and technical reviews.

Unfortunately, Zain was not alone. In *Actual Innocence*, Barry Scheck, Peter Neufeld, and Jim Dwyer examined 62 of the first DNA exonerations secured through Cardozo Law School's Innocence Project to ascertain which factors contributed to these miscarriages of justice. One of the more astounding conclusions was that *one-third* of these cases involved "tainted or fraudulent science."¹²⁰ By September of 2006, DNA evidence

Affair, THE CHAMPION 12 (May 1999); Paul C. Giannelli, *The Abuse of Scientific Evidence in Criminal Cases: The Need for Independent Crime Laboratories*, 4 VA. J. SOC. POL'Y & L. 439 (1997). A number of TV shows documented his abuses. See *Right on, Fred Zain*, CBS 60 MINUTES, April 24, 1994; *Body of Evidence*, NBC DATELINE, April 21, 1999.

¹¹⁹ *In re* Investigation of the W. Va. State Police Crime Lab., Serology Div., 438 S.E.2d 501, 503 (W. Va. 1993) (quoting ASCLD report).

¹²⁰ BARRY SCHECK ET AL., ACTUAL INNOCENCE: FIVE DAYS TO EXECUTION AND OTHER DISPATCHES FROM THE WRONGLY CONVICTED 248 (2000). The other causes include: Mistaken eyewitnesses (84%); Police misconduct (50%); Prosecutorial misconduct (42%); Ineffective defense

had exonerated at least 184 convicts.¹²¹ Another report, which identified an additional 196 non-DNA exonerations,¹²² noted that twenty-four cases involved “perjury by forensic scientists testifying for the government.”¹²³ Subsequent scandals in Oklahoma and Texas led those states to legislate lab accreditation.¹²⁴ Similarly, problems in the Virginia DNA lab¹²⁵ caused that state to make the Division of Forensic Science a separate agency under the Secretary of Public Safety¹²⁶ and to create a Forensic Science Board and a Scientific Advisory Committee.¹²⁷

IV. AMERICAN BAR ASSOCIATION INITIATIVES

As the number of DNA exonerations grew, the legal profession could no longer dismiss these miscarriages of justice

counsel (27%); False confessions (24%); Jailhouse snitches (21%) *Id.*

¹²¹ See <http://www.innocenceproject.org> (last visited Sept. 21, 2006).

¹²² See Samuel R. Gross et al., *Exonerations in the United States 1989 Through 2003*, 95 J. CRIM. L. & CRIMINOLOGY 523 (2005). “Overall, we found 340 exonerations . . . ; 144 of them were cleared by DNA evidence, 196 by other means.” *Id.* at 524 (internal citations omitted).

¹²³ *Id.* at 543.

¹²⁴ Forensic Laboratory Accreditation Act, OKLA. STAT. ANN. tit. 74, § 150.37 (2004) (requiring accreditation by (ASCLD/LAB or the American Board of Forensic Toxicology); Forensic Analysis of Evidence, TEX. CODE CRIM. PROC. ANN. art. 38.35 (2005) (requiring accreditation by the Department of Public Safety). See also DNA and Forensic Identification Data Base and Data Bank Act of 1998, CAL. PENAL CODE § 297 (2004) (requiring accreditation by ASCLD/LAB or any certifying body approved by ASCLD/LAB). Indiana does not require accreditation but does require a laboratory conducting forensic DNA analysis to implement and follow nationally recognized standards for DNA quality assurance and proficiency testing, such as those approved by ASCLD/LAB. Laboratory Standards, IND. CODE ANN. § 10-13-6-14 (2004).

¹²⁵ The problems stemmed from the Earl Washington case. See note 76 *supra*.

¹²⁶ VA. CODE § 9.1-1100 (2005) (changing Division of Forensic Science into the Department of Forensic Science). Previously, it was under the Department of Criminal Justice Services.

¹²⁷ VA. CODE § 9.1-1111 & 1112 (2005).

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as aberrational. The numbers were too large, and the nature of the causes too repetitive. Systemic problems were uncovered, and comprehensive reforms were called for.

A. Innocence Policies

As a result, in 2002 the ABA Criminal Justice Section established the Ad Hoc Innocence Committee to Ensure the Integrity of the Criminal Process.¹²⁸ Forensic science was one concern, and the ABA eventually recommended that “[c]rime laboratories and medical examiner offices should be accredited, examiners should be certified, and procedures should be standardized and published to ensure the validity, reliability, and timely analysis of forensic evidence.”¹²⁹

Another ABA recommendation focused on funding.¹³⁰ The underfunding of crime labs in this country is chronic.¹³¹ As noted earlier, both President Johnson’s and President Nixon’s

¹²⁸ See REPORT OF THE ABA CRIMINAL JUSTICE SECTION’S AD HOC INNOCENCE COMMITTEE TO ENSURE THE INTEGRITY OF THE CRIMINAL PROCESS, *ACHIEVING JUSTICE: FREEING THE INNOCENT, CONVICTING THE GUILTY* (Paul C. Giannelli & Myrna Raeder eds., 2006) [hereinafter *INNOCENCE REPORT*]. The Committee was charged with undertaking a review of the causes for wrongful convictions and recommending policies to better ensure that individuals will not be convicted of crimes they did not commit. Over a three-year period, the Committee drafted resolutions and accompanying reports that have now been adopted by the ABA House of Delegates. They include resolutions on: false confessions, eyewitness identification procedures, forensic evidence, jailhouse informants, defense counsel practices, investigative policies and personnel, prosecution practices, systemic remedies, and compensation for the wrongfully convicted. The resolutions include recommendations for videotaping all interrogations, accrediting crime laboratories, conducting double blind lineups, and requiring corroboration in all cases involving jailhouse snitches. *Id.*

¹²⁹ *Id.* at 47.

¹³⁰ *Id.*

¹³¹ OTA REPORT, *supra* note 78, at 29 (“Most agree that crime laboratories and forensic sciences research that supports technology transfer to crime laboratories are underfunded. Increasingly, indications are that crime laboratories are experiencing difficulties managing the steadily rising influx of casework.”).

Crime Commissions acknowledged the problem.¹³² Twenty years later, a report on Washington State crime labs revealed that a “staggering backlog of cases hinders investigations of murder, rape, arson, and other major crimes.”¹³³ At any time, “thousands of pieces of evidence collected from crime scenes sit unanalyzed and ignored on shelves in laboratories and police stations across the state.”¹³⁴ A *USA Today* survey reached the same conclusion: “Evidence that could imprison the guilty or free the innocent is languishing on shelves and piling up in refrigerators of the nation’s overwhelmed and underfunded crime labs.”¹³⁵ In one case, the delay on processing evidence of a rape was eighteen months, forcing the police to release the suspect, and giving him time to rape a fourth victim.¹³⁶

The ABA also recommended the appointment of defense experts for indigent defendants “whenever reasonably necessary to the defense.”¹³⁷ While the Supreme Court recognized a due process right to a defense expert in *Ake v. Oklahoma*,¹³⁸ a

¹³² See PRESIDENT’S COMM’N ON LAW ENFORCEMENT AND ADMINISTRATION OF JUSTICE, *THE CHALLENGE OF CRIME IN A FREE SOCIETY* 255 (1967) (“[T]he great majority of police department laboratories have only minimal equipment and lack highly skilled personnel able to use the modern equipment now being developed.”); NATIONAL ADVISORY COMM’N ON CRIMINAL JUSTICE STANDARDS AND GOALS, *REPORT ON POLICE* 304 (1974) (“Too many police crime laboratories have been set up on budgets that preclude the recruitment of qualified, professional personnel.”).

¹³³ Tomas Guillen & Eric Nalder, *Overwhelming Evidence—Crime Labs in Crisis—Staggering Backlog of Cases Hinders Investigations of Murder, Rape, Arson and Other Major Crimes*, SEATTLE TIMES, Jun. 19, 1994, at A14.

¹³⁴ *Id.*

¹³⁵ Becky Beaupre & Peter Eisler, *Crime Lab Crisis*, USA TODAY, Aug. 20, 1996, at 1.

¹³⁶ *Id.*

¹³⁷ INNOCENCE REPORT, *supra* note 128, at 47. See also ABA STANDARDS FOR CRIMINAL JUSTICE, *PROVIDING DEFENSE SERVICES* 5-1.4, cmt. at 22 (3d ed. 1992) (“The quality of representation at trial . . . may be excellent and yet unhelpful to the defendant if the defense requires the assistance of a psychiatrist or handwriting expert and no such services are available.”).

¹³⁸ 470 U.S. 68 (1985).

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number of sources indicate that the lack of defense experts continues to be a significant problem.¹³⁹ Finally, the ABA highlighted the importance of lawyer training in forensic science, as well as attorney competence.¹⁴⁰

B. ABA Standards on DNA Evidence

A second ABA project will also undoubtedly impact the regulation of forensic science. The ABA Standards on DNA Evidence cover a wide range of topics.¹⁴¹ Part III of the

¹³⁹ See Giannelli, *supra* note 55, at 1311-13 (discussing the various reports).

¹⁴⁰ See, e.g., Glenn v. Tate, 71 F.3d 1204, 1209-11 (6th Cir. 1995) (finding ineffective assistance in penalty phase of capital murder case for failing to present evidence of defendant's mental retardation/neurological impairment, and by acquiescing to prosecutor's suggestion that experts requested by defense be treated as court-appointed rather than defense experts, and by failing to challenge expert reports); Driscoll v. Delo, 71 F.3d 701, 709 (8th Cir. 1995) (In a capital murder case, whether alleged murder weapon had blood matching the victim's constituted an issue of the utmost importance. Under these circumstances, a reasonable defense lawyer would take some measures to understand the laboratory tests performed and the inferences that one could logically draw from the results. At the very least, any reasonable attorney under the circumstances would study the state's laboratory report with sufficient care so that if the prosecution advanced a theory at trial that was at odds with the serology evidence, the defense would be in a position to expose it on cross-examination."); Foster v. Lockhart, 9 F.3d 722, 726 (8th Cir. 1993) (holding that failure to pursue an impotency defense in a rape case violated the right to effective assistance of counsel); United States v. Tarricone, 996 F.2d 1414, 1418 (2d Cir. 1993) (concluding that failure to consult handwriting expert made out a viable claim of ineffectiveness); Sims v. Livesay, 970 F.2d 1575, 1580 (6th Cir. 1992) (holding that failure to have quilt examined for gunshot residue rendered representation ineffective).

¹⁴¹ ABA CRIMINAL JUSTICE STANDARDS ON DNA EVIDENCE (adopted August 2006). The Standards include provisions on:

- (1) the collection, preservation, and retention of biological evidence,
- (2) pretrial disclosure,
- (3) defense testing and retesting,
- (4) the admissibility of DNA evidence,
- (5) post-conviction testing,

Standards governs the testing of DNA Evidence and includes provisions on laboratories and the testing and interpretation of DNA evidence. The Standards mandate (1) accreditation, for crime laboratories every two years, (2) written policies, including protocols for testing and interpreting test results, (3) quality assurance procedures, including audits, proficiency testing, and corrective action protocols, (4) procedures designed to minimize cognitive bias when interpreting test results, and (5) timely reports of credible evidence of lab misconduct or serious negligence.¹⁴²

The Standards stress two other points. The first is transparency; most laboratory protocols and procedures should be publicly available.¹⁴³ The second is documentation. Each step in the testing of DNA evidence and in the interpretation of the test results should be recorded contemporaneously in case notes.¹⁴⁴ All case notes made and raw electronic data produced during testing should be preserved and are discoverable.¹⁴⁵

CONCLUSION

DNA evidence has revolutionized forensic science. The DNA admissibility wars forced laboratories to develop protocols for declaring a match, to use controls in testing, and to promulgate procedures for interpreting autoradiograms. These challenges also produced the first state statute on lab accreditation—in New York, and the first federal legislation regulating a forensic science. DNA profiling not only set the “gold standard” for forensic evidence but also highlighted the shortcomings of other forensic techniques through the exonerations it produced.

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- (6) charging persons by DNA profile, and
 - (7) DNA databases.

Id.

¹⁴² ABA Standard 3.1(a).

¹⁴³ *Id.* at 1.2(c) & 3.1(a)(vii).

¹⁴⁴ *Id.* at 3.2.

¹⁴⁵ *Id.* at 4.1(a).

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The impact of DNA analysis on forensic science in general and crime labs in particular should be understood in a larger context. In 1993, the year before the federal and New York statutes were passed, the Supreme Court handed down its landmark decision on the admissibility of expert testimony—*Daubert v. Merrell Dow Pharmaceuticals, Inc.*¹⁴⁶ If DNA evidence revolutionized forensic science, *Daubert* and its progeny¹⁴⁷ revolutionized the admissibility standard for evidence based on forensic science. *Daubert* has been transformed from a case that most courts and commentators believed lowered the barriers to the admissibility of scientific evidence to one that the Court now describes as imposing an “exacting” standard.¹⁴⁸ Indeed, some federal courts have read the *Daubert* trilogy as inviting a “reexamination even of ‘generally accepted’ venerable, technical fields.”¹⁴⁹ As a result, attacks have been launched against handwriting evidence,¹⁵⁰ hair comparisons,¹⁵¹

¹⁴⁶ 509 U.S. 579 (1993).

¹⁴⁷ The Court followed with *General Electric Co. v. Joiner*, 522 U.S. 136 (1997), and *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999), to make up what is now known as the *Daubert* trilogy.

¹⁴⁸ *Weisgram v. Marley Co.*, 528 U.S. 440, 455 (2000). See generally Paul C. Giannelli, *Daubert Revisited*, 41 CRIM. L. BULL. 302 (2005) (describing the transformation of *Daubert*).

¹⁴⁹ *United States v. Hines*, 55 F. Supp. 2d 62, 67 (D. Mass. 1999) (handwriting comparison). See also *United States v. Hidalgo*, 229 F. Supp. 2d 961, 966 (D. Ariz. 2002) (“Courts are now confronting challenges to testimony, as here, whose admissibility had long been settled.”; handwriting comparison).

¹⁵⁰ See Paul C. Giannelli, *Daubert Challenges to Fingerprints*, 43 CRIM. L. BULL. 624 (2006) (examining the controversy surrounding the admissibility of fingerprint evidence).

¹⁵¹ See *Williamson v. Reynolds*, 904 F. Supp. 1529, 1558 (E.D. Okla. 1995) (“This court has been unsuccessful in its attempts to locate any indication that expert hair comparison testimony meets any of the requirements of *Daubert*.”), *rev’d on this issue*, *Williamson v. Ward*, 110 F.3d 1508, 1522-23 (10th Cir. 1997) (holding that due process, not *Daubert*, standard applies in habeas proceedings). See generally Paul C. Giannelli & Emmie West, *Hair Comparison Evidence*, 37 CRIM. L. BULL. 514 (2001) (discussing the DNA exoneration cases in which hair evidence was used to convict the innocent).

fingerprint examinations,¹⁵² firearms identification,¹⁵³ bitemark analysis,¹⁵⁴ gunshot residue testing,¹⁵⁵ bullet composition evidence,¹⁵⁶ and intoxication testing.¹⁵⁷ While many of these challenges have failed, the landscape has irreversibly shifted. Lawyers are now accustomed to challenging forensic evidence.

The combined effect of the introduction of DNA evidence and the *Daubert* decision has altered the forensic paradigm and has perhaps rendered the regulation of crime labs inevitable.

¹⁵² See Paul C. Giannelli & Carrin Cozza, *Daubert Challenges to Handwriting Comparisons*, 42 CRIM. L. BULL. 347 (2006) (analyzing the case law and research in the field of questioned document analysis).

¹⁵³ See *United States v. Green*, 405 F. Supp. 2d 104 (D. Mass. 2005) (limiting testimony); Adina Schwartz, *A Systemic Challenge to the Reliability and Admissibility of Firearms and Toolmark Identification*, 6 COLUM. SCIENCE & TECH. L. REV. 2 (2005).

¹⁵⁴ See I.A. Pretty & D. Sweet, *The Scientific Basis for Human Bitemark Analyses—A Critical Review*, 41 SCI. & JUST. 85, 86 (2001) (“Despite the continued acceptance of bitemark evidence in European, Oceanic and North American Courts, the fundamental scientific basis for bitemark analysis has never been established.”).

¹⁵⁵ See Michelle Nethercott & William C. Thompson, *Lessons from Baltimore’s GSR Debacle*, THE CHAMPION 36 (June 2005).

¹⁵⁶ See *Ragland v. Commonwealth*, 191 S.W.3d 569 (Ky. 2006) (excluding evidence); *Clemons v. State*, 896 A.2d 1059 (Md. 2006) (same); *State v. Behn*, 868 A.2d 329 (N.J. Super. Ct. App. Div. 2005) (same). See also NATIONAL RESEARCH COUNCIL, FORENSIC ANALYSIS: WEIGHING BULLET LEAD EVIDENCE 6 (2004).

¹⁵⁷ See *United States v. Horn*, 185 F. Supp. 2d 530, 549 (D. Md. 2002) (“Where, as here, that reliability has been challenged, the court cannot disregard the challenge, simply because a legion of earlier court decisions reached conclusions based on reference to the same then-unchallenged authority. . . . I cannot agree that [various intoxication] tests, singly or in combination, have been shown to be as reliable as asserted by Dr. Burns, the NHTSA publications, and the publications of the communities of law enforcement officers and state prosecutors.”) (footnote omitted).