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Forensic DNA Analysis: Issues

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Introduction

Hailed by many as the "most significant breakthrough ... since fingerprinting" and the "greatest advance ... since the advent of cross-examination," DNA analysis has dramatically altered the work of law enforcement, the courts and forensic scientists in only six short years. DNA — deoxyribonucleic acid — is the basic genetic material within each living cell that determines a person's individual characteristics. Since the early 1980s, DNA testing has been used in AIDS and genetic disease research, bone marrow transplants, and in anthropological investigations.[1] In forensics, DNA testing is typically used to identify individuals, using only small samples of body fluids or tissue — such as blood, semen or hair — left at a crime scene.

This new technology raises profound issues and complex questions, the answers to which effect all of society. Criminal justice practitioners are considering the complexities of obtaining DNA samples from suspects; establishing properly equipped and expertly staffed laboratories; developing national standards for quality assurance; submitting DNA as evidence in court; and creating DNA profile databanks.

Forensic DNA Analysis and Issues focuses primarily on the privacy and confidentiality issues raised by DNA testing for identification purposes. The report consists of two sections. Part One, DNA Testing Methods and Use, provides a brief and general description of the underlying science associated with forensic DNA testing. This section reviews methodologies for identifying the distinctive patterns found in an individual's genetic material, and discusses two major functions of DNA testing: paternity determination and suspect identification. Finally, this section outlines a few of the difficulties and limitations confronting justice agencies interested in establishing DNA testing capabilities including the infancy of DNA databanks, the scarcity of government laboratories and the lack of funding.

Part Two, Issues Regarding DNA Testing, identifies four broad and somewhat controversial topics — invasiveness, reliability, establishment and use of databanks and dissemination of DNA test data — with which criminal justice practitioners are beginning to struggle. This section of the report analyzes questions raised when bodily fluids or tissue are taken from an individual for identification purposes or to build a databank. It discusses developments in the Federal and State courts and in State legislatures, and examines the consistency of DNA testing with prevailing practices.

The report cites the responses of scientists and judicial and criminal justice officials to the question of DNA testing's reliability, and examines some potential problems associated with submitting DNA test results as evidence in court. These challenges include the adequacy of population studies and testing methods, the role of human error in interpreting test results, alleged unfairness to criminal defendants and the lack of standards.

Part Two also considers law enforcement's use of DNA databanks and the relevance of fingerprint databank case law and the maintenance of non-arrestee databanks. It also discusses questions relating to a DNA databank as a national population register, the threat of genetic redlining and problems associated with managing and regulating such databanks.

Finally, Part Two discusses the practice of disseminating DNA test data for both criminal and noncriminal justice purposes; its use as a basis for probable cause; and the distribution of non-offender DNA data. The report concludes by noting that DNA testing's tremendous potential for use in a law enforcement setting must be balanced with privacy considerations.

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[1] Harold M. Schmeck, Jr., "New Test That Finds Hidden AIDS Virus is a Sleuth with Value in Many Fields," *New York Times*, June 21, 1988, Medical Science Page.

Forensic DNA Analysis and Issues relies upon numerous source documents and resource personnel. This report originated in June of 1989 when SEARCH Group, Inc. submitted a report to the Bureau of Justice Statistics, United States Department of Justice, titled "Legal and Policy Issues Relating to Biometric Identification Technologies." This report relies in some measure upon that prior research. Subsequent to completing the June 1989 report, additional research was conducted to account for the many developments that occurred between June 1989 and January 1991. The analysis throughout the report attempts to reflect the reasoning of the case law reported to that date and does not speak of authoritative writings or case decisions which may have been issued since that time.

Additionally, on November 7, 1989, the Bureau of Justice Statistics and SEARCH sponsored a workshop, the Forum on Criminal Justice Uses of DNA, which brought together forensic scientists, lawyers, scholars and criminal justice officials who are currently involved in this complex new technology, as well as congressional staff members. These DNA experts reviewed and discussed an early draft of the report and many of their comments and suggested changes are reflected in the final report.

The research in this report is current to August 1990. Because DNA analysis is a rapidly changing area, both technologically and legally, this report should be viewed as background information rather than an up-to-the-minute analysis of the subject.

Part I
DNA Testing Methods And Use

The analysis of DNA, while not requiring exotic equipment, is nevertheless a highly advanced scientific process. Its proper application, particularly for forensic purposes, requires skill and appropriate judgment. A brief and very general discussion of forensic DNA testing — a methodology for comparing the similarities and differences between one person's DNA and that of another person — inevitably runs the risk of being superficial. An overview of the science and the technology employed, however, is necessary to provide a context for understanding the legal and policy implications of forensic DNA testing.

DNA and its Potential for Identification

In 1865 Gregor Mendel formulated the basic theoretical principles of genetics when, through his famous cross-breeding experiments with peas, he concluded that organisms carry and transmit to their offspring hereditary elements, or genes. It was not until the turn of the century, however, that genetics became an important area of biological research and scientists recognized the existence of deoxyribonucleic acid (DNA) and its almost exclusive location within the chromosome.[2] By 1944, DNA was identified as having a genetic function, but very little was known about its three-dimensional, molecular structure. Finally, in 1953 Francis Crick and James Watson formulated a model of the DNA molecule as a self-complementary, double helix.[3] This structure provided "the highroad to understanding how the genetic material functions,"[4] explaining how genetic information is stored and self-replicates. The discovery initiated a virtual revolution in the study of molecular biology and genetics.

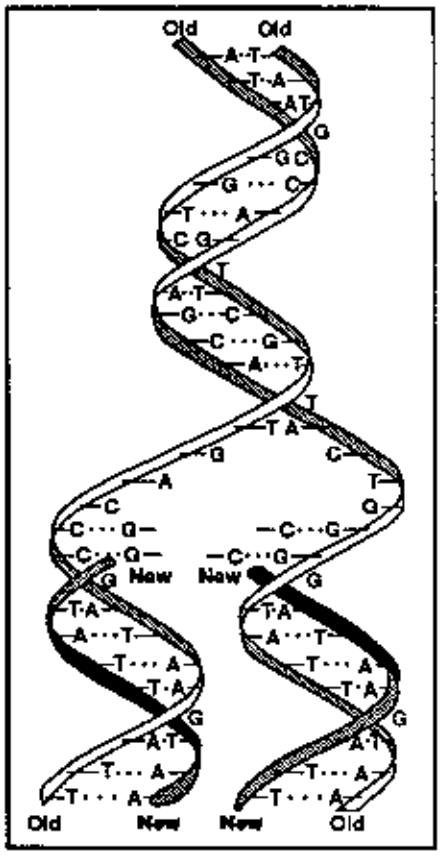

Figure 1
The Replication of DNA

[2] Chromosomes are thread-like bodies made up of strands of DNA and proteins, found within the nucleus of the cells of all living organisms. See Gunther S. Stent, "The DNA Double Helix and the Rise of Molecular Biology," Introduction to *The Double Helix* by James D. Watson, A Norton Critical Edition (New York: W. W. Norton and Company, 1980).

[3] The structure was described in J.D. Watson and F.H.C. Crick, "Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid" *Nature* 171 (April 25, 1953): 737-738. The chemical composition of DNA includes four building blocks, called nucleotides: Adenine (A), Guanine (G), Cytosine (C), and Thymine (T). The A, G, C and T nucleotides are paired in a complementary, double strand structure, held together in a zipper- or ladder-like fashion by hydrogen bonds. The nucleotide A always pairs with T, and G pairs only with C. Thus a fragment of double-stranded DNA might be represented by the following sequence:

A G C G G C T T C A C C T A T T
T C G C C G A A G T G G A T A A

See also James D. Watson, *Molecular Biology of the Gene*, 3d ed. (New York: W.A. Benjamin, Inc. 1977) and Anna C. Pai, *Foundations of Genetics: A Science for Society* (New York: McGraw-Hill Book Company, 1973).

[4] Stent, "The DNA Double Helix," note 2, p. xviii.

Advances in recombinant DNA techniques[5] in the early 1970s provided the basis for analyzing the DNA of individuals for identification purposes. Scientists understood that the cells of each species contain the same number of chromosomes (all genetically normal human beings, for example, have 46 chromosomes in each body cell, half of which are inherited from each parent) and that within a single organism, the DNA of each cell is identical (with the exception of the sperm and ovum). Any one cell, therefore, could provide a match with another cell from the same person. DNA found in human hair follicles, for example, will be identical to DNA found in blood or tissue of the same person.

In contrast to comparing the DNA taken from the hair and blood of the same person, a more difficult task was comparing the similarities and differences between one person's DNA and that of another person. Since similarities among humans far outnumber differences, the vast percentage of DNA in a cell will be common to the species. Nevertheless, each individual (with the exception of identical twins) has DNA strands that are unique to that person.[6] In the early 1980s a geneticist at Britain's Leicester University, Alec Jeffreys, developed a technique of "DNA fingerprinting," a practical test for identifying these variable strands of DNA for the purpose of identifying an individual.[7] This technique was first applied in an immigration/paternity case, and then to a celebrated crime investigation.[8]

DNA Testing Methodologies

DNA testing includes two major components when used for forensic purposes. The first involves the molecular biological techniques that allow analysis to directly examine a DNA sample. The second component has to do with population genetics — how to interpret DNA tests to calculate the degree to which different samples are associated. Such population studies help to determine the results of the analytical work. This section seeks to describe the analytical processes used to directly examine the DNA sample.

DNA tests investigate and analyze the structure and inheritance patterns of DNA. Many methodologies exist, and new ones are constantly being developed. The particular test used will depend on the quantity and quality of the sample, the objective of the test and the preferences of the laboratory conducting the procedure. All tests, however, are designed to isolate certain nucleotide sequences — the polymorphic segments of the DNA molecule carrying marked, recurring distinctions — and these variable segments provide the basis for discriminating among individuals' DNA.

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[5] Recombinant DNA technology refers to procedures in which a new DNA molecule is formed through the union of different DNA molecules. This technology also refers to genetic engineering wherein DNA molecules are cut and spliced into new configurations. See U.S. Congress, Office of Technology Assessment, *Genetic Witness: Forensic Uses of DNA Tests*, OTA-BA-438 (Washington, D.C.: U.S. Government Printing Office, July 1990) p. 184, and William C. Thompson and Simon Ford, "DNA Typing: Acceptance and Weight of the New Genetic Identification Tests," *Virginia Law Review* 75 (February 1989): p. 61, note 73.

[6] There are estimated to be over 3 billion nucleotides in the human chromosome, and large quantities of nucleotides in a DNA molecule are the same for each person. Certain segments of nucleotides in a DNA sequence, however, vary greatly from one individual to another, repeating themselves over and over again. The function of these short sequences of nucleotides, called tandem repeats, is not understood. Nevertheless, their variable nature, or polymorphism, allows them to be used to distinguish identity.

[7] William C. Thompson and Simon Ford, "DNA Typing: Promising Forensic Technique Needs Additional Validation," *Trial* (September 1988): 56. Also see A.J. Jeffreys, V. Wilson and S.L. Thein, "Individual-specific 'Fingerprints' of Human DNA," 316 *Nature* (July 4, 1985): 76-79.

[8] For a nonfiction account of the 1983-86 rape/murder case in Leicester County, England, see Joseph Wambaugh, *The Blooding*, Perigord Press (New York: William Morrow and Company, 1989). In another case, on November 13, 1987, the Bristol Crown Court (England) became the first in the world to convict on DNA evidence when it sentenced Robert Melias to eight years in jail for rape. See Reuters (London), "British Court Convicts Rapist in First Genetic Fingerprinting," November 13, 1987.

In a forensic environment, two common analytical methods used to detect the polymorphic DNA in human samples are Restriction Fragment Length Polymorphism (RFLP) and Polymerase Chain Reaction (PCR)-based techniques. The RFLP method identifies fragments of the DNA chain which contain the polymorphic segments, produces a DNA "print" of the fragments, and measures the fragment lengths. The PCR-based methods seek to determine the presence of specific alleles (alternative forms of genes which occur in different individuals), thus indicating specific genetic characteristics.

— Restriction Fragment Length Polymorphism

Restriction Fragment Length Polymorphism (RFLP) requires the presence of as little as 50 to 100 nanograms of DNA — an amount of DNA that may be present in a single hair follicle. The distinct stages in developing a DNA "print" using RFLP will be portrayed here by describing the analysis of a blood sample.

First, white cells containing the DNA are separated from the blood sample by use of a centrifuge, and the cells are ruptured to extract the DNA strands. The DNA strands are then cut, or digested, using restriction endonucleases (REs) — enzymes derived from bacteria that catalyze the cutting process. A particular enzyme will cut the DNA strands at the same nucleotide sequence (restriction site) each time.[9] For example, REs Hae III recognizes the nucleotide sequence GGCC and makes a cut between the G and the C. By cutting a person's DNA in the same place, the several alternate forms (alleles) of a gene are separated from each other. A specific allele will be of the same size and molecular weight as others of its type. The polymorphism, or individuality, of a person will be detected on the basis of differences in DNA fragment lengths.

At this point in the process, all of the DNA fragments are mixed together. Using a technique called electrophoresis, the polymorphic fragments are separated by length. The DNA is placed at one end of a plate containing agarose gel, with a positive electrode placed at the other end. DNA carries a negative electrical charge, therefore the DNA will move toward the positive electrode. The distance that an individual fragment of DNA travels depends on the amount of its electrical charge, which is determined by its length and molecular weight.[10] Thus, fragments of the same length and weight will travel the same distance but large DNA fragments will move more slowly than smaller fragments. This process sorts the DNA into bands based on length and weight and these length-dependent bands are the basis for DNA identification.

After electrophoresis, the next step calls for transferring the DNA fragments in the gel to a nylon membrane. In a technique called "Southern Blotting," a chemical reagent (such as sodium hydroxide) acts as a transfer solution and a means to separate the double-strand fragments into single-strand fragments. Using the zipper analogy, the strands are unzipped, exposing the A, T, C and G building blocks. The unzipped DNA fragments are now fixed on the nylon membrane, where they are exposed to radioactive DNA probes — laboratory-developed (thus, known sequences), DNA nucleotide fragments which carry a radioactive "marker." The probes seek out the sequence that they match and attach themselves to the complementary split

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9 Using a restriction enzyme is the first step in establishing a DNA print based on size polymorphisms. The DNA pattern revealed depends on the specific restriction enzyme employed; in the absence of a standard enzyme/probes system, individual laboratories may use different enzymes and thus patterns developed at different laboratories may not be comparable. Most public forensic laboratories, however, are using the Hae III restriction enzyme and associated probes.

10 The distance traveled also depends on the consistency of the gel, the temperature and humidity of the laboratory, and other experimental conditions. In cases where the two samples are tested simultaneously, many of these factors "cancel out," but in other cases special care must be taken to assure consistent experimental conditions, and to quantify the effect of minor differences in these conditions.

DNA strands. A split strand of A T T G C A, for example, will bind with T A A C G T.[11]

The probes are made radioactive so that the DNA sequences to which they become attached can be visibly tracked. The nylon membrane is placed against a sheet of x-ray film and exposed for several days. When the film is developed, black bands will appear at the points where the radioactive DNA probes have combined with the sample DNA. The result, called an "autoradiograph" or "autorad" looks much like the bar codes increasingly found on items in supermarkets and department stores.

The final step is the band pattern comparison. Genetic differences between individuals will be identified by differences in the location and distribution of the band patterns, which correspond to the length of the DNA fragments present. The actual measurement of the band patterns being compared can be done manually or by machine, but often DNA identification depends upon manual examination and the expert judgment of a trained practitioner.

— Polymerase Chain Reaction-based Techniques

Polymerase Chain Reaction (PCR) is not only an analytical tool, but also an amplification technique often used when the available amount of DNA material is insufficient for proper analysis, or when the sample is degraded by chemical impurities or damaged by environmental conditions. PCR is an *in vitro* process that causes a specific gene sequence to repeatedly duplicate itself, mimicking its natural replication process. Short pieces of purified DNA, called primers, are used to build a foundation upon which the sample DNA can build. The primers must have sequences that complement the DNA flanking the specific segment to be amplified. The sample DNA is heated to separate the double helix, producing two single strands. By then lowering the temperature, copies of the primers bind to the DNA sample's flanking sequences. A heat-stable DNA polymerase (an enzyme) is then introduced to the DNA sample causing the primers to synthesize complementary strands of each of the single strands. This process is repeated for generally 25 cycles, amplifying the original DNA sequence approximately a million times. The amplified DNA can then be analyzed by any one of several methodologies.[12]

Following are brief descriptions of two of the methods with potential for use in the forensic environment.

Allele-Specific Oligonucleotide Probes

An allele is one of several alternate forms of a gene concerned with the same trait or characteristic and occupying a given locus on a chromosome. At the locus for eye color, for example, there may be alleles resulting in brown or green eyes, for the alleles are inherited separately from each parent. Instead of measuring the length of DNA fragments as in the RFLP technique, allele-specific probes are used to determine whether a specific allele is present — the allele-specific oligonucleotide (ASO) probes try to isolate a specified DNA segment. This process is often conducted in conjunction with PCR.

The DNA is first extracted from the sample of blood, semen or tissue, and is placed on a nylon membrane where allele-specific probes are introduced. A process called "dot blotting" stabilizes the sample and autoradiography or fluorescent labelling makes visible the points at which hybridization (connection with the probe) has occurred. There is also a reverse-ASO method which affixes the specific oligonucleotide to a membrane and uses a signal derived from the amplified DNA.

In the allele-specific technique, the spots where the DNA fragments have combined indicate a "yes" answer, that is, the targeted alleles are present. Because a high percentage of the population may carry a given allele, however, the analysis must use a series of different probes to narrow the percentage of the population that could carry the polymorphic fragments present in the DNA sample.

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[11] In forensic applications, two classes of probes are used: multilocus and single locus. Multilocus probes bind to several locations and reveal a complex DNA band pattern, whereas the single locus probes identify one or just a few bands out of the many bound to the Southern blot. Single-locus RFLP analysis is the methodology most used in forensic cases.

[12] See Jean L. Marx, "Multiplying Genes by Leaps and Bounds," 240 *Science* (June 1988): 1408. Also, Office of Technology Assessment, *Genetic Witness*, note 5, pp. 48-49.

Amplification Fragment Length Polymorphism

Amplification Fragment Length Polymorphism (AMPFLP) is a more recently developed method which detects fragment length polymorphisms using the polymerase chain reaction (PCR) amplification technology. Similar to RFLP analysis, this PCR-based approach involves first isolating DNA, but, rather than fragmenting the DNA with a restriction enzyme, the PCR-amplification technique is used to produce millions of copies of only the specific portion of the chromosome containing the fragment length polymorphism.

The PCR-based techniques do not provide the same degree of discrimination as the RFLP analysis. Rather, allele-specific techniques are exclusionary; they can provide an indication that a given individual does not have alleles matching those found at a crime scene. If the suspect's alleles do match those found at a crime scene, however, then the technique places the suspect in a limited population group that shares those alleles.

Functions Of DNA Testing

DNA testing provides a basis for positive identification, but it is not expected to become a suitable technology for validating identification in security settings. DNA analysis would be inappropriate in situations where a nearly immediate determination must be made as to whether a person seeking entry to a particular area, or seeking to conduct a particular transaction is, in fact, authorized to do so. The chemical analysis required to make a DNA comparison takes weeks, not minutes. DNA testing is increasingly used to determine paternity and, in forensic settings, it has been most prolifically and successfully used to identify or exonerate a suspect.

— Paternity Determinations

In determining paternity, DNA has proven to be extraordinarily useful. Each chromosome contains nucleotides identical to those of each parent, as well as the nucleotides that distinguish the individuality of the person. If samples from the child and from one of the parents are available, the nucleotides of the child that are different from the known parent's DNA must have come from the unknown parent's DNA. If a sample from the suspected, but unknown, parent supplies all the "missing" nucleotides without any superfluous nucleotides, one can conclude that the suspected individual is, in fact, the other parent.

DNA testing has already been used in cases involving questions of paternity and criminal conduct. Suffolk County, New York prosecutors, for example, charged a teenager with hiring a classmate to murder her father. The defense claimed that the deceased father had repeatedly sexually abused his daughter and was the father of her child. A DNA test was performed using tissue samples from the murdered father. The test indicated that the dead man did not father his daughter's child.[13]

— Identification of Suspects

The forensic promise of DNA typing is substantial. Samples of human skin, hair follicles, blood, semen or saliva containing cells or other tissues found on a crime victim or at a crime scene can be examined to identify the DNA pattern. That pattern can be compared with DNA from a suspect to make a "positive identification," or to exonerate a suspect. Recent advances in DNA examination techniques sometimes permit the use of extraordinarily small samples of human tissues or fluids, such as a few hairs or a single spot of blood.[14] Moreover, DNA is durable and is relatively resistant to adverse environmental conditions such as heat or moisture. DNA degrades slowly in a decomposing body, lasting sometimes for years and allowing samples to be analyzed for some time after the death of an individual. Although some experts debate the percentage of useable tissue and fluid samples that is retrieved from all crime scenes, DNA analysis will have the greatest effect on violent crime cases, such as murder and rape where hair, blood, semen or tissue evidence is frequently found.[15]

A 1990 study conducted by the Congressional Office of Technology Assessment (OTA) found that DNA tests have been used in over 2,000 criminal investigations in 49 states and the District of Columbia. As of January 1990, the OTA study found

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[13] Sana Siwolop, *et al.*, "Collaring Criminals with DNA 'Fingerprints,' " *Business Week*, December 1, 1986, p. 128.

[14] Debra Cassens Moss, "DNA — The New Fingerprints," 74 *A.B.A. Journal*, May 1988, p. 67.

[15] Ted Gest, "Convicted by Their Own Genes," *U.S. News and World Report*, October 31, 1988, p. 70.

that DNA evidence has been admitted in at least 185 court cases in 38 states.[16]

Between 1987 and 1990 alone, DNA typing has been used to "solve" a number of celebrated crimes. One of the first widely-reported uses of DNA typing in a criminal investigation occurred in Britain. A suspect, who had confessed to the rape and murder of two young women, was exonerated when DNA tests demonstrated that his DNA did not match that found in traces of semen and blood on the victims. The tests did indicate, however, that both crimes were committed by the same person. According to the London *Times*, police in Leicester County, England, then took blood samples from more than 5,000 males in three villages before identifying the murderer and rapist of the two teenagers.[17] The first appellate case in the United States in which conviction relied heavily upon DNA evidence involved Tommy Lee Andrews, who was sentenced to 78 years in prison for rape after a test indicated that the DNA in semen traces found on a rape victim matched the DNA pattern obtained from an examination of Andrews' blood.[18]

On May 23, 1988, the "MacNeil/Lehrer Newshour" broadcast the story of the arrest and conviction of Fernando Martinez. Martinez broke into a woman's home, shut off the electrical power to the house and raped the woman. Because the woman was legally blind, she was unable to make a visual identification. A latent fingerprint was found on the electric meter, and the print matched Martinez's print. Martinez, however, worked for the sanitation department and collected garbage from the rape victim's house twice a week, thus the fact that his fingerprint was found on the meter box was inconclusive. A DNA test was performed comparing the DNA pattern from the semen left by the rapist with the DNA pattern from a sample of Martinez's blood. The DNA match was judged to be a positive identification.[19]

In addition to DNA testing for purposes of criminal identification and prosecution, there are other potential forensic uses of DNA testing. These uses include identification in situations concerning unknown remains; human rights abuse cases; immigration; missing children; incidents with multiple and traumatic casualties (such as plane crashes), settlement of contested wills and estates; and baby swapping.[20]

Forensic Limitations of DNA Testing

— Infancy of DNA Databanks

For all of its forensic promise, the current state-of-the-art with respect to DNA testing has several problems. The time required to process a DNA sample is lengthy, it is expensive and it requires highly skilled analysts. Another glaring weakness is that DNA testing, unlike fingerprints used in conjunction with an automated fingerprint identification system (AFIS), cannot be used for "cold searching," i.e., to identify candidate suspects, without an automated DNA databank — a new and somewhat controversial technology.

When tissue or fluid samples suitable for DNA testing are

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16 See generally, Office of Technology Assessment, *Genetic Witness*, note 5, p. 14, 98-99, and Appendix A. Vermont is included in this count because in November 1989, an admissibility hearing was pending in a rape case. In November 1990, U.S. District Judge Franklin S. Billings, Jr. of the U.S. District Court for the District of Vermont wrote "...the government has established that [DNA] profiling is highly reliable and such reliability outweighs the increased potential for unfair prejudice or confusion," thus denying a motion by the defense to ban the evidence in the case of *U.S. v. Jakobetz*, No. 89-65. See *Criminal Justice Newsletter* 21 (November 1, 1990): 3-4.

17 Craig Seton, "Life for Sex Killer Who Sent Decoy to Take Genetic Test," *The Times* (London), January 23, 1988, p. 3. See Tyler Marshall, "New Technique Leads to Charges in British Rape-Slaying; 'Genetic Fingerprints' Snare a Suspect," *Los Angeles Times*, September 22, 1987, Part 1, p. 6.

18 *State v. Andrews*, Case No. 87-1565 (9th Cir. Ct., Orange Co., Fla., Div. 15, Nov. 6, 1987) *aff'd*, 533 So. 2d 841 (Fla. Dist. Ct. App. 1988). See Carla Robbins, *et al.*, "Cells That Convict," *U.S. News & World Report*, February 22, 1988, p.11.

19 See *Martinez v. Florida*, 549 So. 2d 694 (Fla. 1989). Transcript of the "MacNeil/Lehrer Newshour," May 23, 1988, distributed by Education Broadcasting and GWETA.

20 Office of Technology Assessment, *Genetic Witness*, note 5, p. 51.

recovered from a crime scene, the sample is not immediately useful unless a suspect is already in custody. If this is the case, DNA from the crime scene sample can be compared with the DNA test results from a tissue or fluid sample obtained from the suspect. If, on the other hand, a suspect has not been identified, the crime scene test results are of little use. In order to use DNA evidence to attempt to identify candidate suspects, the crime scene test results would have to be compared with test results from tissue or fluid samples maintained in a DNA databank.

The idea of maintaining libraries of DNA samples along with automated indices of their RFLP patterns is relatively new and is replete with the problems associated with legislating and implementing a highly sophisticated, but novel, technology. The first DNA databank legislation was adopted by King County, Washington in 1988. Seeking to build a "library of identification data," the county passed an ordinance requiring anyone convicted of a felony defined as a sex offense, to provide a blood sample for the purpose of DNA identification analysis.[21] In addition, at last count 11 states, including Arizona, California, Colorado, Florida, Illinois, Iowa, Minnesota, Nevada, South Dakota, Virginia and Washington are building databanks containing DNA information about offenders convicted of violent or, more often, sexual crimes.[22] California's legislation, for instance, requires individuals convicted of assault with the intent to commit rape or sodomy or oral copulation, as well as certain other sexual crimes, to provide blood specimens and saliva samples.[23] Legislation approved by Virginia's Governor on April 9, 1990, requires that any person convicted of a felony who is in custody after July 1, 1990, must provide a blood sample for DNA analysis prior to release. Those convicted of a felony, but who are not incarcerated, must also submit to a DNA analysis of a blood sample as a condition of their sentence.[24]

New York is among a number of States considering the establishment of DNA databanks using blood and saliva samples of individuals convicted of violent crimes.[25] New York's DNA Advisory Panel recently recommended to the Governor that, "legislation be enacted mandating that all persons convicted of violent sex crimes or other designated offenses be required to give specimens of their DNA to an authorized agency."[26]

— Private versus Government Laboratories

Another factor limiting the utility of DNA testing has been the scarcity of government laboratories performing DNA analysis. Until quite recently, DNA testing has been the province of a few private, commercial laboratories. The three laboratories principally involved are Cellmark Diagnostics, a firm in Germantown, Maryland; Lifecodes Corporation in Valhalla, New York; and Forensic Science Associates in Richmond, California (which is licensed by Cetus Corporation of Emeryville, California to conduct tests for forensic applications).

According to some observers, the key role played by private laboratories has caused problems. At present, for instance, there is not a DNA licensing

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21 KING COUNTY, WASHINGTON ORDINANCES § 12.140.010 - 12.140.070 (1988). The State of Washington is also establishing a DNA databank.

22 Office of Technology Assessment, *Genetic Witness*, note 5, p. 20; Donna Gehrke, "Metro leads way with new DNA lab." *Miami Herald*, November 27, 1989, p. 1B.

23 CAL. PEN. CODE § 290.2.

24 VA. CODE ANN. § 19.2-310.2 (1990). The constitutionality of the law is currently being challenged in a class action suit filed by convicted, non-violent felons.

25 See "New York State considers legislating DNA-fingerprinting for forensics," 8 *Biotechnology Newswatch* (October 17, 1988): 8.

26 "DNA: Report of New York State Forensic DNA Analysis Panel," unpublished report commissioned by John J. Poklemba, Director of Criminal Justice and Commissioner of the Division of Criminal Justice Services, September 6, 1989, p. 33.

or certification process in place for private laboratories.[27] Some critics contend that there are questions about the reliability of commercial laboratory testing. In addition, DNA testing by private laboratories has been expensive, costing anywhere from a few hundred dollars to as much as $1,000.[28] Critics also charge that the waiting period for the return of test results is as much as six weeks for tests conducted using the RFLP technique. Other experts question, however, whether any laboratories, public or private, could improve much upon these turnaround times.

In the last couple of years, several government laboratories have begun to conduct DNA tests. In late 1988, for example, the FBI opened DNA laboratories in Quantico, Virginia and Washington, D.C. and began accepting test orders from State and local law enforcement officials.[29] The Office of Technology Assessment's 1990 report on DNA found that over 75 percent of State and local crime laboratories believe that DNA testing is an integral part of their mission, and 46 percent said that they have plans to implement on-site DNA testing by 1992.[30] OTA summarized this level of interest as follows:

> Considering how recently DNA testing has been introduced, interest and involvement in this new technology at the State and local crime laboratory level are extraordinary.[31]

— Funding

Notwithstanding the level of interest in DNA testing, many State and local laboratories may have difficulty finding the financial and other resources necessary to initiate an ambitious program of DNA testing.[32] In May 1989, the Virginia Division of Forensic Science became the first State forensic laboratory to accept cases from all in-state law enforcement agencies.[33] California, Illinois, North Carolina, Maryland, Georgia, Minnesota, Iowa and Florida are in various stages of establishing DNA testing facilities.[34]

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[27] The American Society of Crime Laboratory Directors (ASCLD) and the ASCLD/Accreditation Board met in September 1990, and with near unanimity, both organizations passed resolutions requiring the accreditation process for forensic laboratories engaged in DNA testing to include regular proficiency testing. This accreditation will be available to all public and private forensic DNA laboratories.

During the 1990 legislative session, both houses of the New York State Legislature passed Assembly Bill No. 11073 that would have required statewide accreditation of crime laboratories performing forensic DNA testing. In addition, the legislation would have established a "Scientific Review Board" to assess the reliability of DNA testing methodologies. Finally, the bill would have established a New York State DNA Advisory Committee to advise the Governor and other State officials on DNA matters. The bill was "recalled" from the Governor's Office and, as of the fall of 1990, prospects for eventual adoption are uncertain. Letter to SEARCH Group Inc. from M. Dawn Herkenham, Counsel, New York State Division of Criminal Justice Services, September 3, 1990.

[28] Gest, "Convicted by Their Own Genes," note 15.

[29] Tom Watson, "FBI Adopts DNA Test At Pioneer's Expense; Firm Must Find New Markets," *Legal Times*, March 27, 1989, p. 11; U.S., Department of Justice, National Institute of Justice, Technology Assessment Program Bulletin, *DNA Profiling: For Positive Identification* (September 1990):6.

[30] Office of Technology Assessment, *Genetic Witness*, note 5, p. 147-148.

[31] Ibid., 147.

[32] Ibid., 30.

[33] A year earlier, in 1988, the Virginia General Assembly had appropriated funds to establish a DNA laboratory. "Bureau of Forensic Science and the DNA 'Revolution,' " Virginia Department of Criminal Justices Services, *Criminal Justice Information Systems and Technology Newsletter*, June 1988, p. 1.

[34] See MINN. STAT. § 299 C. 155 (1989); and IOWA CODE ANN. § 13.10 (West 1989); also see Gehrke, "Metro leads way," note 22, p. 1B. On September 8, 1989, Illinois adopted Pub. Act 86-881 providing authority for the collection of blood and saliva samples from certain types of sex offenders. North Carolina opened a DNA testing facility in September 1989 and Georgia did the same in January 1991. January 7, 1991, telephone interview with Mr. Mark Nelson, Serology Unit, North Carolina State Bureau of Investigations; and January 8, 1991, telephone interview with Mr. George Herrin, Serology/DNA Unit, Division of Forensic Sciences, Georgia Bureau of Investigations.

Part II
Issues Regarding DNA Testing

Despite its potential, DNA testing is by no means without controversy. Indeed, DNA testing raises difficult questions that generally can be classified in terms of four issues: invasiveness, reliability, establishment and use of databanks and dissemination.

- DNA testing inevitably requires taking blood or other bodily fluids or tissue from a subject — often without the subject's consent. Is the very process of DNA testing a violation of privacy? Does it violate constitutional (Fourth or Fifth Amendment) rights? Does it make a difference if samples are collected for purposes of a databank? At a minimum, is the process inconsistent with public policy principles?

- DNA testing involves a highly sophisticated laboratory process which was considered beyond the state-of-the-art even a few years ago. Is the process reliable? What are the problems with admitting the results of DNA tests as evidence in court? Are there circumstances that present special risks?

- Several states are in the process of establishing DNA databanks which will enable analysts to test and compare fluids or tissues taken from crime scenes with "DNA prints" on file, for the purpose of identifying potential suspects. Do we need such databanks? Does the establishment of DNA databanks have an adverse effect on individual privacy? Who should be required to contribute fluid or tissue samples to such databanks? Should the samples themselves be retained or only the digitized test results?

- Most early proposals for DNA databanks contemplate that the databanks will be used for criminal justice purposes only. One commercial laboratory, however, promotes using a DNA databank to store information on children in the event that they are kidnapped. Are there legitimate noncriminal justice uses such as national security; medical diagnostics; research; employment; and insurance purposes; or genetic screening and profiling?

Invasiveness

Forensic DNA testing — either to match a suspect's DNA pattern against that of a crime scene specimen or for purposes of building a DNA databank — involves the taking of body fluids containing nucleus cells (customarily a blood specimen or a saliva sample) or a tissue sample (customarily hair follicle samples). If the subject does not consent to this process, does the compulsory taking of the specimen raise privacy or other legal or policy considerations?

— Obtaining DNA Specimens From a Suspect

There are several legal considerations with respect to obtaining DNA specimens from a suspect. The Fourth Amendment to the Constitution is one of these.[35] The Supreme Court has held that the compulsory withdrawal of blood constitutes a search within the meaning of the Fourth Amendment.[36] Accordingly, law enforcement officials may be required to obtain a search warrant prior to obtaining a blood sample. In order to obtain a search warrant, law enforcement officials are required to show that they have probable cause to believe that the suspect has committed a crime.

A few courts require a showing of more than just probable cause. The New York State Court of Appeals, for example, held that in order to permit the taking of samples of blood, hair or other human materials, law enforcement officials must establish: "(1) probable cause to believe the suspect has committed the crime, (2) a clear indication that relevant material evidence will be found, and (3) the

[35] The Fourth Amendment states: "The right of the people to be secure in their persons, houses, papers, and effects against unreasonable searches and seizures shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized." *Constitution*, amend. IV.

[36] *Schmerber v. State of California*, 384 U.S. 757, 764-65 (1966).

method used to secure it is safe and reliable."[37]

A New York county court recently applied the court of appeals' standard in upholding the compulsory taking of a blood specimen from an individual suspected of raping and murdering a mentally-retarded woman. In *People v. Wesley*, DNA from the victim had already been matched with DNA retrieved from blood stains on the suspect's clothing. The prosecution sought a warrant to test the suspect's DNA to further verify that the blood on his clothing was not his own blood. The court held that a DNA specimen, in the form of a blood sample, could be extracted in a medically safe way and that such a process would not be "unduly intrusive."[38]

Literally dozens of courts have held that the taking of blood or urine samples (generally in the context of an investigation for drug or alcohol use) is intrusive and a search within the meaning of the Fourth Amendment.[39] It has also been held that breath tests are searches within the meaning of the Fourth Amendment.[40] It is likely that a court would find that the taking of other types of specimens suitable for DNA testing, such as saliva samples or body hair, is also intrusive in the sense that the nonconsensual taking constitutes a search.

The question of intrusiveness is important because were a court to find that the taking of a DNA specimen were not intrusive, a search would not occur and the State could require the taking of the DNA specimen on less than probable cause.

"Dragnet" Testing Impermissible

Taken to its logical extreme, police could use "dragnet" techniques to obtain blood samples from literally thousands of *potential* suspects to test against DNA prints derived from fluid or tissue samples taken from crime scenes. This is precisely what the police did — as noted in Part I — in three villages in Leicester County, England. In 1983, a teenage girl from the village of Narborough was raped and murdered. Three years later, another young woman from the adjoining village of Enderby suffered the same fate. DNA testing of semen stains indicated that the same individual committed both crimes.

After exhausting all leads and suspects, the police did something remarkable. They "asked" males born between 1953 and 1970 who lived in one of three adjoining villages — Narborough, Enderby and Littlethorpe — to voluntarily provide blood samples. Those samples that matched the blood type found at the crime scene were then subjected to DNA analysis.[41] No match was found. Later, however, a man confessed that he had provided a blood sample for a fellow worker, Colin Pitchfork of Littlethorpe. When Mr. Pitchfork's real blood was tested, a match was made.[42]

Dragnet DNA testing of the type used in the Leicester County case (putting aside for the moment that the subjects theoretically provided blood samples on a voluntary basis) would be barred in the United States under virtually any reading of the Fourth Amendment. Nevertheless, in recent years courts and legislatures have relaxed the probable cause standard as it applies to searches and detentions that are conducted for purposes of identification.

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[37] *In re Abe A.*, 56 N.Y. 2d 288, 291, 437 N.E.2d 265, 452 N.Y.S. 2d 6 (1982); see also *People v. Wesley*, 533 N.Y.S.2d 643, 659 (Albany Co. Ct. 1988).

[38] 533 N.Y.S.2d at 659.

[39] See *Railway Labor Executives' Association v. Burnley*, 839 F.2d 575, 580 (9th Cir. 1988) and the cases cited therein.

[40] See, e.g., *Burnett v. Municipality of Anchorage*, 800 F.2d 1447, 1449 (9th Cir. 1986).

[41] Tyler Marshall, "Genetic Evidence Aids Crime Probe," *The Sacramento Bee*, March 12, 1987, p. A26.

[42] Seton, "Life for Sex Killer," note 17. See also, Clare M. Tande, "DNA Typing: A New Investigatory Tool," *Duke Law Journal* (April 1989).

Particularized Suspicion May Be Adequate

In 1969, the Supreme Court in *dictum* set the stage for reexamining the need for probable cause. In *Davis v. Mississippi*, the Court held that the prolonged detention of suspects for fingerprinting on less than probable cause violated the Fourth Amendment.[43] The Court speculated, however, that "because of the unique nature of the fingerprinting process... detentions might, under narrowly defined circumstances, be found to comply with the Fourth Amendment even though there is no probable cause in the traditional sense."[44]

In the so-called "stop and frisk" context, the Supreme Court developed a complementary doctrine. The Court's 1968 decision in *Terry v. Ohio* held that a police officer could temporarily detain an individual on the street for purposes of establishing identity and determining that the individual was not armed on the basis of "reasonable suspicion" rather than probable cause.[45] Both *Terry* and *Davis* are good law today.

In a 1985 opinion, *Hayes v. Florida*, the Court applied *Davis* to hold that an individual's forcible removal to a police station for fingerprinting is sufficiently intrusive to constitute a search and thus requires probable cause.[46] At the same time, however, the Court emphasized that both *Davis* and *Terry* support the view that, "if there are articulable facts supporting a reasonable suspicion that a person has committed a criminal offense, that person may be stopped in order to identify him, to question him briefly, or to detain him briefly, while attempting to obtain additional information."[47]

In reaction to both the *Davis dictum* and the holdings in *Terry v. Ohio* and its progeny, nine states have adopted statutes that permit the police, on the basis of reasonable suspicion and thus on something less than probable cause, to detain individuals temporarily in order to determine their identity.[48] The State courts have split as to whether these statutory schemes pass constitutional muster.[49]

More Stringent Standard for DNA Searches?

An argument can be made, of course, that even if fingerprinting or photographing can be constitutionally justified on less than probable cause, the nonconsensual taking of blood or tissue samples is more intrusive and thus cannot rest on a standard of less than probable cause. As noted earlier, the Supreme Court's decision in *Schmerber* indicates that the nonconsensual taking of blood is indeed sufficiently intrusive so as to constitute a search. On the other hand, the Supreme Court, as early as 1957, characterized the taking of blood as a "routine" event.

> The blood test procedure has become routine in our everyday life. It is a ritual for those going into the military service as well as those applying for marriage licenses. Many colleges require such tests before permitting entrance and literally millions of us have voluntarily gone through the same, though a longer, routine in becoming blood donors. Likewise, we note that a majority of our States have either enacted statutes in some form authorizing tests

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[43] 394 U.S. 721, 727 (1969).

[44] Ibid., see also discussion in Tande, "DNA Typing," note 42, p. 486.

[45] 392 U.S. 1, 21 (1968).

[46] 470 U.S. 811, 815-817.

[47] Ibid., 816.

[48] ALASKA R. CT. 16(c)(1)-(2) (1988); ARIZ. REV. STAT. ANN. 13-3905 (1978); COLO. R. CRIM. P. 41.1 (1984); IDAHO CODE ANN. 19-625 (1987); IOWA CODE ANN. 810.1-2 (West 1978 & Supp. 1988); NEB. REV. STAT. 29-3301-3307 (1985); N.C. GEN. STAT. §§ 15A-271-282 (1983); UTAH CODE ANN. 77-8-1-4 (1982); VT. R. CRIM. P. 41.1 (1983), as cited in Tande, "DNA Typing," note 42, p. 119.

The Judicial Conference considered and rejected a change in the Federal Rules of Criminal Procedure that would have authorized Federal magistrates to issue orders on the basis of reasonable suspicion, permitting Federal law enforcement officials to detain suspects for any of the following identification procedures: "fingerprints, palm prints, footprint measurements, blood specimens, urine specimens, saliva samples, hair samples or other reasonable physical or medical examination..." Tande, "DNA Typing," note 42, p. 489.

[49] Compare *People v. Madson*, 638 P.2d 18, 31-32 (Colo. 1981), and *State v. Grijalva*, 111 Ariz. 476, 533 P.2d 533, 534 (1975), *cert. denied* 423 U.S. 873 (1975), with *State v. Evans*, 338 N.W. 2d 788, 792-93 (Neb. 1983), and *In re Abe A.*, note 37.

> of this nature or permit findings so obtained to be admitted in evidence. We therefore conclude that a blood test taken by a skilled technician is not such "conduct that shocks the conscience"... nor such a method of obtaining evidence that it offends a "sense of justice."[50] [citations omitted]

Thus, while the issue is by no means free of doubt, it is entirely possible that a limited detention of a criminal suspect for purposes of obtaining a blood sample for DNA testing might be upheld on the basis of reasonable suspicion or some other kind of particularized suspicion short of probable cause.[51]

[50] *Breithaupt v. Abram*, 352 U.S. 432, 436 (1957).

[51] The Fifth Amendment also provides a protection for criminal defendants which, at first blush, would seem applicable to DNA testing. The Fifth Amendment prohibits the use of coerced confessions or other types of compelled self-incrimination. In *Schmerber v. State of California*, however, the Supreme Court made clear that the Fifth Amendment's privilege against self-incrimination applies only to "testimonial" information, and not to the compelled production of biological material such as blood or other body fluids. The Court concluded that evidence involving analysis of blood withdrawn at a hospital by a physician over the suspect's objection but after the suspect's arrest for driving while under the influence, was neither "testimony" nor "evidence related to some communication or writing" and therefore was not inadmissible on the theory that it violated the Fifth Amendment. 384 U.S. at 764-65. *Schmerber* continues to be good law.

— Obtaining DNA Specimens for Databank Purposes

The standard by which the constitutionality of a search is judged changes if the search is not for purposes of identifying and apprehending a suspect, but rather for administrative purposes. One such administrative purpose could be building a databank containing DNA test results of certain individuals who have previously been convicted of designated offenses. In *Camara v. Municipal Court*, the Supreme Court first addressed whether an administrative search — in that case for health and fire prevention inspections — had to be based upon probable cause to believe that the subject had committed a crime.[52] Understandably, the Court concluded that health and fire inspections and other kinds of administrative searches could seldom, if ever, meet a test based upon individualized suspicion. By its very nature and purpose, an administrative search does not involve a particularized suspicion that a crime has been committed.

In order to reconcile this reality with the Fourth Amendment's express language, the Court noted that the Amendment's protections only attach to "unreasonable" searches. The Court found that health and fire inspections of the type at issue in *Camara* are reasonable and thus the probable cause and warrant protections do not attach. In doing so, however, the Court balanced the public interest served by these searches against the personal interest — in that case privacy — affected by the searches.

[52] 387 U.S. 523, 536-37 (1967).

The Court concluded that the degree of privacy invasion was minimal and that the interests served by the inspections were compelling.

Administrative Searches Judged Using Rational Basis Test

Courts still apply the *Camara* approach to administrative searches — including "searches" for purposes of determining identity. Where the administrative search is only minimally intrusive, the search will meet Fourth Amendment standards of reasonableness provided that the government can demonstrate that it has a "rational basis" for requiring the search, i.e., there is a reasonable relationship between the action in question and the accomplishment of a legitimate governmental objective.[53]

In *Utility Workers of America v. Nuclear Regulatory Commission*, for instance, a Federal district court upheld a statute requiring the fingerprinting of all workers at a nuclear power facility on the theory that fingerprinting is minimally intrusive and thus the government need only demonstrate a rational basis for the search.

> Whatever the outer limits of the right to privacy, clearly it cannot be extended to apply to a procedure the Supreme Court regards as only minimally intrusive. Enhanced protection has been held to apply only to such fundamental decisions as contraception and family living arrangements.

[53] *Jacobucci v. City of Newport*, 785 F.2d 1354, 1355-56 (6th Cir. 1986), *rev'd on other grounds*, 479 U.S. 921 (1986).

> Fingerprints ... have not been held to merit the same level of constitutional concern.[54]

Inasmuch as the court found that fingerprints do not merit enhanced protection, the court concluded that in order to justify fingerprinting, it is merely necessary for the Congress or a legislature to show that the fingerprinting bears a rational relationship to a legitimate governmental objective. Ensuring the security of nuclear reactors clearly met this test.

Blood Sample Searches Often Judged Using Compelling State Interest Test

In two recent companion cases, *National Treasury Employees Union v. Von Raab*,[55] and *Skinner v. Railway Executives' Association*,[56] the Supreme Court reaffirmed that for an administrative search to be reasonable under the Fourth Amendment, the search need not depend upon a showing of probable cause or individualized suspicion. On the other hand, in both cases, the Court found that the compulsory taking of urine or blood samples represented a serious intrusion. Accordingly, in balancing the public and private interests at stake, the Court required the government to demonstrate more than a rational basis. The government had to show that the search rested upon a "compelling state interest."

In *Von Raab*, the Court upheld a Customs Service program that required all employees applying for positions involving the interdiction of illegal drugs to supply urine samples for drug testing. In *Skinner*, the Court upheld compulsory blood and urine, drug and alcohol tests for railroad employees involved in certain types of train accidents.

While reaffirming that Fourth Amendment probable cause and warrant requirements customarily apply to any search, including urine and blood tests, the Court emphasized that, "the probable cause standard 'is peculiarly related to criminal investigations' " [citations omitted].[57] The Court went on to say that the "traditional probable cause standard may be unhelpful in analyzing the reasonableness of routine administrative functions."[58]

Instead, the Court instructed that the proper course is to weigh the "interference with individual liberty that results from...a urine test," against the government's "compelling interest in ensuring that front-line interdiction [Customs'] personnel...have unimpeachable integrity and judgment."[59] Given the government's compelling interest in both the integrity of Customs' drug interdiction personnel and in the reliability of key railroad personnel, the Court, in both cases, upheld the constitutionality of suspicionless searches.

In *Von Raab* and *Skinner*, it also was important that the searches were limited and professionally supervised and administered. In this kind of setting, the Court was comfortable that even the blood tests mandated for railroad employees "do not constitute an unduly extensive imposition on an individual's privacy and bodily integrity" [citations omitted].[60]

Blood Tests for DNA Databank Purposes Likely to be Held Constitutional

In light of these relevant authorities, it is certainly possible to predict the methodology that a court would use in examining the constitutionality of a statute requiring certain types of individuals to submit blood samples for purposes of building a DNA databank. Were a court to address the constitutionality of a State program to establish a DNA databank, it likely would find that the compulsory taking of blood samples is a search to produce DNA prints for inclusion in a DNA databank. In addition, by the very nature of a DNA databank, a court would probably not conclude that a State could have individualized suspicion with respect to the subjects of those searches. Finally, a court would probably weigh the law enforcement interests served by a DNA databank against the individual's liberty interests in being free of the mandate to submit blood samples.

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[54] 664 F. Supp. 136, 139 (S.D.N.Y. 1987).

[55] 489 U.S. 656 (1989).

[56] 489 U.S. 602 (1989).

[57] *Von Raab*, 489 U.S. at 667.

[58] Ibid., 668.

[59] Ibid., 670-671.

[60] *Skinner*, 489 U.S. at 625.

It is uncertain, however, whether a court would find the privacy invasion to be minimal and thus hold that the balance tips in favor of the government if the government merely can show that the DNA testing program serves a legitimate governmental interest; or would find the privacy invasion sufficiently serious to require that the government show that the DNA testing program serves a *compelling* governmental interest.

The government may be able to sustain its burden, particularly if DNA testing is limited to types of individuals in whom the government properly has a heightened law enforcement interest. In both *Von Raab* and *Skinner*, the Supreme Court gave weight to the fact that the individuals who were subject to the tests were in a narrow class to which the government could show a legitimate and special interest. In the DNA databank context, the government's position would certainly be advanced if the government could show that the individuals in question are likely to recidivate and thus the State has a compelling law enforcement and investigative interest in having their DNA test results on file.

To the extent that inclusion in a DNA databank is limited to convicted felons or convicted felons who have been incarcerated, there is already existing authority to suggest that a DNA databank would pass constitutional muster. At least eighteen states already have in place statutory provisions that expressly require all persons committed to State penal or correctional institutions to be fingerprinted upon admission to such facilities.[61] To date, none of these statutes has been struck down. To the contrary, the United States Court of Appeals for the Second Circuit held that a New York statute providing for the compulsory fingerprinting and photographing of mental patients, whether admitted on a voluntary or involuntary basis, does not violate the mental patients' Fourth Amendment rights to privacy, Fifth Amendment rights to substantive or procedural due process or Fourteenth Amendment rights to equal protection of the laws.[62]

— Issues Associated with DNA Testing

Thirty years ago legal scholars and policymakers debated whether it was ever legal or appropriate to compel an individual to submit to a blood test. Today there continues to be debate over the circumstances in which it is appropriate for the government to require a blood test, but there is virtually no debate over the legality or wisdom of imposing a blood test requirement in at least some circumstances.

In 1957, in *Breithaupt v. Abrams*, the Supreme Court grappled with whether the taking of blood from an unconscious driver of a motor vehicle was ever justified, or rather, was a "brutal" and "offensive" act forbidden by the Constitution.[63] Although the *Breithaupt* Court eventually upheld the constitutionality of a blood test, Chief Justice Warren, joined by Justices Black and Douglas, vigorously dissented. They warned that such conduct was unlawful and violated American notions of privacy and liberty. Chief Justice Warren wrote that due process means that:

> law-enforcement officers in their efforts to obtain evidence from persons suspected of a crime must stop short of bruising the body, breaking skin, puncturing tissue or extracting body fluids, whether they contemplate doing it by force or by stealth.[64]

Blood Tests for Suspects or Offenders

Today such concerns are seldom voiced. Blood testing has proven to be a useful tool in a deadly war against crime, drugs and alcohol. As a result, compulsory blood testing for DNA purposes is unlikely to provoke

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[61] SEARCH Group, Inc., "Legal and Policy Issues Relating to Biometric Identification Technologies," unpublished report for the Bureau of Justice Statistics, U.S. Department of Justice, June 16, 1989, p. 47, note 267.

[62] *Winters v. Miller*, 446 F. 2d. 65, 71-71 (2d Cir. 1971), *cert. denied*, 404 U.S. 985 (1971).

[63] 352 U.S. at 432 (1957).

[64] Ibid., 442.

much criticism, particularly if the subjects of the testing are limited to criminal suspects or offenders. Indeed, most of the DNA databank statutes prohibit the retention of DNA specimen or identification information from suspects in ongoing investigations and, instead, limit the databank to information obtained from certain categories of convicted felons.[65]

Offenders and suspects are already subject to fingerprinting and photographing requirements. Indeed, offenders are subject to a far more serious imposition on their liberty and privacy interests in the form of incarceration. As a practical matter, the public, the media and legislators are likely to feel that such individuals have effectively waived their privacy interest in avoiding the compulsory taking of fingerprints, photographs, DNA specimens or other physiological characteristics that can be used for identification. The public concerns with respect to compulsory DNA testing for these types of suspects or offenders are likely to be muted.

Universal DNA/Blood Testing Program

On the other hand, there is every reason to believe that a universal requirement to provide blood specimens for inclusion in a DNA databank would provoke a significant policy debate.

No doubt opposition would arise, in part, from the view that a requirement to provide blood or other body fluids or tissue specimens is "dehumanizing."[66] Surveys, for example, indicate that approximately 5 to 33 percent of all Americans find fingerprinting to be objectionable.[67] Research for this report did not find empirical information with respect to Americans' reaction to the compulsory taking of blood. Nevertheless, it is fair to assume that the public's adverse reaction to the compulsory taking of blood would exceed the public's adverse reaction to the compulsory taking of fingerprints.

In addition, as discussed in more detail in the pages ahead, the universal taking of blood or tissue specimens for the establishment of a DNA databank would be opposed by many on the theory that such a process effectively creates a national identification system or population register. Some would also fear that such a databank would eventually be misused for a variety of noncriminal justice decisions.

Reliability

— Scientists Claim Reliability

There is broad consensus among scientists that DNA testing can produce a reliable identification, however, the mathematical probabilities are debated. Some sources claim that the chances of two individuals having the same DNA pattern is 100 million to one.[68] A group of British researchers went further and argued that there is no more than one in 30 billion chances of two individuals having the same DNA pattern — although this number has been disputed.[69]

Whatever the exact number, all researchers agree that the theoretical possibility of two individuals having the same DNA pattern (other than identical twins) is exceedingly remote. A recent study of the accuracy and reliability of DNA testing by a team of Yale University geneticists concluded that the tests, when properly conducted and read, provide an accurate means of identification — even when involving members of the same ethnic group.[70] The recently published report by the Office of Technology Assessment reached the same conclusion.

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[65] Title 19.2-270.5 of the Code of Virginia (1990), for example, prohibits the retention of DNA test results involving suspects in criminal proceedings.

[66] See *Goodman v. Liebowitz*, 410 N.Y.S. 2d 502, 506 (Sup. Ct. Sp. Term 1978) in which a plaintiff testified that:

> " '[F]ingerprinting' makes me feel as if I am in the same category as those who have committed crimes or those who are under suspicion. ... I find fingerprinting a psychological and physical handling of me by the State, which is insulting, intrusive and offensive."

[67] SEARCH Group, Inc., "Biometric Identification Technologies," note 61, p. 75.

[68] Harold M. Schmeck, Jr., "DNA Findings are Disputed by Scientists," *New York Times*, May 25, 1989, pp. B1, B12.

[69] Dan L. Burk, "DNA Fingerprinting: Possibilities and Pitfalls of a New Technique," *Jurimetrics Journal*, (Spring 1988): 466.

[70] "Yale study supports accuracy of 'fingerprinting' via DNA," *The Sacramento Bee*, September 21, 1990.

> The Office of Technology Assessment (OTA) finds that forensic uses of DNA tests are both reliable and valid when properly performed and analyzed by skilled personnel.[71]

Forensic scientists and researchers participating in the BJS/SEARCH DNA Forum also stressed that the science underlying DNA testing is valid and provides a solid basis for confidence in the reliability of DNA testing.

— *Courts Accept Reliability*

Frye Test

In reliance upon DNA testing's scientific acceptance, the courts have largely embraced the theory that DNA testing can produce a reliable, indeed for all practical purposes, a near-positive identification. In making this determination, most American courts rely upon what is known as the "*Frye* test." In 1923, in *Frye v. United States*, the United States Court of Appeals for the District of Columbia held that before the results of a polygraph test could be admitted into evidence, the reliability of the test would have to be accepted in its own field.[72] The oft-quoted test propounded by the *Frye* court is as follows:

> Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.[73]

Over the years, the *Frye* test has been modified. The Second Circuit Court of Appeals, in particular, has refined the *Frye* test by emphasizing that the court itself must be satisfied that the test or process in question is reliable. In *United States v. Williams*, the Second Circuit held that before the results of a "scientific test" can be admitted into evidence, the court must weigh the evidence's "probativeness, materiality, and reliability [against] ... any tendency to mislead, prejudice or confuse the jury..."[74]

Relevancy Test

In addition, a minority of States and a few of the Federal courts of appeal use the more permissive "relevancy" standard. Courts that use the relevancy standard weigh the probative value of a test against the test's potential for prejudice. In *United States v. Downing*,[75] the court stated that the relevancy test requires an examination of: (1) the soundness and reliability of the process or technique used in generating the evidence; (2) the possibility that admitting the evidence would overwhelm, confuse, or mislead the jury, and (3) the proffered connection between the scientific research or test result to be presented and particular disputed factual issues in the case.[76]

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[71] Office of Technology Assessment, *Genetic Witness*, note 5, pp. 7-8.

[72] *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923).

[73] Ibid., p. 1014; see also Burk, "DNA Fingerprinting," note 69, p. 468.

[74] *United States v. Williams*, 583 F.2d 1194, 1198 (2d Cir. 1978); see also *People v. Middleton*, 54 N.Y. 2d 42, 49 (Ct. of App. 1981), in which the New York Court of Appeals further refined the *Frye* standard by emphasizing that a test need not be unanimously endorsed by experts in its field. "[T]he test is not whether a particular procedure is unanimously endorsed by the scientific community, but whether it is generally accepted as reliable."

[75] 753 F.2d 1224 (3rd. Cir. 1985).

[76] Ibid., 1237. See also discussion in C. Thomas Blair, "*Spencer v. Commonwealth* and Recent Developments in the Admissibility of DNA Fingerprint Evidence," in Comment of *Virginia Law Review* 76 (May 1990): 853, 858, n. 21.

DNA Test Results Admitted as Evidence

Regardless of whether courts use the *Frye* test, a modified version of the *Frye* test, or the more permissive relevancy test, the courts, with just a few exceptions, have endorsed DNA testing and admitted its results in evidence.[77] As of mid-1989, DNA test results had been admitted into evidence in at least 80 cases of murder and rape in 27 States.[78] A New York State study recently found that over 30 *Frye* hearings on the admissibility of DNA evidence have been held throughout the nation. With rare exception, the courts have found that DNA testing meets the *Frye* criteria.[79]

Recently, an appellate court affirmed that the results of DNA-typing tests, when properly performed, are admissible in a criminal trial. In *Andrews v. Florida*, the defendant, Tommy Lee Andrews, was convicted of various sexual offenses, in part on the basis of a DNA comparison of blood and semen stains taken from the rape victim with samples of Andrews' blood. Andrews appealed on several grounds, including a claim that shoddy laboratory work made the DNA tests unreliable. The Florida appeals court disagreed, finding that DNA testing has been in use for approximately ten years; that there is extensive scientific literature on the subject; and that the chance that Andrews' DNA "bands" would be duplicated in another person's cells is less than one in 839 million, and that control tests were used to guard against faulty laboratory work.[80]

In admitting DNA evidence, the *Andrews* court did not rely upon the *Frye* test. The court complained that the *Frye* test's dependence on a technology's "general acceptance" led to "nose counting." If applied literally, the *Frye* test could exclude reliable, but not yet widely accepted tests such as DNA typing. Instead, the *Andrews* court relied upon the Third Circuit's relevancy test propounded in *Downing*.[81]

In the summer of 1988, the evidentiary use of DNA typing reached another milestone. The Virginia Supreme Court, in three unanimous rulings, imposed the death penalty on Timothy W. Spencer for rape and strangulation, based, in part, on the use of DNA evidence. The DNA pattern obtained from semen stains on the victim's body matched the DNA pattern in Spencer's blood sample. The Virginia decision represents the first time that DNA evidence was admitted in a capital case.[82]

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[77] A California superior court in Sacramento, California, is one of the exceptions. The court refused to admit into evidence the results of a DNA test of sperm stains found on the undergarments of a rape victim. The test procedure used the polymerase chain reaction (PCR) amplification technique. In holding that the PCR technique is not sufficiently established in the relevant scientific community to warrant its use in capital cases, the court reportedly gave weight to three considerations: (1) the PCR test was not developed until 1985; (2) the warranty notice used by the laboratory performing the test stated, "the performance characteristics of these procedures have not been fully established"; and (3) the semen evidence was "impaired due to the degraded quality and small amounts of the specimen materials." Wayne Wilson, "Judge throws out DNA evidence," *The Sacramento Bee*, September 20, 1990, p. B1.

[78] Schmeck, "DNA Findings are Disputed," note 68, p. B12.

[79] "New York DNA Report," note 26, p. 19. Opportunities for courts to consider the admission of DNA-typing evidence are not frequent. According to published reports, most of the cases in which DNA evidence is available do not go to trial. Instead, these cases tend to be plea bargained on terms favorable to the government. See Robbins, "Cells That Convict," note 18, p. 11.

Moreover, at least one court has been confronted with the question of whether DNA evidentiary matters are so complex that only scientifically trained or literate judges should be allowed to sit on DNA cases. In *Bethune v. Honorable A.D. Zaios*, a Texas appeals court acknowledged that DNA fingerprinting evidence presents complex legal and scientific issues, but held that the motion to recuse the judge on grounds of scientific complexity did not meet Texas' recusal standards. LEXIS No. 2491 (October 6, 1988).

[80] " 'DNA Fingerprinting' Upheld in First Appellate-Level Challenge," *Criminal Justice Newsletter* 19 (December 1, 1988): 3.

[81] 753 F.2d at 1224.

[82] *Spencer v. Commonwealth*, 238 Va. 275, 384 S.E.2d 775 (1989); "Virginia Jury Sentences Man to Die, Based on DNA Evidence," *Crime Control Digest* 22 (July 25, 1988): 1; see also Pamela Zurer, "Death Penalty Imposed Based on DNA Profile," *Chemical and Engineering News* (July 25, 1988): 5; see also Blair, Comment, *Virginia Law Review*, note 76.

A 1988 New York State court opinion also upheld the admissibility of DNA test results, finding that:

> ... DNA Fingerprinting — its underlying principles, procedures and technology — is a scientific test that is reliable and has gained general acceptance in the scientific community and in the particular fields thereof in which it belongs — to wit, molecular biology, population genetics and diverse other branches of genetics, chemistry, biology and biochemistry.[83]

Judge Joseph Harris, who authored this opinion, later called DNA testing, "the single greatest advance in the search for truth since the advent of cross examination."[84]

Several States, including Minnesota, Maryland, Louisiana, Nevada and Virginia, have recently adopted statutes that expresly provide that DNA test results are admissible in evidence in criminal proceedings.[85] Under all of these statutes, however, the court must be convinced that the DNA-typing test conducted in that particular case yielded a reliable result.

— Criminal Justice Officials Endorse Reliability

Not surprisingly, many criminal justice officials are enthusiastic about the reliability and potential of DNA testing. FBI Director William Sessions, for example, has praised DNA's potential.

> ... Probably the most exciting, as I view it, of the new techniques emerging for the criminal investigator, is the DNA identification technology. Through a genetic pattern-matching process, criminals can now be identified positively by comparing evidence from a crime scene — that is, blood, body fluids or sometimes a single hair — with that of a suspect. The FBI Laboratory Division is nearing completion of that project, that will bring about the full implementation of that process and make it available to all law enforcement agencies nationwide. The cooperation of states such as California in this new technology has been outstanding, and we are, of course, as I believe, standing on the edge of a new technological age and forensic capability, the cutting edge being the DNA capability...[86]

The use of DNA tests as evidence received another boost in January 1989, when California's Attorney General, after extensive review and testing, approved the use of DNA evidence in criminal cases presented in the California courts. The Attorney General had previously been wary

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[83] *People v. Wesley*, 533 N.Y.S.2d 643, 659 (Albany Co. Ct. 1988). Other recently reported decisions that have endorsed the validity of DNA typing and have admitted DNA test results into evidence include the following: *State v. Horsley*, 792 P.2d 945, (Idaho 1990); *State v. Pennell*, Westlaw 167430, (Del. Super. Ct. Nov. 6, 1989); *People v. Huang*, 546 N.Y.S.2d 920 (Nassau Co. Ct. 1989); *Martinez v. State*, 549 So.2d 694 (Fla. App. 5 Dist. 1989); *Woodall v. State*, 385 S.E.2d 253 (W.Va.1989); *Cobey v. State*, 559 A.2d 391 (Md. Ct. App. Spec. 1989); *Yorke v. State*, 556 A.2d 230 (Md. App. 1989); and *Kennedy v. State*, 545 So.2d 214 (Ala. Ct. App. 1989).

[84] Gest, "Convicted by Their Own Genes," note 15, p. 70.

[85] MINN. STAT. § 634.25 (West 1969); MD. EVIDENCE CODE ANN. § 10-915 (1986); 1989 LA. REV. STAT. ANN. § 15.441.10; and NEV. REV. STAT. ANN. § 56.020(1)(2); and see Office of Technology Assessment, *Genetic Witness*, note 5, p. 107. The Code of Virginia states that, "In any criminal proceeding, DNA...testing shall be deemed to be a reliable scientific technique and the evidence of a DNA profile comparison may be admitted to prove or disprove the identity of any person." VA. CODE ANN. § 19.2-270.5 (1990).

[86] Address by William Sessions, Director of the Federal Bureau of Investigation, before the National Press Club in Washington, D.C., on September 1, 1988, distributed by Federal Information Systems, Corp., Federal News Service.

about rushing a case into court and running the risk of the technology being ruled inadmissible.

> ...So [in January 1988] he named a DNA Advisory Committee, comprised of representatives from the FBI, the state Bureau of Forensic Services, District Attorneys, sheriffs and police, to research both the technology and the legal issues it posed. The California Association of Crime Lab Directors produced 150 blind DNA comparisons so accurate that the DNA Advisory Committee endorsed the new technology for use in court.[87]

Addressing the California District Attorney's Association's 1989 annual convention, the Attorney General announced that DNA evidence was now ready for use in a serial rapist case and a murder trial scheduled for the winter.[88]

Law enforcement officials attending the Forum on Criminal Justice Uses of DNA sponsored by the Bureau of Justice Statistics and SEARCH in November 1989, also voiced strong support for the forensic benefits of DNA testing. They emphasized that DNA testing has unprecedented potential to identify rapists, murderers and other violent offenders.

— Problems in Admitting DNA Test Results in Court

This is not to say however, that there are no questions with respect to the reliability and the use in court of DNA test results. Critics contend, for example, that there has been too much enthusiasm for the underlying science and too little skepticism about the methodology and the outcome of specific DNA tests.[89] Many also contend, as discussed below, that the use of DNA test results in criminal trials is unfair in that it overwhelms defense resources and blinds the jury to other probative and potentially exculpatory items of evidence.[90] In late 1989, courts in New York and Minnesota limited, or altogether refused to permit, the introduction of DNA test results citing concerns about the use of the specific DNA test results at issue.[91]

Adequacy of Population Studies

With few exceptions, critics cite concerns about only one issue that goes to the underlying science of DNA testing: is the possibility of two individuals having the same DNA pattern indeed as remote as claimed? This criticism loses some of its sting if DNA testing is not used for positive identification. Nevertheless, critics note that research with respect to the uniqueness of DNA patterns has been done on only a few hundred human subjects, and at that, on a population not chosen for ethnic diversity. They point out that DNA typing is not yet anchored in the kind of empirical research and operational use that characterizes friction-ridge fingerprinting.

Moreover, critics note that even if the chances of two people having the same complete DNA (with the exception of identical twins) is remote, there certainly remains the possibility that two people could produce the same DNA "fingerprint" using the RFLP technique because this test measures DNA fragment length rather than the entire DNA content.[92]

In *People v. Wesley*, the court considered the defense's claim that population studies are insufficient to support a claim that a DNA match

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[87] Office of the Attorney General, News Release, "DNA Typing Is Now Ready for Use in California Criminal Trials," January 24, 1989.

[88] Ibid.; see also, Jack Jones and Thomas Maugh II, "Van de Kamp OKs 'Genetic Fingerprint' Use in Trials," *Los Angeles Times*, January 25, 1989, Part I, p. 3; and, "Authorities Moving Toward Use of DNA Fingerprinting," *Criminal Justice Newsletter* 19 (February 1, 1988): 3.

[89] See, e.g., Stephen Petrovich, "DNA Typing: A Rush to Judgment," 24 *Georgia Law Review* (Spring 1990): 669, 688, n. 91.

[90] See, *e.g.*, Janet Hoeffel, "The Dark Side of DNA Profiling: Unreliable Scientific Evidence Meets the Criminal Defendant," 42 *Stanford Law Review* (January 1990): 465, 519-525.

[91] *People v. Castro*, 545 N.Y.S.2d. 985 (Sup. Ct. 1989); and *State v. Schwartz*, 447 N.W.2d 422 (Minn. 1989).

[92] Hoeffel, "The Dark Side," note 90, pp. 488-92.

could not involve multiple individuals.[93] The court noted that the private laboratory statistics introduced in evidence were based on an extrapolation of DNA tests of 900 unrelated individuals in three ethnic groupings. The court was satisfied that as a mathematical matter the laboratory had demonstrated that the chances of two individuals having the same DNA pattern were one in 1.4 billion for American blacks and one in 840 million for American whites.[94]

The OTA report on DNA characterizes questions about the "validity of DNA typing — either the knowledge base supporting technologies that detect genetic differences or the underlying principles of applying the techniques per se" as "red herrings that do the courts and the public a disservice."[95] The report acknowledges, however, that even though the scientific principles of population genetics are not at issue, there is controversy about how to apply these principles to interpret DNA test results.[96]

Adequacy of Testing Methods

Even assuming the theoretical reliability of DNA testing, important questions remain as to whether a particular DNA test was performed properly. According to many experts, DNA testing presents numerous opportunities for error.

One such opportunity involves the purity or integrity of the blood or other DNA specimen. Samples can be mixed with foreign debris, or worse, with DNA from other sources.[97] Certain crime scenes, such as settings for gang fights or multiple rapes, may produce a bewildering "stew" of DNA which could resist even the most careful analytical techniques. In addition, the DNA sample, much like other types of crime scene evidence, may be too small, too old, or damaged.[98] Because a blood or tissue specimen is easily contaminated, commentators have urged courts to insist that prosecutors establish that a reliable chain of custody was preserved before admitting DNA evidence.[99]

A New York State court recently conducted a 12-week *Frye* hearing before excluding DNA test results in a murder trial.[100] The defendant, Joseph Castro, was charged with the murder of a mother and her two-year-old daughter. A DNA test determined that a blood stain on Castro's watch matched a blood sample from the murder victim. In conducting the "gel electrophoresis" test, the laboratory reportedly improperly discounted as non-human contaminants two bands of DNA that did not match. Scientists serving as expert witnesses for both the prosecution and the defense issued a statement criticizing the testing procedure and concluding that, "...overall, the DNA data in this case are not scientifically reliable enough to support the assertion."[101] Experts from the commercial laboratory, however, strongly defended the validity of the laboratory's test results.

In weighing the admissibility of the DNA test results, the *Castro* court looked at three factors:

(1) whether the theory of DNA testing is scientifically accepted;

(2) whether the techniques and experiments associated with DNA testing are scientifically accepted; and

(3) whether in the particular case at issue, the testing laboratory adequately performed the accepted scientific techniques.[102]

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[93] Ibid., 488. In other cases, defendants have also challenged the adequacy of population studies. In *Cobey v. State*, 559 A.2d at 391, for instance, the defense argued that Cellmark's database of 700 individuals was inadequate.

[94] *People v. Wesley*, 533 N.Y.S. 2d at 656.

[95] Office of Technology Assessment, *Genetic Witness*, note 5, p. 8.

[96] Ibid., 8-10.

[97] Thompson and Ford, "DNA Typing Needs Additional Validation," note 7, p. 64.

[98] See Hoeffel, "The Dark Side," note 90, p. 481; Petrovich, "A Rush to Judgment," note 89, pp. 694-95.

[99] Ibid., 694.

[100] *People v. Castro*, 549 N.Y.S.2d at 987.

[101] *People v. Castro*, as reported in Schmeck, "DNA Findings are Disputed," note 68, p. B12; see also, *New York DNA Report*, note 26, pp. 20-21.

[102] *People v. Castro*, 545 N.Y.S.2d at 986-87; and see discussion, Blair, Comment, *Virginia Law Review*, note 76, pp. 868-69, n. 94.

The court acknowledged that the theory of DNA testing is scientifically accepted but gave close scrutiny and considerable weight to the third factor.

Just a few months later, the Minnesota Supreme Court took much the same approach, with much the same result. In *Minnesota v. Schwartz*, the court ruled that DNA test results were inadmissible in a murder case. The court acknowledged that the science underlying DNA testing had gained wide acceptability. The opinion concluded, however, that the test at issue had deficiencies in its quality control procedures. The court also found that the private laboratory's failure to disclose to the public or the defense the results of the lab's experimental studies rendered the results unreliable and thus inadmissible.[103]

Human Error in Interpreting Test Results

Even assuming that a laboratory uses a proper test methodology, test results are difficult to interpret. There is a possibility of human error. If an analyst, for instance, refuses to declare a match unless all DNA prints are identical in all respects, the declared non-match could result in false negatives — that is, two samples of DNA may actually come from the same individual, but the prints are interpreted as a negative match.[104]

What little empirical research is available suggests that human error is sometimes a factor in DNA testing. In recent controlled tests, for instance, one of the three commercial laboratories that currently conducts DNA-typing tests incorrectly identified one individual in 48 identification trials and another laboratory made one incorrect identification out of 54 samples. Both incorrect hits were due to human error, which, evidently, caused a mix-up in the DNA samples.[105]

Alleged Unfairness to Criminal Defendants

Critics also contend that introduction of DNA test results in criminal proceedings has the potential to undermine defendants' rights to a fair trial.[106] They point to several considerations. First, DNA test results are both impressive and complicated. Thus, there is a risk that juries will be unduly impressed with and swayed by DNA results.[107] Of course, DNA proponents point out that juries should be impressed with DNA test results given their reliability and their ability to make a near positive identification. Proponents also note that juries still exercise independent discretion. In a recent Connecticut rape trial, for instance, the jury ignored DNA evidence exculpating the defendant and convicted him based upon the victim's eyewitness identification.[108]

Use of DNA test results is also considered unfair by some who argue that defendants are seldom able to obtain adequate expert witnesses.[109] Certainly, it is true that in the initial flurry of DNA criminal cases the defense bar has seldom produced expert rebuttal witnesses. Many experts, however, predict that as state-administered laboratories enter the DNA testing field, the role of private DNA laboratories will shift to provide

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[103] *State v. Schwartz*, 447 N.W.2d at 428; see also, Blair, Comment, *Virginia Law Review*, note 76, pp. 873-74; see also "Minnesota Supreme Court Rules DNA Tests Inadmissible," *Criminal Justice Newsletter* 20 (November 15, 1989): 2-3.

[104] Thompson and Ford, "DNA Typing Needs Additional Validation," note 7, pp. 63-64.

[105] Mark Thompson, "The Myth of DNA Fingerprints," *California Lawyer* (April, 1989): 34; see also, *New York DNA Report*, note 26, p. 28.

[106] It should also be pointed out, however, that DNA testing provides an important benefit to many investigative suspects. OTA has found, for instance, that "37 percent of the cases received by the FBI for DNA analysis result in exclusion of the primary suspect." Office of Technology Assessment, *Genetic Witness*, note 5, p. 17.

[107] Petrovich, "A Rush to Judgment," note 89, pp. 689-90.

[108] Ibid., n. 104; see also Johnson, "DNA defense rejected: jury convicts in rape," *Hartford Currant*, March 20, 1990, p. A. FBI forensic scientists testified for the defense in this case and opined that the DNA test results from the semen stains on the victim's clothes did not match the test results from the defendant's DNA and hence the semen could not have come from the defendant.

[109] Hoeffel, "The Dark Side," note 90, pp. 519-23; Petrovich, "A Rush to Judgment," note 89, pp. 689-90.

services (and expert witnesses) to the defense bar.[110]

Other "flaws" in a criminal trial in which the prosecution relies upon DNA test results include: the expense of DNA testing and the resultant inability of many defendants to afford their own DNA tests; the lack of an opportunity to retest and thereby check DNA results (often because small DNA sample sizes make re-testing impossible); and the prosecution's (and DNA testing laboratories') failure to make test results and methodologies fully available for examination and analysis by peer reviewers and defendants.

In rebuttal, proponents point out that as government-administered laboratories conduct more DNA tests, particularly for the prosecution, test methodologies and results will be more available for scrutiny.

Lack of Standards

Finally, some observers argue that before DNA test results are universally accepted in criminal proceedings, standards need to be further developed. Such standards would include controls to assure accurate interpretation of test results; standards for declaring matches; standards for determining probabilities of identical DNA in population cohorts; standards for preserving a chain of custody; standards for recordkeeping; and standards for accreditation and proficiency testing.[111]

The OTA report concludes that substantive and immediate attention must be given to the development of standards.

> Setting standards for forensic applications of DNA testing is the most controversial and unsettled issue. Standards are necessary if high quality DNA forensic analysis is to be ensured, and the situation demands immediate attention.[112]

OTA sees a need for both technical standards (gel controls, electrophoresis conditions, population data, etc.) and operational standards (record-keeping, proficiency testing, etc.).[113]

Experts participating in the BJS/SEARCH "Forum on Criminal Justice Uses of DNA" agreed that standards are useful, but disagreed with any implication that DNA testing is unreliable. They point out that even taking today's relatively unregulated DNA testing environment into account, DNA testing is quite reliable and that most laboratories use numerous controls.

They also point out that strides are already being made to set standards for the DNA testing process. At present, for instance, the Technical Working Group DNA Analysis Methods (TWGDAM) — a group representing state forensic laboratories, commercial laboratories performing DNA tests, the Canadian government and the FBI — is at work developing DNA testing guidelines that address such subjects as chain of custody, proficiency testing, and quality assurance. The FBI is providing staff support for this effort. According to the OTA, some observers see the TWGDAM guidelines emerging as the nucleus for national standards for quality assurance.[114]

In September 1989, the American Society of Crime Laboratory Directors (ASCLD) endorsed the TWGDAM quality assurance guidelines.[115] The group already has in place an accreditation program for forensic laboratories and has passed an initiative to establish accreditation standards for forensic and private laboratories doing DNA testing.[116] The National Academy of Sciences has also convened a committee to recommend procedures and guidelines for DNA testing. BJS/SEARCH DNA forum participants noted that

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110 Virginia's law requires the prosecution to provide the defense with at least 21 days notice of the prosecution's intention to use DNA evidence and to give the defense copies of any profiles, reports or statements to be introduced. VA. CODE ANN. § 19.2-270.5 (1990).

111 See discussion in Hoeffel, "The Dark Side," note 90, pp. 479-494.

112 Office of Technology Assessment, *Genetic Witness*, note 5, p. 10.

113 Ibid., 82.

114 Ibid., 13, 74, 75. OTA also reports that the National Institute of Justice, through its Law Enforcement Standards Laboratory at the National Institute of Standards and Technology, has begun to examine standards for DNA testing.

115 Ibid., 146.

116 See note 27 of this report for information regarding the initiative.

the emergence of government-administered forensic laboratories capable of doing DNA testing will likely contribute to the standardization and reliability of DNA testing.

Establishment and Use of DNA Databanks

— Law Enforcement Use

Given the high rate of recidivism associated with violent crime, the potential benefits of establishing DNA databanks from a law enforcement standpoint are undeniable.[117] With DNA databanks in place, investigators will be able to identify suspects, indeed prime suspects, based upon blood, semen, skin, hair or other fluid or tissue specimens found at crime scenes. The DNA test results from a crime scene could be digitized and compared with the digital record of DNA specimens held in the databank. Inasmuch as fingerprint information is often not obtained from crime scenes, it is not hyperbole to suggest that DNA databanks could revolutionize efforts at apprehending violent and sex offenders.

It is no wonder, then, that numerous law enforcement agencies have proposed the establishment of databanks containing the results of DNA tests. As noted earlier, the first legislation authorizing the establishment of a DNA databank was adopted in 1988 in King County, Washington.[118] The local ordinance requires all persons convicted of a sexual offense to submit blood specimens for DNA testing. The FBI has also proposed the construction of a databank containing an automated (i.e. digitized) record of DNA test results of certain classes of offenders.[119]

As noted earlier, the following States have adopted legislation authorizing the establishment of libraries of DNA samples (along with indices of their RFLP patterns): Arizona, California, Colorado, Florida, Illinois, Iowa, Minnesota, Nevada, South Dakota, Virginia and Washington.[120]

Arizona's law provides that any person convicted of a sexual offense shall submit to DNA testing for law enforcement purposes.[121] Test reports are to be maintained by the Arizona Department of Public Safety. Minnesota's new statute requires the Bureau of Public Safety to adopt uniform procedures and protocols to maintain, preserve, and analyze human biological specimens for DNA identification purposes.[122] The statute also directs the Bureau to establish a centralized system to cross reference this data. Access to the databank is limited to law enforcement officials, prosecutors and defendants.

Virginia's 1990 law authorizes the establishment of a repository to store, maintain and exchange the results of DNA tests conducted in Virginia.[123] The statute reaches a broader subject group than most other DNA databank statutes in that it authorizes the maintenance of DNA test results relating to every person convicted of a felony on or after July 1, 1990. The results of a DNA analysis may be made available "directly to Federal, state and local law enforcement

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117 Office of Technology Assessment, *Genetic Witness*, note 5, p. 32. A few observers, nevertheless, argue that DNA databanks are unnecessary. They point out that in a few years, DNA examination techniques are expected to be sufficiently advanced that information about a suspect's race, eye color, hair color, sex and even body style will be able to be inferred from DNA samples. Even assuming that this prediction is accurate, such inferences are hardly a substitute for the identification potential offered by DNA databanks.

118 See footnote 21 of this report.

119 Sally E. Renskers, "Trial by Certainty: Implications of Genetic DNA Fingerprints," in Comment of *Emory Law Journal* 39 (Winter 1990): 332. Federal funding for this effort was included in the FBI's Fiscal Year 1990 appropriation. Senator Paul Simon (D-IL), a proponent of responsible development of DNA technology, applauded Federal funding. One early sign is positive: Congress recently showed its general support for the goal of interagency cooperation when it approved funds requested for the FBI to develop standards and to design a national DNA typing databank for information sharing by State and local law enforcement agencies. Press Advisory by Senator Paul Simon, August 5, 1990.

120 Office of Technology Assessment, *Genetic Witness*, note 5, p. 20.

121 House Bill 89-2119 adding a new Article 5 to Title 31, Ch. 2 of the ARIZ. REV. STAT.

122 H.R. No. 59 dated May 20, 1989 and amending MINN. STAT. ANN. § 299 C. 155.

123 VA. CODE ANN. § 19.2-310.2, 19.2-387 (1990).

officers upon request made in furtherance of an official investigation of any criminal offense."[124]

California's Department of Justice has already collected DNA samples from about 14,000 persons convicted of certain sex crimes and has frozen and stored these samples to be used as the base for an operational system to be called "Cal-DNA" (the name is meant to draw a parallel with the successful Cal-ID system for fingerprint analysis). The databank is being kept current through the addition of DNA specimens from persons newly convicted of murder and assault as well as sex crimes.

As previously discussed, other States are also considering the establishment of DNA databanks. Indeed, James E. Starrs, a George Washington University professor and forensic expert, predicts that "police will build DNA identification files like the massive fingerprint files that now exist."[125]

Relevance of Fingerprint Databank Case Law

Statutes in most states and at the Federal level already authorize State identification bureaus or State central repositories and the Federal Bureau of Investigation respectively, to establish and maintain databanks of fingerprints, and, in some cases, photographic records of offenders and arrestees. None of those statutes has been struck down, although in certain circumstances, such as false or unlawful arrest, administrative or judicial relief is available to assure that the fingerprint or photographic records will be destroyed or returned.[126]

No decisions were found dealing with whether a record subject's constitutional rights are violated in the event that a law enforcement agency maintains a record of a subject's DNA test results. In any court test with respect to DNA databanks, the case law with respect to the establishment and maintenance of fingerprint databanks would likely be relevant. No reported decision has held that a law enforcement agency violates an offender's rights in maintaining the offender's fingerprint record.

For that matter, no recent case has been found that holds that an *arrestee's* rights are violated if the arrestee's fingerprints are maintained in a law enforcement databank. In *Gallagher v. Marion County Victim Advocate Program, Inc.*, for example, an Indiana appellate court upheld the police department's retention of the fingerprints of an individual who had been arrested, but never convicted.[127] The court rejected the record subject's privacy claim. The court reasoned that retention of fingerprints, unlike the exhibition of photographs in a "rogues' gallery," does not result in a disclosure of stigmatizing information to the idle curious. Presumptively, the maintenance of DNA specimens would similarly not result in the disclosure of stigmatizing information to the idle curious.

In *Cissell v. Brostron*, a Missouri court balanced an individual's privacy interest in the return of fingerprints against the benefits that law enforcement agencies receive from maintenance of a fingerprint databank.[128] The court held that the benefits outweigh the risks, provided that the prints are not disseminated to the public or made available for inspection in a rogues' gallery. The court emphasized that retention of the prints is justified by a common-sense need for these prints in major investigations. Presumably, those same common sense arguments would support the utility of retaining DNA test results for use in future law enforcement investigations.

Maintaining a Databank on Non-Arrestees

The case law with respect to the establishment and maintenance of a non-offender, fingerprint databank comprised of non-arrestees indicates that in order to retain and maintain

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124 VA. CODE ANN. § 19.2-310.5 (1990).

125 Reuskers, Comment, *Emory Law Journal*, note 120, p. 330, n. 143, citing Hilts, "New Crime Identification Tool Devised," *Washington Post*, September 20, 1987, p. A23.

126 SEARCH Group, Inc., "Biometric Identification Technologies," note 61, pp. 58-59.

127 401 N.E.2d 1362, 1366-67 (Ct. App. Ind. 1980).

128 395 S.W.2d 322, 325 (Mo. Ct. App. 1965).

such prints, the State must be able to establish, at a minimum, that there is a rational basis for maintaining the databank. If it could be shown, for example, that maintaining a DNA databank containing non-arrestee information bore a reasonable relationship to improving law enforcement's ability to identify and apprehend offenders (surely a legitimate governmental interest), then it is likely that the rational basis test could be met.

Indeed, research for SEARCH's report on the "Legal and Policy Issues Relating to Biometric Identification Technologies" found only one decision that indicated that the maintenance of a non-offender fingerprint record could not meet the rational basis test. In *Goodman v. Liebovitz*, a New York State court held that a State statute requiring prospective grand jurors to *submit* their fingerprints is constitutional.[129] In the view of the *Liebovitz* court, however, the *retention* of such prints, once a grand jury eligibility decision is made, would violate the grand jurors' constitutional rights of privacy. Importantly, however, the *Liebovitz* court acknowledged that its result might change if the State statute had expressly called for the retention of the prints.

— National Population Register

One of the public policy issues that arises from the establishment of DNA databanks is the fear that any new type of identification databank inevitably moves the nation toward the *de facto* creation of a national identification system or card. Of course, that concern can be assuaged or exacerbated depending upon whose information is in the databank. If information on all citizens is in the databank, the potential for use of that databank for national identification purposes is greatly enhanced. If, on the other hand, only certain classes of offenders are in the databank, the extent to which the databank moves the nation toward a national identification capability is minimal.

In this regard, however, at least a few participants in the BJS/SEARCH DNA Forum recommended that if a DNA databank were to be used only for criminal justice identification purposes, and assuming that the databank contained only digitized DNA identification information and it were economically feasible; then all citizens should be tested and their DNA test results included in the databank in order to make the databank as useful as possible.

Critics of the DNA databank concept worry that, inevitably, such databanks will be used to link files and build dossiers about individuals; or that the databanks will be used in an abusive way to target certain individuals for close or inappropriate law enforcement scrutiny; or that the maintenance of such databanks inevitably has a "dehumanizing" effect on both the individuals whose information is in the databank and society as a whole.[130]

> The idea of DNA fingerprints as a future method of national identification, or as an "internal passport," is not unrealistic. Because many proponents are advocating the development of DNA fingerprint files, it is logical and realistic that DNA fingerprints could replace social security numbers as personal identifiers, thereby becoming *de facto* internal passports. Such a step is not likely to occur within the next few years. However, if DNA fingerprints replace social security numbers as personal identifiers, the efficiency of such an identification and record-keeping system will increase markedly because DNA information, unlike social security numbers, cannot be changed or forged. The temptation to transform the system into an official "internal passport" system would increase significantly. *[footnote omitted]*[131]

— Genetic Redlining

Many fears about establishing DNA databanks arise from the potential for abuse of such databanks. So long as DNA databanks are used only for criminal justice identification purposes, most observers would conclude that the benefits of the databank — identifying suspects and offenders from crime scene evidence — far outweigh any potential drawbacks.

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[129] 410 N.Y.S. 2d 502, 507 (Sup. Ct. Sp. Term, 1978) *aff'd* 423 N.Y.S. 2d 488 (1980).

[130] Authorities in Northern Ireland, for instance, are currently requiring suspected terrorists to submit blood samples for DNA testing. *California Law Review*, 1989, p. 679. See also, discussion at Hoeffel, "The Dark Side," note 90, p. 533; and Renskers, Comment, *Emory Law Journal*, note 120, pp. 334-336.

[131] Renskers, Comment, *Emory Law Journal*, note 120, pp. 339-340.

But that conclusion may change if DNA databanks are used to identify AIDS victims, drug users or, more ambitiously, to construct genetic profiles which, in turn, can be used in a myriad of employment, insurance, licensing, and other decisions affecting access to desired statuses or benefits.

Of course, the potential for such ambitious and abusive uses of DNA databanks depend upon whether the databank contains actual blood or tissue samples or merely the digitized records of DNA test results. If only the digitized records are preserved, the DNA databank can be used only for identification functions, and the possibility of using the databank for what many citizens would see as invasive and inappropriate purposes — such as genetic profiling — is avoided. With this in mind, New York's DNA Advisory Panel has recommended that only digitized DNA test result data be maintained in any future New York State DNA databank.[132]

Many of the participants in the BJS/SEARCH DNA Forum emphasized, however, that there are important and valid reasons for preserving the actual blood or tissue specimens and not simply the digitized record of the DNA test results. Participants argued that maintenance of only a digitized record locks in "old science." If new test methods or protocols are developed, they cannot be used because they will not produce a test result that is not comparable to the test results in the DNA database. For that reason, some States, including Illinois and Minnesota, are establishing databanks that include both tissue or fluid samples and digitized records. At this point, a consensus has not emerged within the forensic community with respect to whether actual tissue and fluid samples should be maintained.

Forum participants — while acknowledging the dangers posed by preserving fluid or tissue samples in DNA databanks — expressed confidence that access to and use of the information in the databanks could be regulated responsibly.

— Management and Regulation

The establishment of DNA databanks also raises difficult issues with respect to management and regulation. For example, should DNA databanks be centralized so as to effectively create one national databank; or, as appears to be occurring, should decentralized, State DNA databanks be maintained? If so, will these decentralized databanks be supported by a national index, much like the FBI's National Crime Information Center's (NCIC) Interstate Identification Index (III) supports the decentralized, fingerprint-based, criminal history records system? Many participants in the BJS/SEARCH DNA Forum voiced support for some kind of a national, decentralized, automated index to state-based DNA databanks. According to the OTA's report on DNA, the FBI supports using the III to obtain access to state-held DNA data.[133] In December of 1987, the FBI's state-dominated Advisory Policy Board (APB) voted against adding DNA information to NCIC. In 1989, however, the APB reconsidered its position, "and voted to endorse the FBI's plan to index and match DNA profiles in NCIC."[134] Certainly, in the absence of such an index, a national DNA search would be difficult, if not impossible.

Assuming that the DNA databank system is decentralized, difficult policy issues will arise with respect to the uniformity of the data and its standardization and compatibility for transfer among DNA databanks. A related question involves whether standards can or should be devised to assure that both hardware and software are sufficiently compatible to facilitate the transfer of such information.

Within each state there will also be a question as to what type of entity should maintain the DNA databank. At present, DNA databanks in most states are managed within the law enforcement system, by State identification bureaus and central repositories for criminal history record information.

Dissemination of DNA Test Data

— Use of DNA Data for Criminal Justice Purposes

As a legal matter, there is little question that DNA test results can be used for all legitimate criminal justice purposes. Indeed, DNA test results have already been widely used at the investigative/law enforcement stage, the prosecutorial stage and the

132 "New York DNA Report," note 26, p. 35.

133 Office of Technology Assessment, *Genetic Witness*, note 5, p. 125.

134 Ibid., 126-127.

adjudicatory stage of criminal justice proceedings.

The FBI, and State identification bureaus in most states, enjoy ample statutory authority to share identification information, and specifically fingerprint information, for all criminal justice purposes.[135] Presumably, statutory charters establishing DNA databanks will include an express authorization to disseminate and use information in these databanks for criminal justice purposes. Minnesota's DNA statute, for instance, does include express authority to use DNA data for law enforcement and criminal justice purposes. It seems clear that there would not be constitutional or other legal impediments to this kind of statutory provision.

—Use of DNA Data as a Basis for Probable Cause

Can DNA test and databank data which indicates a DNA match be used as a basis for probable cause for an arrest? New York's Advisory Panel report recommends that in the event of a DNA match arising from a search of a DNA databank, the match be used by investigating authorities only as a basis for further investigation.

> ... While it is ultimately for the courts to decide whether an arrest can be made based solely on information contained in the [DNA] data bank, the Panel recommends that, because of the infancy of the technology and all of the problems enumerated in this report, that the DNA match should not be the sole basis for making an arrest. We recommend that a computer generated DNA match be used only to provide the legal justification for questioning a suspect or securing a court ordered line-up, search warrant, fingerprint, or extraction of samples of physical evidence from the suspect. Additionally, if a search of the DNA databank reveals a hit on an evidentiary sample taken from a crime scene, a court order could be obtained to take a fresh DNA sample from the suspect. Making a second, new DNA comparison could cure many of the technical and scientific challenges to the accuracy and reliability of the older DNA code lodged in the computer.[136]

Implicit in this recommendation, of course, is the view that a second DNA match or a fingerprint match would provide the basis for an arrest and prosecution.

— Use of Non-Offender DNA Data

Can criminal justice agencies use DNA data pertaining to non-offenders? In a fingerprint context, a handful of courts have addressed whether, in the absence of statutory authorization, non-offender prints can be shared with law enforcement officials and used for investigative or other criminal justice purposes. In *People v. Stuller*, for instance, a California appellate court upheld the use of a non-offender fingerprint in a criminal investigation for rape, where the fingerprint on file was obtained in connection with an employment identification requirement.[137]

More recently, however, a concurring opinion by the then-Chief Justice of California's Supreme Court argued, in effect, that *Stuller* was wrongly decided. In *Perkey v. Department of Motor Vehicles*, the California Supreme Court, sitting *en banc*, held that fingerprint information obtained in connection with applications for California driver's licenses is rationally related to highway safety and, therefore, the statutory fingerprinting requirement is not violative of the Federal or State constitutional rights of privacy.[138]

Research for SEARCH's "Biometric Identification Technologies" report did not find a single court decision holding that the use of a validly obtained and validly retained non-offender print for law enforcement purposes is unconstitutional or otherwise unlawful. Nevertheless, statutory charters for DNA databanks should address criminal justice access to and use of DNA data, particularly if non-offender DNA test data is included in the databank.

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[135] SEARCH Group, Inc. "Biometric Identification Technologies," note 61, p. 64.

[136] "New York DNA Report," note 26, p. 36.

[137] 10 Cal. App. 3d 583 (1970), *cert. denied*, 401 U.S. 977 (1971).

[138] 42 Cal. 3d 185, 193 (Cal. 1986) (Bird, C.J. concurring; Mosk, J. dissenting).

— Use of DNA Data For Noncriminal Justice Purposes

Are there legal problems if DNA test results are disseminated and used outside of the criminal justice system? Many jurisdictions have adopted statutes which prohibit the dissemination of fingerprint (or photographic or other identification information) to the public.[139] Similarly, California's new statute providing for the establishment of a DNA databank expressly provides that "the blood grouping analysis information shall be released only to law enforcement agencies and district attorneys' offices, at the request of the agency."[140]

In jurisdictions that have not addressed this issue through statute law, the courts have sometimes prohibited the release of fingerprint data to the public on various common law or even constitutional theories.[141] Statutory charters for DNA databanks should be careful to address the question of noncriminal justice access to and release of DNA test result data.

— General Dissemination Policy Issues

Simply stated, if DNA databanks are established, privacy proponents fear, not unreasonably, that the databanks will soon become targets for noncriminal justice organizations seeking access to DNA information.

The list of potential (and worthy) users is substantial. National security agencies — which already enjoy access to criminal history record information pursuant to the Federal Security Clearance Information Act — may argue that if law enforcement needs are sufficiently compelling to justify access to a DNA databank, then national security needs are at least as compelling. Other types of governmental, noncriminal justice agencies may also claim that their needs may, from time to time, require access to DNA databank information.

In the private sector, numerous types of organizations can be expected to seek access to DNA databank information. Many private sector organizations, such as those involved in providing child care services, already enjoy statutory access to criminal history record information. In this connection, as noted earlier, one of the commercial DNA laboratories, Cellmark, already advertises that DNA test information can and should be used to register children in order to guard against kidnapping. Medical researchers may also seek access to DNA databanks for various research purposes, thus raising the specter of genetic profiling.

The ACLU of Washington has proposed formal safeguards to minimize the risk of improper dissemination and use of DNA test data. Many others agree that steps must be taken to minimize the possibility of leakage or abuse of the potentially sensitive and personal information contained in a DNA databank.

On the other hand, some DNA proponents, including some participants in the BJS/SEARCH DNA Forum, point out that as long as the DNA databank consists only of the digitized DNA "print" and not the blood or tissue specimens, there is little privacy risk in making DNA identification information available to the public. Proponents of this view argue that information in a DNA databank is beyond the public's ability to comprehend, much less use. Even if the public were capable of understanding DNA data, the interpretation provides nothing more than an identification. Proponents also point out that in many states the public, or at least segments of the public, already have a right of access to criminal history record information. Access to criminal history record information, it is argued, provides access to far more substantive and sensitive information than does access to mere DNA identification information.

In response, privacy proponents argue that dissemination, outside the criminal justice system, of the fact that law enforcement agencies are maintaining DNA test results about a particular individual customarily indicates that the individual is either an offender or is currently the subject of a criminal justice investigation. In either case, the information is sensitive and stigmatizing.

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139 SEARCH Group, Inc., "Biometric Identification Technologies," note 61, p. 65-66.

140 CAL. PEN. CODE § 290.2(d).

141 SEARCH Group, Inc., "Biometric Identification Technologies," note 61, p. 66; *Cf. Paul v. Davis*, 425 U.S. 693 (1976).

In view of these concerns, privacy proponents call for DNA databank charters that include safeguards such as: express prohibitions on dissemination of DNA data outside the criminal justice system;[142] a scheme for purging DNA data after passage of a certain number of years without a rearrest or other involvement in the criminal justice system; remedies for unauthorized dissemination of DNA test data, including civil and criminal penalties and a private right of action; and a requirement that DNA databank subjects receive a written notice that their DNA test data has been retained in a DNA databank and an explanation of the permissible uses of their data and the confidentiality and other protections that apply to their data.[143]

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[142] California's DNA law prohibits release of DNA data outside the criminal justice system. See Hoeffel, "The Dark Side," note 90, p. 536, n. 413.

[143] Virginia's new DNA statute prohibits the release of DNA data except to law enforcement officials and to the record subject in cases where the record subject submits a suitable fluid sample and a match is made. Title 19.2-310.4 and 310.5 of the Code of Virginia (1990).

Conclusion

DNA testing and the establishment of DNA databanks hold enormous promise. There seems little doubt that this technology can make a substantial contribution to law enforcement's ability to apprehend offenders, particularly with respect to the most violent and disabling types of crime, such as murder and rape.

Techniques that use sophisticated biological processes and computers to identify individuals may be considered by some as posing threats to individual privacy interests. To capture the potential of DNA testing, policymakers must put protections in place that will ensure that the technology will operate in a manner consistent with applicable legal principles.

Does this mean that the criminal justice system is constrained from making effective use of DNA testing? The answer surely is no. It does mean, however, that the nation's approach to DNA testing and the establishment of DNA databanks must be calibrated to match American sensibilities. Such measures customarily involve establishing appropriate due process and privacy protections as discussed in this report.