

all slow the use of DNA evidence in the courtroom. In the ensuing decade (1995–2004), thousands of criminal and civil cases have been resolved (often by plea bargaining or settlement) after a review of the results of DNA testing. For example, litigation to establish paternity, once common in American courtrooms, has disappeared. If an accused man is the father, the results of the DNA evidence are too powerful to counter. In 2005, one can confidently say that DNA identification evidence is now routinely accepted in legal matters. This recognition has generated two important new challenges for the criminal justice system: the DNA analysis of old evidence to reopen closed cases and the proper use of DNA felon data banks.

As the defense bar became familiar with DNA evidence, lawyers quickly realized that they had access to a powerful new tool with which to challenge the operation of the criminal justice system. In 1992, Barry Sheck, who would later become the “DNA” lawyer on O.J. Simpson’s defense team, and Peter Neufeld started a legal clinic at Benjamin Cardozo Law School in New York City called the Innocence Project. They began to investigate cases in which men who had been convicted of rape and murder steadfastly maintained their innocence and in which there was crime scene evidence that, if subjected to DNA analysis, could potentially exonerate them. Many of the early cases involved men who had been given lengthy sentences for rape based on eyewitness testimony in the years before DNA testing became available.

The Innocence Project faced a difficult challenge. In our criminal justice system, once an individual has been convicted, exhausted his appeals, and gone to prison, the system regards the case as closed. As time passes, there is a strong bias against reopening it. Furthermore, in many states, there is not a clear procedure for doing so. However, most district attorneys will be quick to acknowledge that obtaining a conviction on an innocent man is one of their worst nightmares. Sheck, who had schooled himself in DNA science and won some key scientific allies, was indefatigable. In some cases, a judge who was reluctant to reconsider did so because Sheck convinced the prosecuting attorney to side with him on the petition.

During the last decade, the Innocence Project has had a remarkable impact. As of 2008, more than 200 men who were serving lengthy sentences for felony convictions have been exonerated and released because an analysis of DNA evidence from the crime scene demonstrated unequivocally that

the convicted individual could not be the source of the semen or blood that was analyzed. The success of the Cardozo legal clinic has spawned many similar efforts in other law schools. The growing number of exonerations has called into question the validity of eyewitness testimony and the manner in which police organize and use “lineups.” It also has pointed out the need, when there is biological evidence that could exonerate but that has not been tested, to establish a method for doing so. Over the past few years, at least 35 states have enacted laws to permit post-conviction DNA testing. Some, however, set out extremely limited circumstances under which this might occur. The Innocence Project has drafted a model statute to cover this issue and continues to lobby for a more liberal use of DNA evidence.

As the battle over the interpretation of DNA evidence was played out in the courtrooms of America from 1987 to 1995, the FBI was quickly moving forward to develop a platform to support a national network of state-based DNA felon data banks. These are computerized files made with a commonly used set of DNA probes that record the genetic identity of convicted felons before they are paroled. The idea of such a data bank is a logical extension of the century-old practice of fingerprinting, but (as I shall discuss) DNA profiling raises a number of difficult issues that do not complicate fingerprinting. California was the first state to collect tissue on convicted felons. Beginning in 1983, it began testing convicted sex offenders for protein markers found in human saliva that were also present in semen. The idea, of course, was to assist the state in solving future crimes, a good idea given the high frequency with which such felons strike again.

Shortly after Alec Jeffreys grasped the possible utility of DNA forensic evidence, law enforcement officers at the Home Office in the United Kingdom and the FBI in the United States quietly began to create the foundations for what are rapidly becoming national criminal DNA databases. From the start, officials in the United Kingdom were able to progress more quickly, largely because of the major difference in the governmental structures of the two nations. Police policy in the United Kingdom is largely set at the national level; in the United States, each state operates its own criminal justice system. In 1994, Parliament enacted the Criminal Justice and Public Order Act to amend a 1984 law on evidence to expressly permit the police to take samples for DNA profiling. In contrast, the FBI faced the challenge of developing a DNA test system that would be adopted by all 50 states, of assisting law enforcement in each state to obtain enabling legis-

lation and adequate funding to participate, and of developing a secure network for data to be fed into a common bank for subsequent analysis in the investigation of future crimes.

Not surprisingly, state and local police were eager to participate. In the period from 1989 through 1999, all 50 states enacted laws that created DNA felon databases, a rare legislative event. Although some states did not provide adequate funding, most new programs were funded well enough to get at least one local DNA forensics lab up and running. Initially, the state laws applied only to persons who had been convicted of violent crimes such as murder and rape. However, as DNA technology became ever more sophisticated, lawmakers reacted by steadily expanding the scope of crimes to which the laws applied. Once it became clear that forensic scientists could use amplification techniques to isolate and study minuscule amounts of DNA left on the steering wheel of a stolen car or inside the glove that a burglar dropped at a crime scene, DNA felon laws were amended to cover car theft and burglary. In 2001, the British Parliament enacted a law (The Criminal Justice and Police Act) that permits the police to retain DNA samples on persons who were arrested but not prosecuted, and even on those who were acquitted!

As of 2007, the United Kingdom National DNA Database (a nation of about 68 million) held DNA profiles on over 4,000,000 people, making it on a per capita basis the largest database of its kind in the world. The bank, which is growing by more than 30,000 samples a month, is composed of samples recovered from crime scenes and from suspects. Since a new Criminal Justice Act came into force in 2004, any person arrested in England or Wales for all but the most minor offenses, will have his or her DNA sample stored for 100 years. Between 2005 and 2006, more than 45,000 samples taken from suspects or the crime scene were linked to profiles in the database. Among them were matches relating to 422 homicides and 645 forcible rapes.

The UK DNA Database now contains samples from more than 5% of the national population. The vast majority of samples have been collected from men. Currently, samples taken from about 10% of white men and 37% of black men in the United Kingdom are in the database, a fact that has led the Black Police Officers' Association to voice concern. Also troubling is that more than 24,000 samples have been collected from children or teenagers who have never been charged with a crime. In late 2004, a law-

suit was brought to challenge the policy of retaining samples from persons who were charged with an offense, but not convicted or arrested, and never charged. The Court of Appeal upheld the law, and an appeal has been filed with the European Court of Human Rights.

Currently, officials in the United Kingdom estimate that the probability of identifying one or more suspects by running a DNA profile of a crime scene sample against the national database is over 40%. As the database has grown, so have its successes. For domestic burglary, the identification rate when a DNA sample is recovered is over 40%, compared to only 14% when no usable sample is found. The Home Office estimates that about 50% of the samples at crime scenes that are analyzed help secure a conviction, with half of those resulting in a custodial sentence. They further estimate that each such sentence results in about eight fewer crimes being committed in the nation!

The development of DNA felon databases in the United States has been quite similar to the trajectory in the United Kingdom. As of 1999, every state had enacted the legislation necessary for it to participate in the national data-sharing system (called CODIS, which stands for Combined DNA Index System) developed by the FBI to enable investigators to search offender profiles created in the 50 different jurisdictions. As of mid 2007, more than 4.5 million samples had been collected and profiles. Officials at CODIS report that, on more than 50,000 occasions, they have found a match of new crime scene evidence with a profile in the database.

Some states now have highly developed felon data banking systems, and they are having an extraordinary impact. For more than a decade, the Bureau of Forensics in Virginia has been a leader in developing a state-based DNA criminal database and using it to resolve crimes. As of July 31, 2004, the Virginia database contained 221,242 samples. Unlike most other states that target convicted felons about to be paroled, since 2003, Virginia law also permits investigators to collect and store a DNA profile on any person *arrested* on suspicion of having committed a violent felony. Analysis of the impact of the database clearly shows that as it grows larger (collects DNA profiles on an ever greater number of convicted criminals), the chances that DNA evidence found at a crime scene for which there is no suspect will match a profile of a prior offender grows dramatically. These so-called "cold hits" have been steadily on the rise in Virginia; in August 2003 alone, evidence from 94 new crime scenes matched profiles in the ex-

tant database. In the first 18 months after the creation of the arrestee database, a total of 103 matches of crime scene DNA profiles to arrestee profiles have been made. Of these, 24 involved violent sexual assaults. About 80% of the matches would not have occurred if the database had been limited only to violent (rapists and murderers) offenders. About 37% of the violent crimes that have been solved because of DNA matches were committed by men whose only prior convictions were for crimes against property!

Although it is impossible to claim a cause-and-effect relationship, during the last decade (1993–2003)—the period in which DNA criminal databases have been maturing—the rape rate (defined as victimization rate per 1,000 persons age 12 and over) has dropped by over 60% and is historically at an all-time low. The broader violent crime index has witnessed a similar pattern.

The proliferation of DNA criminal databases has its critics. Not unexpectedly, the key theme has been privacy. Initially, those opposed to DNA criminal databases repeatedly challenged the enabling statutes in state and federal courts as a violation of the constitutional safeguard against unreasonable search and seizure provided by the Fourth Amendment. By 2004, more than a dozen such cases had been decided, all in favor of the state's right to create such databases.

Despite its great contribution to the criminal justice system, even wider use of DNA forensics is hampered by all-too-regular reports of sloppy or fraudulent work by scientists and technicians who are performing the analyses that will be crucial to the case offered by the prosecution. Although many important steps have been taken to reduce the risks of such events, the huge caseload backlog has created time pressures on many labs that increase the risk for errors. The best way to address this problem is by better funding of the labs.

Currently, the policy debate focuses on the permissible scope and use of the databases. Civil libertarians argue for restricting them to samples taken from felons serving time for violent acts against persons. Law enforcement officials have consistently favored much more expanded use. The reach of the statutes varies. Some state laws apply to all felons; others include arrestees. Recently, the FBI argued for the inclusion of juvenile offenders in the databases. As evidenced by Virginia, the trend is definitely to broaden the application of the databases. This has led some persons to assert that there should be a universal DNA database that includes a DNA

profile on all citizens. They argue that this is the only way to avoid tainting the data banks with the racial prejudice that they think is rife in the criminal justice system. For both economic and political reasons, this is not likely to occur—unless, of course, fear of terrorism drives society to call for it. If someday our society adopts a universal DNA database, we will be assured of linking nearly every crime scene sample with an individual, potentially a huge boon to crime prevention.

One fascinating question in the policy debate is whether law enforcement officials should be allowed to conduct “low stringency searches.” It has long been recognized that one of the single best predictors of whether a person will commit a crime is whether or not a close relative (especially the father) has already done so. In states with large DNA databases, it is relatively common that a DNA sample found at a crime scene does not match precisely any profile in the database, but does partially match with one in a way that indicates that the perpetrator of the new crime is a sibling, parent, or child of a person in the database. Databases of close relatives are routinely used to resolve identity in mass disasters such as the attacks on the World Trade Center. I think it likely that if the courts are asked to rule on the constitutionality of using partial matches to apprehend persons, they will approve them.

In my view, the great debate about the role of DNA evidence in law enforcement lies ahead. Two or three decades hence, the field of behavioral genetics may have matured to the point where district attorneys, parole boards, and others will become intrigued with the possibility of using DNA information to assist them in their work. For example, should the decision to parole a man who served time for vehicular manslaughter while he was inebriated be influenced by DNA tests that show he was born with a gene variant that confers a high proclivity to alcoholism? Since parole boards use a wide variety of evidence to reach their decisions, there is no fundamental reason that genetic test results should be excluded. Our society might decide that it cannot tolerate such deterministic evidence even if the underlying scientific claims are strong, but I think it more likely that we will embrace such information.