

The Evolution of Quality Standards for Forensic DNA Analyses in the United States

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INTRODUCTION

Violent crime has always been a significant law enforcement issue in the United States. Annual FBI Uniform Crime Report (UCR) statistics continue to show the persistence of violent crimes, including homicide, sexual assault, kidnapping, aggravated assault and closely related crimes. Forensic DNA technology has gained wide application in violent crime investigations involving biological evidence, as in rape cases (semen evidence), or more uncommonly, as in cases like the World Trade Center bombing (saliva evidence). Forensic DNA technology's broadest and most effective application has been in rape and related sexual assault cases because it may reliably include and identify, or exclude, a potential suspect.

Rape and other violent crimes are a genuine concern to the public, and programs that bring about the successful resolution of these types of crimes, are important to the welfare of the public and the administration of justice. The forensic DNA typing community, the relevant scientific community and the United States Congress have all played a role in establishing national quality assurance standards for laboratories performing forensic DNA testing. These standards have helped to ensure the reliability of forensic DNA testing, which in turn has served to benefit and enhance the American judicial system.

BACKGROUND

In 1985, Dr. Alec Jeffreys of the University of Leicester, England, first used DNA technology to assist police in identifying a suspect in the rape homicides of two teenage girls. This use of DNA technology prompted the development and application of DNA typing technology in the United States, which first used polymerase chain reaction (PCR) DNA technology in a Pennsylvania court case in 1986. Because DNA technology is scientifically sound and could potentially be very persuasive in convincing a jury that a particular suspect may have been associated with a crime, DNA

technology invoked a great deal of interest from attorneys and scientists as it began to be used extensively. The concerns regarding the appropriate use of DNA technology by the courts and law enforcement motivated the forensic DNA testing community to establish guidelines, relevant scientists to recommend actions, and Congress to investigate and develop legislation specifically aimed at forensic DNA technology applications.

NATIONAL AND CONGRESSIONAL INFLUENCES ON FORENSIC DNA TYPING ISSUES

In 1988, the forensic DNA testing community through the Technical Working Group on DNA Analysis Methods (TWGDAM) began to address various issues regarding forensic DNA testing. TWGDAM was established in 1988 under FBI Laboratory Division sponsorship and consisted of government and private sector forensic DNA scientists and other related experts from the United States and Canada (1). In 1989, 1991 and 1995, TWGDAM issued guidelines for quality assurance in DNA analysis (2–4). The TWGDAM guidelines served as the de facto standards for forensic DNA testing until October 1998, when the subsequent DNA Advisory Board (DAB) standards went into effect. The DAB was created by the DNA Identification Act of 1994 and became operational in 1995. The TWGDAM guidelines and subsequent DAB standards covered the following quality assurance program areas for forensic DNA testing laboratories: planning and organization, personnel qualifications and training, equipment, materials and facilities, evidence handling procedures, validation, analytical procedures, proficiency testing, case work documentation, interpretation, report writing and review, safety and audits. (For more information, see the references listed above or the SWGDAM web site, www.for-swg.org/swgdamin.htm.)

In March 1989, the House Committee on the Judiciary, Subcommittee on Civil and Constitutional Rights, began to hear testi-

mony on the use of DNA technology for identifying violent criminal offenders through evidence left at crime scenes. House testimony from a university professor, an attorney and an American Civil Liberties Union (ACLU) member raised concerns regarding the adequacy of DNA technology to identify violent criminals and the perceived negative effects of DNA typing on individual civil liberties (5). Also in March 1989, the Senate Committee on the Judiciary, Subcommittee on the Constitution, heard testimony from university professors, an attorney and FBI Laboratory personnel stressing the importance of forensic DNA evidence in criminal investigations and prosecutions and the advantages of DNA technology in identifying criminal offenders (6).

In 1990, the Office of Technology Assessment (OTA), an investigative arm of Congress, published *Genetic Witness: Forensic Uses of DNA Tests*, which reviewed the then state-of-the-art forensic uses of DNA technology (7). The OTA report addressed policy issues for Congressional action, technological issues, validity, reliability and quality assurance issues, and civil liberty and informational privacy issues. The legal community, in response to the OTA report, concurred that DNA testing is indeed valid but suggested that additional standards and quality assurance measures were still needed (8).

In 1992, the National Research Council and National Academy of Sciences issued a report that recommended forensic DNA laboratories establish formal quality assurance programs, use external mechanisms of review such as certification, accreditation or regulation and receive increased National Institute of Justice (NIJ) funding for education, training and research in forensic DNA testing (9). In 1996, the National Research Council issued a second report recommending that forensic DNA testing laboratories adhere to high standards, make every effort to become accredited, regularly participate in proficiency testing, and where feasible, preserve remaining forensic samples or portions for

additional independent testing (10). Both the 1992 and 1996 National Research Council reports recommended that DNA technology be used in the resolution of criminal and civil cases but also stressed the need for additional quality assurance measures and programs.

FOCUSED CONGRESSIONAL ACTIONS

After the 1989 Congressional hearings and the 1990 OTA report, in June 1991, joint House and Senate Congressional hearings considered the use of DNA technology to identify criminal offenders and the need for standards to ensure the accuracy of DNA testing results. These 1991 hearings also proposed recommendations for Federal legislation (11). In March 1993, the DNA Identification Act of 1993 legislation proposed grants to state and local governments for establishing and improving forensic DNA testing capabilities and directed the establishment of standards for DNA testing laboratories (12). In 1994, the Congress passed and funded the Violent Crime Control and Law Enforcement Act of 1994, which included Title XXI and the DNA Identification Act of 1994. Title XXI and the DNA Identification Act of 1994 authorized grants to state and local law enforcement for establishing or improving DNA testing in forensic laboratories, established standards for forensic DNA testing through a national DNA Advisory Board, and required the FBI to establish a national index of convicted offenders' DNA profiles (13).

THE DNA ADVISORY BOARD (DAB) STANDARDS

The DNA Identification Act of 1994 created and funded the DAB, which was staffed and implemented in 1995. The first chairman of the DAB was Nobel laureate Dr. Joshua Lederberg. During his tenure, the "Quality Assurance Standards for Forensic Testing Laboratories" were created and approved by the Director of the FBI. These standards took effect on October 1, 1998. In 1998, Dr. Arthur Eisenberg was appointed the chair of the DAB and during his tenure the "Quality Assurance Standards for Convicted Offender DNA Databasing Laboratories" were finalized, approved and took effect on April 1, 1999. These standards now govern the use of forensic DNA testing and databasing in the United States and have required a consistently high degree of quality in forensic DNA analysis.

These comprehensive standards address the following quality assurance program

areas for forensic DNA testing: goals and objectives, organization and management, personnel qualifications and training, facilities, sample control, validation, analytical procedures, calibration and maintenance, proficiency testing, corrective action, documentation, review, safety, audits and subcontracting of analytical testing.

The DAB standards require comprehensive annual audits, and every two years the audit must have external participation. The audits are required to cover the following areas: quality assurance program, organization and management, personnel, facilities, evidence control, validation, analytical procedures, calibration and maintenance, proficiency testing, corrective action, reports, review, safety and previous audit compliance. The American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB), an international accrediting body for crime laboratories, cites specific required accreditation criteria from the DAB standards for forensic DNA examiners' education, training, experience and proficiency testing (14).

A functional National DNA Indexing System (NDIS) database has only recently been implemented, so the assessment of its full effect is still too early. The use of databased DNA profiles in unsolved crimes during the early operations of NDIS indicates that it will be a significant and effective tool for the criminal justice system and the protection of society.

The DNA typing of forensic samples in criminal cases has clearly had a major beneficial effect on the criminal justice system. In 1995, the National Institute of Justice published a book titled *Convicted by Juries, Exonerated by Science*, which cited the use of DNA technology not only for the conviction of offenders, but also for the exoneration of wrongly charged or convicted individuals in criminal cases (15). The DAB standards and preceding TWGDAM guidelines have helped to ensure the reliable use of DNA technology in the scientific resolution of judicial matters, regardless of the adversarial legal system imperfections.

CONCLUSION

Forensic DNA technology in the United States has successfully evolved into an important and reliable tool for justice and society. Forensic DNA technology is used in the resolution of civil and criminal cases and in the support of numerous types of investigations. The forensic DNA testing community, relevant experts and the courts have established

the reliability and acceptability of its use. The FBI Laboratory, the forensic science community through TWGDAM (now known as SWGDAM, the Scientific Working Group on DNA Analysis Methods) and Congressional actions, by way of the DAB, have helped to support the evolution and proliferation of high-quality standards in forensic DNA testing, and ultimately, advance the efficient administration of justice.

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