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DNA TYPING: EMERGING OR NEGLECTED ISSUES

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Abstract: DNA typing has had a major impact on the criminal justice system. There are hundreds of opinions and thousands of cases dealing with DNA evidence. Yet, at virtually every stage of the process, there are important issues that are just emerging or that have been neglected.

At the investigative stage, courts have barely begun to focus on the legal limitations on the power of the police to obtain samples directly from suspects and to use the data from DNA samples in various ways. Issues such as the propriety of "DNA dragnets" (in which large numbers of individuals in a geographic area are asked to provide samples voluntarily), the validity of court orders for samples based on a lesser standard than probable cause, and the permissibility of collecting DNA "abandoned" in public places are being litigated for the first time. Using crime-scene samples to infer racial or ethnic characteristics is emerging as a distinct possibility. Then there are the more than 282 million specimens of human biological material stored by private and public agencies in the United States; in some situations, police may well turn to some of these repositories to obtain samples. There is little or no case law analyzing the constitutional restrictions on these investigative practices.

After the filing of charges, an accused sometimes moves to dismiss on the ground of the expiration of the statute of limitations. However, there is a movement to carve out a DNA exception to the statute of limitations in cases in which DNA evidence permits the identification of the perpetrator after the expiration of the normal period of limitations. The argument is that the legislative purpose of the statute is to prevent the maintenance of prosecutions based on stale, unreliable evidence but that DNA evidence is so reliable that its availability should lift the bar of the statute. However, little attention has been given to the difficulties inherent in drafting such a legislative exception that will not be overinclusive.

At the trial stage, in a growing number of cases, after the defense attacks the weight of the government's DNA evidence, prosecutors are commenting to the jury that the defense has requested an opportunity to retest the DNA. Do such comments run afoul of the Fifth or Sixth Amendment?

The purpose of this Article is to identify and analyze such emerging issues. If the criminal justice system is to realize the full potential of DNA technology while maintaining the essential fairness of the system, it must come to grips with these issues in short order.

Fifteen years ago, deoxyribonucleic acid (DNA) analysis began to be applied to law enforcement.[1] Before long, its suitability for the

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1. The earliest instance of DNA analysis for legal purposes is reported in Alec J. Jeffreys et al., *Positive Identification of an Immigration Test-Case Using Human DNA Fingerprints*, 317 NATURE 818 (1985) (applying the multilocus probes described in Alec J. Jeffreys et al., *Individual-Specific*

courtroom was bitterly contested. Significant questions were raised in the popular press,[2] books from scientific publishers,[3] law reviews,[4] and, of course, in trial and appellate courts.[5] Today, the controversy over the scientific validity of forensic DNA testing has largely dissipated,[6] but more subtle issues of criminal procedure and evidence often arise when DNA is employed in the investigations and trials. Unlike the question of the scientific validity of the usual methods of forensic DNA analysis, many of these new matters have yet to be extensively litigated. This Article identifies some of these emerging or neglected issues.[7]

"Fingerprints" of Human DNA, 316 NATURE 76 (1985), and Alec J. Jeffreys et al., *Hypervariable "Minisatellite" Regions in Human DNA*, 314 NATURE 67 (1985)). Soon after, this group applied the technique to a serial-murder case described at length in JOSEPH WAMBAUGH, THE BLOODING 71–75, 79–82, 146–47, 150–54, 156–57, 167–71, 213–18, 227–28, 275, 282, 284 (1989), excluding one suspect and incriminating another. In the United States, another form of DNA typing made its debut in an unreported Pennsylvania case, *Commonwealth v. Petinikis*. *See* COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE: AN UPDATE, NATIONAL RESEARCH COUNCIL, THE EVALUATION OF FORENSIC DNA EVIDENCE 174 n.18 (1996) [hereinafter NRC II].

2. *See, e.g.*, Gina Kolata, *Some Scientists Doubt the Value of "Genetic Fingerprint" Evidence*, N.Y. TIMES, Jan. 29, 1990, at A1 ("Leading molecular biologists say a technique promoted by the nation's top law enforcement agency for identifying suspects in criminal trials through the analysis of genetic material is too unreliable to be used in court."). Several of the biologists referred to in this story complained that their views were misrepresented, but the New York Times declined to print their letters to the editor. *See* Andre A. Moenssens, *DNA Evidence and Its Critics—How Valid Are the Challenges?*, 31 JURIMETRICS J. 87, 99–100 (1990).

3. *See, e.g.*, Marjorie M. Shultz, *Reasons for Doubt: Legal Issues in the Use of DNA Identification Evidence*, *in* DNA ON TRIAL: GENETIC IDENTIFICATION AND CRIMINAL JUSTICE 19 (Paul R. Billings ed., 1992), *reviewed by* John F.Y. Brookfield, *Gene Justice*, 363 NATURE 122 (1993) (dismissing the criticism as "parochial nonsense").

4. *See, e.g.*, Janet C. Hoeffel, Note, *The Dark Side of DNA Profiling: Unreliable Scientific Evidence Meets the Criminal Defendant*, 42 STAN. L. REV. 465 (1990).

5. For reviews of the challenges to admissibility, *see* Paul C. Giannelli, *The DNA Story: An Alternative View*, 88 J. CRIM. L. & CRIMINOLOGY 380 (1997) (concluding that courts were too willing to admit an untested technology); David H. Kaye, *DNA Evidence: Probability, Population Genetics, and the Courts*, 7 HARV. J.L. & TECH. 101 (1993) (suggesting that the principal objection to the computations of random-match probabilities was exaggerated); William C. Thompson, *Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the "DNA War,"* 84 J. CRIM. L. & CRIMINOLOGY 22 (1993) (reviewing the debate on population structure but not discussing studies indicating that the effect is generally minor). Some of the leading court opinions are reproduced in D.H. KAYE, SCIENCE IN EVIDENCE 167–206 (1997).

6. *See infra* Part II.A.

7. This Article builds on a report prepared by the authors for the Legal Issues Working Group of the National Commission on the Future of DNA Evidence, entitled FORENSIC DNA TYPING: SELECTED LEGAL ISSUES (2000). The authors are grateful to Paul Bender, Susan Ehrlich, Rockne Harmon, Dorothy Nelkin, Barry Scheck, Michael Smith, Ralph Spritzer, Jeffrey Thoma, William Thompson, James Weinstein, and Richard Willing for information, comments, discussions, or arguments about topics discussed in this Article.

Part I discusses constitutional problems that arise when the government uses DNA evidence in investigating a crime. It focuses primarily on methods of acquiring DNA from an individual suspected of committing a crime and considers the constitutionality of compelling suspects to submit to DNA sampling and of acquiring stored samples of a suspect's DNA or medical records relating to these samples from private medical providers or laboratories.[8] It also considers the constitutionality of gathering DNA from large numbers of people to see whether any have genotypes that match those seen in the trace evidence. It shows that although the Fourth Amendment usually requires the police to have probable cause and a warrant to compel a person to provide a DNA sample, there are many situations in which police may be able to secure DNA samples without these safeguards.

Part I also considers a second investigative use of DNA: deducing physical or other characteristics of an individual whose DNA is found at the scene of crime. Genetic typing will permit inferences as to ancestry, physiognomy, or inherited disorders. Part I concludes that investigators can use genetic data to make valid inferences without infringing any constitutional rights.

Part II addresses legal issues that arise at a later stage in the justice system, when DNA analysis is used as evidence in the prosecution of persons charged with crimes. It discusses the admissibility of new DNA tests and the results of proficiency tests at particular laboratories and suggests that the rules of character evidence create a largely unrecognized, and probably undesirable, obstacle to admissibility. It also considers proposals that the durability of DNA evidence justifies extending the statute of limitations for prosecutions for certain crimes. It calls for more legislative sensitivity to the policies that underlie

8. This Article does not consider legal issues associated with collecting or using DNA from individuals who are not specifically suspected of the crime that is under investigation. These issues are central to building and administering many DNA databases for law enforcement and will be addressed in a separate article that is in progress. The most comprehensive treatment published to date is Michelle Hibbert, *DNA Databanks: Law Enforcement's Greatest Surveillance Tool?*, 34 WAKE FOREST L. REV. 767 (1999). For rejoinders to some of the criticisms advanced there, see D.H. Kaye, *Bioethics, Bench, and Bar: Selected Arguments in* Landry v. Attorney General, 40 JURIMETRICS J. 193 (2000); David H. Kaye & Edward J. Imwinkelried, FORENSIC DNA TYPING: SELECTED LEGAL ISSUES (2000). For discussion of the acquisition of DNA for the purpose of proving that a convict is innocent, see Cynthia Bryant, *When One Man's DNA Is Another Man's Exonerating Evidence: Compelling Consensual Sexual Partners of Rape Victims to Provide DNA Samples to Postconviction Petitioners*, 33 COLUM. J.L. & SOC. PROBS. 113 (2000).

limitations on the period of criminal liability and a better understanding of how the durability of DNA evidence interacts with these policies.

For some of these emerging issues, it is possible to make a reasonably confident prediction of the courts' ultimate resolution of the questions posed by DNA technology. However, other questions seem much closer and require more attention to the underlying policies. The hope is that this Article will stimulate judicial attention and scholarly commentary by identifying the full range of issues and analyzing some of the unresolved questions surrounding the use of DNA evidence.

I. DNA ANALYSIS IN CRIMINAL INVESTIGATIONS

Traditionally, DNA has been employed to link a suspect to a crime. Finding that a suspect's DNA matches the DNA left at a crime scene, for example, tends to incriminate the suspect.[9] Inversely, when the DNA does not match, the suspect usually can be excluded as the source of the crime-scene DNA.[10] If trace evidence is to be used in these ways, the police must secure samples of DNA from individuals who might have committed the crime under investigation. Officials can secure such samples in many ways. They can seek a court order to compel an individual to submit to sampling; they can turn to a preexisting collection of DNA samples; they can take a sample with the consent of the individual; or they can try to locate a sample that the suspect has abandoned.

As a matter of constitutional law, the principal constraint[11] on such government action is the Search and Seizure Clause of the Fourth Amendment to the U.S. Constitution,[12] which states:

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9. It does so by suggesting that the suspect is the source of the crime-scene DNA. Of course, other explanations may exist. The match might be a laboratory artifact, it might be coincidental in that an unrelated person is the source of the trace evidence, or the match could be the result of kinship in that a close relative of the defendant is the source. Suitable investigative and testing procedures often can eliminate such alternative hypotheses. *See* David H. Kaye & George F. Sensabaugh, Jr., *Reference Guide on DNA Evidence*, *in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 485 (Federal Judicial Center ed., 2d ed. 2000).

10. As with an inclusion, there can be other explanations for a reported exclusion. *See* Kaye & Sensabaugh, Jr., *supra* note 9.

11. The Self Incrimination Clause of the Fifth Amendment and the Due Process Clauses of the Fifth and Fourteenth Amendments have less force in this context. *See* D.H. Kaye, *The Constitutionality of DNA Sampling on Arrest*, 10 CORNELL J.L. & PUB. POL'Y (forthcoming 2001); *cf., e.g.*, Schmerber v. California, 384 U.S. 757, 760–65 (1966) (rejecting such claims with regard to involuntary taking blood from an individual suspected of driving while intoxicated for the

> 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.[13]

However, what makes a search reasonable and when a warrant supported by probable cause is required are not always apparent. The following sections analyze the application of these requirements to the various methods of acquiring DNA from suspects.

A. Legality of Compelling Suspects To Submit to DNA Extraction

Because the Search and Seizure Clause protects "[t]he right of the people to be secure in their persons," it applies both to restraining a person and to searching the inside or outside of a person's body. The Supreme Court made this clear in *Schmerber v. California*.[14] Schmerber was arrested at a hospital while receiving treatment for injuries suffered in an automobile accident. He had allegedly been driving while intoxicated, and a police officer directed a physician at the hospital to withdraw a blood sample.[15] Chemical analysis revealed a high concentration of alcohol in his blood at the time of the offense, and the report of this analysis was admitted in evidence at trial in Los Angeles Municipal Court even though the defendant objected that he never consented to the test.[16] He was convicted of driving an automobile while under the influence of intoxicating liquor, and the state appellate court affirmed the conviction.[17] The U.S. Supreme Court affirmed, but only

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purpose of measuring his blood alcohol concentration shortly after he had been injured in an automobile accident).

12. Some state constitutions provide enhanced protection from searches and seizures and other police practices. For example, in *United States v. Robinson*, 414 U.S. 218 (1973), and *Gustafson v. Florida*, 414 U.S. 260 (1973), the Court authorized broad searches incidental to the lawful arrest of a person. *Robinson*, 414 U.S. at 230–35; *Gustafson*, 414 U.S. at 263–66. Under their state constitutions, several courts have refused to follow *Robinson* and *Gustafson*. *See, e.g.*, State v. Taylor, 808 P.2d 324 (Ariz. 1990); People v. Innis, 604 N.E.2d 389 (Ill. Ct. App. 1992); State v. Hoskinson, 879 P.2d 180 (Or. 1994).

13. U.S. CONST. amend. IV.

14. 384 U.S. 757 (1966).

15. *Id.* at 758.

16. *Id.* at 758–59.

17. *Id.* at 759.

after applying the Search and Seizure Clause to the act of removing the biological sample.[18] The majority began its analysis from the premise that "[s]uch testing procedures plainly constitute searches of 'persons,' and depend antecedently upon seizures of 'persons' . . . within the meaning of that Amendment."[19] The Court emphasized that "[t]he integrity of an individual's person is a cherished value of our society."[20]

Because *Schmerber* established that the Fourth Amendment applies to removing material from a suspect's body, as a general rule, police must persuade a judge or magistrate that there is probable cause to believe that the desired DNA sample will produce evidence linking the suspect to the crime.[21] With judicial authorization, police can use necessary force to extract the biological material.[22] Furthermore, once the authorities legally have acquired a suspect's profile, they are permitted to compare it to profiles from unrelated, unsolved crime-scene stains.[23] The current state of the law appears to allow evidence legitimately acquired for one purpose to be used for another purpose, at least if the additional use entails no further search or seizure of the person.[24]

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18. *Id.* at 766–72.

19. *Id.* at 767.

20. *Id.* at 772.

21. *See, e.g.*, People v. Marshall, 244 N.W.2d 451, 457 (Mich. Ct. App. 1976); *In re* J.W.K., 583 N.W.2d 752, 755 (Minn. 1998); State v. Evans, 338 N.W.2d 788, 794 (Neb. 1983); *In re* Death of Abe A., 437 N.E.2d 265, 266 (N.Y. 1982); Commonwealth v. Riedel, 651 A.2d 135, 139 (Pa. 1994).

22. *E.g.*, United States v. Bullock, 71 F.3d 171, 175–77 (5th Cir. 1995).

23. *See* Bickley v. State, 489 S.E.2d 167, 170 (Ga. Ct. App. 1997) (rejecting the claim that investigators violated Fourth Amendment by using a DNA sample taken pursuant to a search warrant in a 1994 rape investigation to convict a man of two earlier rapes as well as the 1994 rape); Smith v. State, 734 N.E.2d 706, 709–10 (Ind. Ct. App. 2000) (involving DNA obtained by court order in rape case in which defendant was acquitted on a consent defense; police found a match between this DNA sample and a profile in the state's database of DNA from unsolved crimes; the court held the database check was constitutional because "police conduct in *comparing* Smith's court-ordered DNA sample with the DNA obtained from the V.O. rape is not a Fourth Amendment search or seizure"); Wilson v. State, 752 A.2d 1250, 1268–72 (Md. Ct. Spec. App. 2000) (stating that because "[n]o new Fourth Amendment intrusion is involved," use of a previously legally obtained sample to link defendant to present crime obviated need for new warrant even though police had obtained one); People v. King, 663 N.Y.S.2d 610, 614 (App. Div. 1997) (stating that police could use the profile from a sample obtained under a warrant with probable cause in a second rape investigation even if they lacked probable cause to acquire the sample for that investigation because "once a person's blood sample has been obtained lawfully, he can no longer assert either privacy claims or unreasonable search and seizure arguments with respect to the use of that sample").

24. Because the invasion of privacy was justified (by probable cause and a warrant for seizing the DNA and searching its structure), the conventional additional-use theory would allow the later

In some circumstances, however, either a warrant or probable cause might not be essential to obtain the sample in the first place. For instance, if a person is legitimately under arrest, the seizure of the person is justified,[25] and routine, non-invasive DNA sampling of all arrestees solely for the purpose of creating a record of the true identity of the individual is probably constitutional.[26] Furthermore, according to conventional wisdom, once the government has acquired the sample

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further comparisons. *See supra* note 23. An analogy can be drawn to the situation in which police searching a dwelling for specific stolen items record the serial number of an item not enumerated in the warrant and check this number against a list of serial numbers of other stolen items. Recording the serial number would not be considered a search if the number was in plain view. *Cf.* Arizona v. Hicks, 480 U.S. 321, 324–25 (1987) ("[T]he mere recording of the serial numbers did not constitute a seizure, [but] taking action, unrelated to the objectives of the authorized intrusion, which exposed to view concealed portions of the apartment or its contents, did produce a new invasion of respondent's privacy unjustified by the exigent circumstance that validated the entry."). Under the additional-use theory, checking the number against a list is not an additional search of the person or the property and therefore would be allowed. *Cf.* State v. Wamre, 599 N.W.2d 268, 274–77 (N.D. 1999) (holding that the Fourth Amendment was satisfied when the police used a serial number that was in plain view during a search to secure a warrant by telephone that allowed them to seize the additional items).

The logic of the existing Fourth Amendment doctrine has been sharply questioned. *See* Harold J. Krent, *Of Diaries and Data Banks: Use Restrictions Under the Fourth Amendment*, 74 TEX. L. REV. 49, 53 n.25 (1995) (arguing that the current understanding of the Fourth Amendment should be altered so that "each governmental use of information about an individual constitutes a separate seizure of that person's effects" and hence "all such uses must satisfy the reasonableness requirement").

25. A valid arrest requires probable cause to believe that the individual has committed an offense. Alternatively, the presence of exigent circumstances may justify a seizure in the absence of a warrant. This was the basis for upholding the search in *Schmerber v. California*, 384 U.S. 757 (1966). The Court reasoned that there was an exigency because blood-alcohol concentrations decline rapidly. *Id.* at 770–72. However, DNA cases are readily distinguishable. In the typical case, the police desire a DNA sample to test for permanent, identifying markers—markers that will not evaporate or disappear with the mere passage of time. Consequently, it will be more difficult for the authorities to justify a warrantless seizure of a DNA sample than it would be to justify a similar acquisition of a blood sample for intoxication testing. *See In re* J.W.K., 583 N.W.2d 752, 757 (Minn. 1998). In the absence of exigent circumstances, the police would be obliged to obtain the functional equivalent of a warrant, that is, a court order that the suspect furnish a DNA sample. *See* Thurman v. State, 861 S.W.2d 96, 100 (Tex. Ct. App. 1993).

26. *See* Kaye, *supra* note 11 (describing the types of sampling and the protections on disclosure of the information that might be required to satisfy the Due Process and the Search and Seizure Clauses of the Bill of Rights). Of course, a state may adopt a more restrictive approach under its own constitution. *See generally* DARIEN A. MCWHIRTER & JOHN D. BIBLE, PRIVACY AS A CONSTITUTIONAL RIGHT 174, 178 (1992); RICHARD C. TURKINGTON & ANITA L. ALLEN, PRIVACY LAW 122–25 (1999) (listing state constitutional provisions).

consistent with Fourth Amendment protections, the Search and Seizure Clause does not bar its use for another purpose.[27]

It also is likely that an order compelling a person to give a sample could be issued on something less than probable cause. In *Davis v. Mississippi*,[28] the Supreme Court suggested in dictum such a procedure. A woman in Meridian, Mississippi, reported that "a Negro youth" broke into her home and raped her. Police, "without warrants, took at least 24 Negro youths," including Davis, "to police headquarters where they were questioned briefly, fingerprinted, and released without charge."[29] After Davis's fingerprints were discovered to match those lifted from the windowsill, he was indicted, tried, and convicted.[30] His objection to the admission of the fingerprint evidence was overruled, and the Mississippi Supreme Court affirmed the conviction on the theory that fingerprint evidence is so reliable that the Fourth Amendment exclusionary rule does not apply to this evidence.[31] The U.S. Supreme Court reversed. The Court held that the Fourth Amendment requires the exclusion of evidence that is the fruit of an unreasonable search or seizure, regardless of how reliable that evidence may be.[32] Reasoning that Davis was detained without a warrant and without probable cause, and that he was not merely fingerprinted but interrogated, the Court concluded that the resulting fingerprints were inadmissible.[33] However, the Court's response to the state's argument that an arrest made solely for the purpose of obtaining fingerprints should be allowed without probable cause was less definitive. Although Justice Brennan, writing for the

27. *See supra* note 23. Under *City of Indianapolis v. Edmond*, 121 S. Ct. 447 (2000), and *Ferguson v. City of Charleston*, 121 S. Ct. 1281 (2001), the reuse would not be allowed if the samples from arrestees were obtained as part of a program that had as its primary goal the acquisition of DNA samples for later database searches. *See* Kaye, *supra* note 11.In addition this reuse would not be acceptable under the theory advanced in Krent, *supra* note 24, at 53 n.25. A narrower version of this view holds that when the police rely on a special justification to deviate from the normal Fourth Amendment requirements of probable cause or a warrant, their utilization of the evidence seized must be limited to uses that promote that special justification. Thus, if as in *Schmerber v. California*, 384 U.S. 757 (1966), the police justify a warrantless seizure of evidence on the theory that blood alcohol testing requires a sample to be taken without further delay, they could not use the blood sample for DNA testing. This narrower version has merit, although no published opinion has embraced it as a basis for excluding evidence.

28. 394 U.S. 721, 727 (1969).

29. *Id.* at 722.

30. *Id.*

31. *Id.* at 723–24.

32. *Id.* at 724.

33. *Id.* at 726–28.

majority of the Court, emphasized that "[d]etentions for the sole purpose of obtaining fingerprints are . . . subject to the constraints of the Fourth Amendment,"[34] he added that:

> It is arguable, however, that, because of the unique nature of the fingerprinting process, such 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 . . . . Detention for fingerprinting may constitute a much less serious intrusion upon personal security than other types of police searches and detentions. Fingerprinting involves none of the probing into an individual's private life and thoughts that marks an interrogation or search. Nor can fingerprint detention be employed repeatedly to harass an individual, since the police need only one set of each person's prints. Furthermore, fingerprinting is an inherently more reliable and effective crime solving tool than eyewitness identifications or confessions . . . . Finally, because there is no danger of destruction of fingerprints, the limited detention need not come unexpectedly or at an inconvenient time.[35]

The Court opened the door to the possibility that "the requirements of the Fourth Amendment could be met by narrowly circumscribed procedures for obtaining, during the course of a criminal investigation, the fingerprints of individuals for whom there is no probable cause to arrest."[36] The Court virtually invited states to devise procedures to obtain evidence of identifying characteristics on the basis of something less than probable cause.

Many states seized on this invitation by adopting statutes or court rules permitting the police to obtain evidence of identifying physical characteristics after a showing of founded or reasonable suspicion.[37] For instance, Arizona authorizes magistrates to issue "an order authorizing . . . temporary detention, for the purpose of obtaining evidence of identifying physical characteristics" on a showing of "[r]easonable cause

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34. *Id.* at 727.

35. *Id.* at 727–28.

36. *Id.* at 728.

37. For discussions of the statutes and court rules adopted by the various states, as well as the court rule proposed for federal practice, see Jerold H. Israel, *Legislative Regulation of Searches and Seizures: The Michigan Proposals*, 73 MICH. L. REV. 222, 238–41 (1974); Angus J. Dodson, Comment, *DNA "Line-Ups" Based on a Reasonable Suspicion Standard*, 71 U. COLO. L. REV. 221, 234–38 (2000); Note, *Detention to Obtain Physical Evidence Without Probable Cause: Proposed Rule 41.1 of the Federal Rules of Criminal Procedure*, 72 COLUM. L. REV. 712 (1972).

for belief that a felony has been committed" and proof that the "physical characteristics . . . may contribute to the identification of the individual who committed such offense."[38] As in this instance,[39] the language of many of these statutes and court rules is broad enough to apply to DNA samples.[40]

One might argue that these statutes or rules are too broad—that unlike the fingerprints in *Davis*, blood, urine, or hair samples should be treated differently because they have the potential to reveal information that is more significant than the pattern of whorls and ridges in a fingerprint. Some support for this distinction can be found in *Skinner v. Railway Labor Executives' Ass'n*,[41] which involved drug testing of railway employees. The Court observed that "chemical analysis of urine, like that of blood, can reveal a host of private medical facts about an employee, including whether he or she is epileptic, pregnant, or diabetic."[42] The same concern with "private medical facts" arises with

38. ARIZ. REV. STAT. ANN. § 13-3905(A) (West 1999).

39. The Arizona statute specifies that "'identifying physical characteristics' includes, but is not limited to, the fingerprints, palm prints, footprints, measurements, handwriting, handprinting, sound of voice, blood samples, urine samples, saliva samples, hair samples, comparative personal appearance or photographs of an individual." *Id.* § 13-3905(G).

40. Clyde M. Tande, Note, *DNA Typing: A New Investigatory Tool*, 1989 DUKE L.J. 474 (describing the breadth of the language of the various state statutes and court rules). For example, Alaska Rule of Criminal Procedure 16(c) allows a court to order detention to "[p]ermit the taking of samples of blood, hair and other materials of the person's body which involve no unreasonable intrusion thereof" on the basis of an affidavit or testimony establishing

> probable cause to believe that: (i) An offense has been committed by one of several persons comprising a narrow focal group that includes the subject person; (ii) The evidence sought may be of material aid in identifying who committed the offense; and (iii) The evidence sought cannot practicably be obtained from other sources.

ALASKA R. CRIM. P. 16(c)(2)(vii) & 16(c)(1).

Although the Supreme Court has not ruled authoritatively on the constitutionality of these procedures, in *Hayes v. Florida*, 470 U.S. 811 (1985), the Court referred approvingly to its previous statement in *Davis*. *Id.* at 817.

41. 489 U.S. 602 (1989).

42. *Id.* at 617. Read in context, however, this language does not necessarily support imposing a requirement of probable cause. In *Skinner*, the Supreme Court was reviewing a judgment of the Ninth Circuit Court of Appeals striking down the drug testing regulations because they did not require any showing of individualized suspicion—not even reasonable suspicion, let alone probable cause. *Id.* at 612–13. The majority merely mentioned "private medical facts" in establishing that urinalysis constitutes a search. *Id.* at 617. It does not follow from the fact that a search is involved that probable cause is required. That is precisely the point made in *Davis*, where the Court indicated its willingness to relax the probable cause requirement for the undeniable searches or seizures involved in compelling a suspect to provide fingerprints. *See* Davis v. Mississippi, 394 U.S. 721, 727 (1969).

any samples that can be subjected to DNA analysis. To this extent, it would be facile to say that DNA typing, like the fingerprinting in *Davis*, "involves none of the probing into an individual's private life and thoughts that marks an interrogation or search."[43] Certain parts of one's genome—those that are related to otherwise nonobvious disease states or behavioral characteristics—are as much, if not more, a part of "an individual's private life" as are the hormones or other chemicals found in one's urine.

However, all the other factors listed in the *Davis* dictum apply to DNA sampling. Detention to obtain the sample cannot "be employed repeatedly to harass an individual, since the police need only one set of each person's [DNA types]."[44] DNA analysis "is an inherently more reliable and effective crime-solving tool than eyewitness identifications or confessions."[45] And, "the limited detention need not come unexpectedly or at an inconvenient time."[46] Moreover, in describing these features of fingerprinting, the *Davis* Court recognized the possibility that the police might abuse even fingerprinting to harass or inconvenience a suspect.[47] The suggestion of relaxing the probable cause requirement presupposes the police will conform to the court order and the judiciary will issue orders that avoid these problems. This premise applies as well to the informational privacy concern voiced in *Skinner*. Just as there is no need to detain an individual repeatedly or to detain a person in the middle of the night, there is no reason for the police to probe parts of the genome that conceivably could be used to indicate disease states, susceptibilities, or the like.[48] Because the judicial order can limit the search to loci that are of strictly biometric interest, the analogy to *Davis* is apt. Detention for DNA typing, as much as detention for fingerprinting, "may constitute a much less serious intrusion upon personal security than other types of police searches and detentions."[49] If a person can be compelled to submit to fingerprinting on reasonable

43. *Davis*, 394 U.S. at 727.
44. *Id.* at 727–28.
45. *Id.*
46. *Id.*
47. *Id.* at 726–27.
48. *See* Kaye, *supra* note 8.
49. *Davis*, 394 U.S. at 727.

suspicion rather than probable cause, he or she can be required to submit to DNA sampling on the same showing.[50]

B. *Legality of Acquiring Samples or Records from Medical Providers or Laboratories*

Rather than compel a person to submit to DNA sampling, police might obtain DNA data on a suspect from preexisting samples or databases. As of 1998, it was estimated that there were more than 282 million specimens of human biological material stored in the United States, with samples from another 20 million individuals accumulating each year.[51] These samples are stored in academically based repositories of scientists studying genetic disorders, commercially based repositories that offer DNA banking as a service to researchers and individuals, teaching and other hospitals that have acquired samples in the course of clinical diagnostic or surgical procedures, laboratories that screen blood samples of newborns for metabolic or other diseases pursuant to state public health laws, and armed forces repositories of pathology specimens and samples collected to permit identification of human remains.[52] Although the Fourth Amendment plainly regulates police

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50. *See In re* Non-Testimonial Identification Order Directed to R.H., No. 99-353, 2000 WL 1234251, at *12–13 (Vt. Sept. 1, 2000) (upholding the constitutionality of a Vermont rule as applied to an order for a saliva sample on the basis of reasonable suspicion); *cf.* Doe v. Senechal, 725 N.E.2d 225, 231 (Mass. 2000) (holding that even if the Fourth Amendment applies to a private action for assault and battery and other torts, a court-ordered buccal swab to test whether a member of the staff of a residential treatment facility for mentally ill adolescents fathered the child of a patient is a reasonable search and seizure).

The conclusion that a court order based on probable cause (or perhaps reasonable suspicion) normally is required applies even if the police do not themselves demand or collect the DNA sample, but direct or request private citizens to acquire the sample. Suppose that shortly after an incident, a suspect goes to or is taken to a private hospital. While the suspect is still at the hospital, the police learn of the suspect's location. The police contact the hospital staff and request them to obtain a DNA sample from the suspect for law enforcement use. The private hospital would be acting as a government agent in making the intrusion and the Fourth Amendment would apply. *See* Skinner v. Ry. Labor Executives' Ass'n, 489 U.S. 602, 614–16 (1989). There is sufficient state action to trigger the Fourth Amendment if "the drawing of blood is instigated by the government," State v. Hardy, 963 S.W.2d 516, 523 (Tex. Crim. App. 1997), by, for instance, requesting that an emergency room doctor take a sample. Commonwealth v. Kohl, 615 A.2d 308, 310 (Pa. 1992). When the authorities intervene and request a sample even before the private entity takes one, the otherwise private entity is acting as a government agent in seizing the sample.

51. 1 NATIONAL BIOETHICS ADVISORY COMMISSION, RESEARCH INVOLVING HUMAN BIOLOGICAL MATERIALS: ETHICAL ISSUES AND POLICY GUIDANCE 13 (1999).

52. *See id.* at 13–15; Lawrence O. Gostin, *Health Information Privacy*, 80 CORNELL L. REV. 451, 464, 467–68 (1995); M. Therese Lysaught et al., *A Pilot Test of DNA-based Analysis Using*

efforts to obtain samples directly from suspects,[53] the prohibition against unreasonable searches applies only to government action.[54] As the Supreme Court commented in *United States v. Jacobsen*:[55] "This Court has . . . consistently construed this protection as proscribing only governmental action; it is wholly inapplicable 'to a search or seizure, even an unreasonable one, effected by a private individual not acting as an agent of the Government or with the participation or knowledge of any governmental official.'"[56]

This state action doctrine raises the possibility that police may be able to acquire preexisting information from cooperative private hospitals or laboratories without a court order and without probable cause or reasonable suspicion.[57] This practice would fall outside the constraints of the Fourth Amendment on two conditions: (1) the government did not instigate the original acquisition of the data, and (2) in acquiring the data that the suspect already has provided private entities, the state is not engaging in any search or seizure.

Anonymized Newborn Screening Cards in Iowa, *in* STORED TISSUE SAMPLES: ETHICAL, LEGAL, AND PUBLIC POLICY CONSIDERATIONS 3, 17 (Robert F. Weir ed., 1998); Jean E. McEwen, *DNA Databanks*, *in* GENETIC SECRETS: PROTECTING PRIVACY AND CONFIDENTIALITY IN THE GENETIC AGE 231 (Mark Rothstein ed., 1997).

53. When the police obtain a sample directly from a private citizen, there is undeniably sufficient state action to bring the Fourth Amendment into play. *E.g.*, *In re* J.W.K., 583 N.W.2d 752, 754–56 (Minn. 1998); State v. Binner, 886 P.2d 1056, 1057–58 (Or. Ct. App. 1994). The extent of the government involvement is the same whether the motivation of the police is to obtain the sample to add to a database or to acquire an evidential sample to be compared to a database.

54. United States v. Pervaz, 118 F.3d 1, 6 (1st Cir. 1997); United States v. Reed, 15 F.3d 928, 931 (9th Cir. 1994); State v. Grant, 620 N.E.2d 50, 60 (Ohio 1993); State v. Maxfield, 125 Wash. 2d 378, 384, 886 P.2d 123, 127 (1994), *rev'd on other grounds*, 133 Wash. 2d 332, 945 P.2d 196 (1997).

55. 466 U.S. 109 (1984).

56. *Id.* at 113–14 (quoting Walter v. United States, 447 U.S. 649, 662 (1980)); *see also* Coolidge v. New Hampshire, 403 U.S. 443, 488 (1971); Burdeau v. McDowell, 256 U.S. 465, 475 (1921); Tims v. State, 711 So. 2d 1118, 1122 n.2 (Ala. Crim. App. 1997) (finding "no state involvement"); People v. Perlos, 462 N.W.2d 310, 315 (Mich. 1990) (same); State v. Nelson, 941 P.2d 441, 445 (Mont. 1997) (same); State v. Enoch, 536 P.2d 460, 461 (Or. Ct. App. 1975) ("[I]f an independent private citizen finds evidence and turns it over to the police, the evidence is legitimate."); State v. Guido, 698 A.2d 729, 733 (R.I. 1997) (finding "no state action").

57. If the medical provider or researcher were uncooperative, the authorities could resort to compulsory process such as a subpoena. *See, e.g.*, United States v. Dionisio, 410 U.S. 1, 10–11 (1973) (stating that "a grand jury subpoena to testify is not that kind of governmental intrusion on privacy against which the Fourth Amendment affords protection, once the Fifth Amendment is satisfied," but recognizing that "[t]he Fourth Amendment provides protection against a grand jury subpoena duces tecum too sweeping in its terms 'to be regarded as reasonable'"); State v. Fears, 659 S.W.2d 370, 375–76 (Tenn. Crim. App. 1983) (requiring only a showing that the object of the subpoena is logically relevant to the subject matter of a legitimate criminal investigation).

The first condition is relatively straightforward and often will be satisfied for medical records and tissue samples.[58] Pathology specimens at private hospitals, for example, would fall into this category, but newborn screening samples compelled under state law would not.

The second condition is more subtle, for it depends on the meaning given to the phrase "search or seizure." The basic framework for determining whether a form of data collection amounts to a search or seizure for Fourth Amendment purposes is found in *Katz v. United States*.[59] In *Katz*, the government acquired key evidence to convict the defendant of interstate gambling by attaching an electronic listening-and-recording device to the outside of a public telephone booth. The government argued that the interception was not a search because there was no physical trespass and the telephone booth was a public place.[60] The Supreme Court held that neither entry onto private property nor inspection of tangible items is an essential feature of a search, for "the Fourth Amendment protects people, not places."[61] The Fourth Amendment protected the defendant, the Court explained, because "a person in a telephone booth . . . who occupies it, shuts the door behind him, and pays the toll that permits him to place a call is surely entitled to assume that the words he utters into the mouthpiece will not be broadcast to the world."[62] Because the federal agents had no warrant authorizing the interception, the Court held that the search violated the Fourth Amendment.[63] In a concurring opinion, Justice Harlan elaborated on the majority's remarks. In perhaps the most famous passage in the *Katz* opinions, he wrote: "[T]here is a twofold requirement, first that a person have exhibited an actual (subjective) expectation of privacy and, second, that the expectation be one that society is prepared to recognize as 'reasonable.'"[64] Applying this standard, he explained that "[t]he point is not that the booth is 'accessible to the public' at other times, but that it is

58. The condition is fulfilled if, before the government's request, the private parties acted on their "own initiative" and out of an "independent" medical or research "motivation." State v. Comeaux, 818 S.W.2d 46, 50 (Tex. Crim. App. 1991).

59. 389 U.S. 347 (1967).

60. *Id.* at 352–53.

61. *Id.* at 351.

62. *Id.* at 352.

63. *Id.* at 354–59.

64. *Id.* at 361 (Harlan, J., concurring).

a temporarily private place whose momentary occupants' expectations of freedom from intrusion are recognized as reasonable."[65]

Although the courts have applied the *Katz* "test" in many contexts, for present purposes the most important is the Supreme Court's 1976 decision in *United States v. Miller*.[66] In *Miller*, the accused was charged with possessing an unregistered still, carrying on a distillery business without paying the whiskey tax, and possessing whiskey on which no taxes had been paid.[67] Prior to trial, the government served subpoenas on two banks at which the defendant had accounts. The banks surrendered copies of the defendant's checks and deposit slips as well as the bank's own records of the defendant's accounts. The defendant moved to suppress the documents, but the trial judge denied the motion and admitted the evidence at trial.[68] The defendant was convicted and later appealed. The First Circuit reversed, holding that the banks' surrender of the records violated the defendant's Fourth Amendment rights.[69]

On appeal, the Supreme Court reversed the First Circuit's decision and reinstated the defendant's conviction. Writing for the majority, Justice Powell relied heavily on *Katz*. The Court upheld the denial of the suppression motion because "there was no intrusion into any area in which [the defendant] had a protected Fourth Amendment interest."[70] Because the defendant had transferred the checks and deposit slips to the bank, he could not assert "ownership []or possession" as to any of the subpoenaed records,[71] and "[a]ll of the documents obtained, including financial statements and deposit slips, contain only information voluntarily conveyed to the banks and exposed to their employees in the ordinary course of business."[72]

The defendant had argued that he retained an expectation of privacy because he had made the information available to the bank only "for a limited purpose."[73] However, Justice Powell made short shrift of that argument:

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65. *Id.* (Harlan, J., concurring).
66. 425 U.S. 435 (1976).
67. *Id.* at 436.
68. *Id.* at 438–39.
69. *Id.* at 439.
70. *Id.* at 440.
71. *Id.*
72. *Id.* at 442.
73. *Id.*

> The depositor takes the risk, in revealing his affairs to another, that the information will be conveyed by that person to the Government .... This Court has held repeatedly that the Fourth Amendment does not prohibit the obtaining of information revealed to a third party, even if the information is revealed on the assumption that it will be used only for a limited purpose and the confidence placed in the third party will not be betrayed.[74]

Justice Powell concluded that even if the banks were "acting solely as Government agents in" transcribing and surrendering the information, there was "no intrusion upon the [defendant's] Fourth Amendment rights."[75]

The logic of *Miller* has been applied to medical samples or records. As in the case of financial information, the patient or research subject neither owns nor possesses tissue samples or data that have been "voluntarily conveyed" to health care providers or medical researchers. Thus, in many of the cases challenging police requests for medical samples and records, the lower courts invoke *Miller* to defeat the defendant's claim.[76]

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74. *Id.* at 443.

75. *Id.*

76. *See, e.g.*, Tims v. State, 711 So. 2d 1118, 1123–24 (Ala. Crim. App. 1997); People v. Perlos, 462 N.W.2d 310, 316 (Mich. 1990); State v. Guido, 698 A.2d 729, 734 (R.I. 1997); State v. Fears, 659 S.W.2d 370, 375–76 (Tenn. Crim. App. 1983); Thurman v. State, 861 S.W.2d 96, 98 (Tex. Ct. App. 1993); Robert M. Gellman, *Prescribing Privacy: The Uncertain Role of the Physician in the Protection of Patient Privacy*, 62 N.C. L. REV. 255, 290–91 (1984) ("As a practical matter, in the absence of a statute or a definitive court decision, the *Miller* decision is effectively being applied when medical records are subpoenaed."). However, few cases deal with the specific question of obtaining DNA samples from private entities. *See In re* J.W.K., 583 N.W.2d 752, 754–57 (Minn. 1998). The vast majority concern blood samples used for intoxication testing. *E.g.*, People v. Dolan, 408 N.Y.S.2d 249, 250–51 (Sup. Ct. 1978); State v. Enoch, 536 P.2d 460, 460–61 (Or. Ct. App. 1975); Commonwealth v. Kohl, 615 A.2d 308, 310–11 (Pa. 1992); *Guido*, 698 A.2d at 731–32; State v. Comeaux, 818 S.W.2d 46, 48–49 (Tex. Crim. App. 1991). To an extent, that area of law is sui generis. In the United States, drunk driving exacts a huge toll in death and economic loss. For that reason, every state has enacted an implied-consent law. ANDRE A. MOENSSENS ET AL., SCIENTIFIC EVIDENCE IN CIVIL AND CRIMINAL CASES 176–225 (4th ed. 1995). By the terms of the implied-consent statute, when a citizen obtains a driver's license, he or she impliedly consents to later tests of his or her blood, breath, or urine alcohol concentration. The existence of these statutes in every jurisdiction reflects legislative recognition of an important public interest in the prevention of drunk driving, and the provisions of the statutes also weaken the argument that the citizen has a protected expectation of privacy in either the sample or a medical record reflecting the results of a sample's test. In the drunk-driving area, the implied-consent laws enable the government to contend both that the statutes reduce the citizen's privacy expectations and that any expectations are ones that society is unprepared to recognize as reasonable.

Nevertheless, *Miller* might be distinguished on at least three bases. First, the *Miller* Court stated that the bank records in question concerned "commercial transactions."[77] In contrast, a medical record can relate to far more intimate aspects of a person's life,[78] and the law should not create significant disincentives to persons seeking necessary medical advice and treatment. Although a patient has a greater privacy interest in medical records than a business or individual has in bank records,[79] it is not clear that the interest is so much deeper that the two types of records are distinguishable when the prosecution seeks the records to advance a criminal investigation.[80] Although recent polls indicate that the vast majority of Americans are concerned about the privacy of their medical records,[81] there are countervailing indications of the relevant, societally recognized expectations of privacy that are firmly settled. Most jurisdictions have enacted a general physician-patient privilege,[82] which typically encompasses not only communications in a conventional sense, but also any information that the physician gains by virtue of the examination.[83] Yet, the majority of jurisdictions do not recognize the privilege in criminal cases.[84] Thus, several courts have pointed to that

77. 425 U.S. at 442.

78. *See Perlos*, 462 N.W.2d at 324 (Levin, J., dissenting) ("A person's medical records are an intensely personal matter. Few persons would willingly share their medical records with the state."); State v. Binner, 886 P.2d 1056, 1059 (Or. Ct. App. 1994) ("Such testing could reveal the most personal of the medical details of our private lives that would not be known to the public in general."); Peter H. W. van der Goes, Jr., Comment, *Opportunity Lost: Why and How to Improve the HHS-Proposed Legislation Governing Law Enforcement Access to Medical Records*, 147 U. PA. L. REV. 1009, 1037–40 (1999).

79. *See Thurman*, 861 S.W.2d at 98.

80. *Fears*, 659 S.W.2d at 376 (asserting, after discussing *Miller*, "[w]e think that the same principle applies to medical records as to bank records and that the above holding of the *Miller* case is applicable").

81. *See* van der Goes, *supra* note 78, at 1011 n.10 ("A 1996 CNN/*Time* poll indicates that 87% of Americans want to be asked permission every time their medical records are accessed for any reason.").

82. *See* State v. Hardy, 963 S.W.2d 516, 525 (Tex. Crim. App. 1997) (noting that "most states" have a physician-patient privilege). A minority of jurisdictions do not recognize the privilege at all. *See, e.g.*, Tims v. State, 711 So. 2d 1118, 1122 (Ala. Crim. App. 1997); *Fears*, 659 S.W.2d at 375.

83. *See e.g.*, CAL. EVID. CODE § 992 (1995); Hale v. Superior Court (DeFelice), 34 Cal. Rptr. 2d 279, 280 (Ct. App. 1994); People v. Maltbia, 653 N.E.2d 402, 405–06 (Ill. Ct. App. 1995); State v. Comeaux, 818 S.W.2d 46, 54–56 (Tex. Crim. App. 1991) (Campbell, J., concurring); CHRISTOPHER B. MUELLER & LAIRD C. KIRKPATRICK, MODERN EVIDENCE: DOCTRINE AND PRACTICE § 5.36, at 621–22 (1995); Comment, *The Physician-Patient Privilege*, 56 NW. U. L. REV. 263 (1961).

limitation as evidence that society is unwilling to recognize a constitutionally enforceable privacy expectation in medical records or samples. In *Thurman v. State*,[85] for instance, the Texas Court of Appeals pointed out that the medical privilege is inapplicable to criminal cases;[86] hence, even if the citizen has a subjective expectation of privacy, society does not recognize that expectation as reasonable in a criminal setting.[87] For that matter, many jurisdictions not only carve out an exception to the privilege for criminal proceedings, but also require physicians to report certain types of events such as violent injuries and child abuse to the public authorities.[88] One jurisdiction has enacted even more sweeping legislation, requiring hospitals to furnish blood-test results to the prosecutor on request in a criminal investigation.[89] The reporting requirements and limited scope of the medical privilege strongly suggest that the person, who is the subject of the medical record, lacks a "societally recognized," constitutionally protected privacy expectation.[90]

Second, *Miller* might be distinguished by arguing that even if it permits the government to obtain medical records from a private source such as a hospital, it does not apply to a tissue sample. Certainly, the analogy between a DNA sample and the records in *Miller* is, at the very least, debatable, for there may be a more intense privacy expectation in the sample than in the records reflecting the results of a particular test on the sample. The sample represents a greater threat to privacy in that its existence would permit further testing and the revelation of additional information. Although noting that "[t]he precise question as to who owns the blood upon extraction from an individual raises a novel point

84. *See* CAL. EVID. CODE § 998; Green v. Cooper Med. Hosp., 968 F. Supp. 249, 252 (E.D. Pa. 1997) ("Under Pennsylvania law, the physician-patient privilege does not extend to criminal matters."), *aff'd*, 151 F.3d 1025 (3d Cir. 1998); Alexander v. Commonwealth, 708 A.2d 1251, 1257 (Pa. 1998); *Hardy*, 963 S.W.2d at 523.

85. 861 S.W.2d 96 (Tex. Ct. App. 1993).

86. *See id.* at 100 ("Society can afford the physician-patient privilege in certain civil cases in order to protect personal privacy, but the need to protect the public from crime requires disclosure of the same information in criminal cases.").

87. *See id.* at 98–101.

88. *See* State v. Fears, 659 S.W.2d 370, 376 (Tenn. Crim. App. 1983); Gellman, *supra* note 76, at 274.

89. *See* People v. Perlos, 462 N.W.2d 310 (Mich. 1990) (discussing MICH. COMP. LAWS. ANN. § 257.625(a)(9) (West 1990)).

90. State v. Hardy, 963 S.W.2d 516, 524 (Tex. Crim. App. 1997). In other contexts, the Supreme Court has treated widespread state legislative patterns as persuasive evidence of societal expectations. *See, e.g.*, Jaffee v. Redmond, 518 U.S. 1, 12–14 (1996) (recognizing an impressive number of states that had codified a psychotherapist-patient privilege).

without apparent judicial precedent," a New York trial court suggested that the "defendant had a [property] interest in the blood specimen in . . . vial containers" retained by a private hospital.[91] Also, in upholding subpoenas, courts occasionally stress that the records in question were "made [and] kept . . . by the hospital"[92] or that the records were not "personal papers created or kept by the defendant,"[93] suggesting that the outcome might be different if the defendant personally had produced the subpoenaed items.

Yet, most courts construe *Miller* to apply to biological samples as well as to mere records.[94] In *Miller*, the prosecution sought not only financial statements that the bank had generated, but also checks and deposit slips from the defendant. *Miller* expressly rejected the argument that there was a significant difference between the documents generated by the bank and those prepared by the depositor.[95] Financial statements prepared by a bank are like medical records prepared by a hospital or laboratory, and checks and deposit slips from the depositor can be analogized to samples from the defendant. To this extent, *Miller* appears pertinent whether the government seeks the original genetic samples or merely records documenting the results of tests on those samples.

Finally, *Miller* could be distinguished in that the defendant "voluntarily conveyed" the information to the banks[96] while the voluntariness of providing tissue samples might be questionable. For instance, in *People v. Perlos*,[97] a leading case[98] involving blood-alcohol testing, a dissenting justice of the Michigan Supreme Court argued that

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91. People v. Dolan, 408 N.Y.S.2d 249, 252 (Sup. Ct. 1978). The usual view is that body parts and tissues are not property, but that they are subject to the legal protections afforded to a person's body. *See* Moore v. Regents of the Univ. of Cal., 793 P.2d 479, 487–97 (Cal. 1990) (holding, in response to a claim for conversion, that a commercially valuable cell line is not the property of the patient from which the original cells were taken); Moe M. Litman, *The Legal Status of Genetic Material, in* HUMAN DNA: LAW AND POLICY, INTERNATIONAL AND COMPARATIVE PERSPECTIVES 17, 25–27 (Bartha Maria Knoppers ed., 1997) (reviewing cases and advocating a sui generis classification in which genetic material is regarded as a hybrid of private property, common property, person, and information).

92. State v. Gonzalez, 852 P.2d 851, 855 (Or. Ct. App. 1993).

93. State v. Guido, 698 A.2d 729, 734 (R.I. 1997).

94. *See Perlos*, 462 N.W.2d at 317 (stating, immediately after discussing *Miller*, that this line of authority deals with "privacy rights in medical records [and] blood samples").

95. *See* United States v. Miller, 425 U.S. 435, 442 (1976).

96. *Id.*

97. 462 N.W.2d 310 (Mich. 1990).

98. 1 WAYNE R. LAFAVE, SEARCH AND SEIZURE: A TREATISE ON THE FOURTH AMENDMENT § 2.7(d), at 638 (3d ed. 1996).

although under the implied consent statute a driver agrees in advance to a government test of his or her alcohol concentration, the driver does not consent to a search of medical records reflecting a test conducted by a private entity. As the dissent observed, "[i]n today's society, a person has little choice but to undergo medical treatment at a medical facility, generally licensed by and authorized to operate by the state. Few persons have the ability to obtain medical treatment in their homes . . . ."[99] Nevertheless, the majority relied on *Miller* to uphold a state statute mandating that hospital personnel disclose to the prosecution the results of any blood-alcohol test of a driver involved in an accident.[100]

When a conscious person in need of medical treatment is admitted to a hospital, the patient consents to treatment[101] and explicitly or implicitly agrees to medical testing incident to the treatment. The patient therefore voluntarily conveys the data disclosed by the test results to the institution's staff in the same manner that the depositor in *Miller* "voluntarily conveyed [information] to the banks [to be] exposed to their employees in the ordinary course of business."[102] Given the rules of medical ethics,[103] the patient might have a stronger subjective expectation that the hospital will keep the information in question confidential. However, *Miller* states that when a person voluntarily reveals information to a third party, for Fourth Amendment purposes the person "takes the risk" that the third party will disclose the information "to Government authorities, even if the information is revealed . . . only

99. *Perlos*, 462 N.W.2d at 324 & n.7 (Levin, J., dissenting); *see also* State v. Hardy, 963 S.W.2d 516, 524 (Tex. Crim. App. 1997) ("[R]elease of medical information to hospitals is less optional than the release of financial information to banks. A person can choose not to maintain a bank account, but it hardly seems reasonable to expect someone to forego medical attention.").

100. *See Perlos*, 462 N.W. 2d at 316.

101. If the person in need of emergency medical treatment is unconscious, the hospital will still administer treatment on the legal theory underlying the implied-intent statutes: the hospital personnel may ordinarily assume that if the person were conscious and understood his or her condition, he or she would want to be treated. *See* People v. Woodson, 630 N.Y.S.2d 670, 671 (Sup. Ct. 1995) (involving defendant who was unconscious and comatose when he was originally admitted to the hospital); State v. Guido, 698 A.2d 729, 732 (R.I. 1997) (involving defendant who was unconscious when he was found, and the hospital staff withdrew a blood sample during emergency-room treatment); *Hardy*, 963 S.W.2d at 526–27 ("Many statutes also permit officers to conduct a chemical test (without a warrant) on an unconscious person . . . . Some statutes even permit obtaining a sample for chemical testing (without a warrant) from an unconscious person even when that person is not under arrest."); State v. Jenkins, 259 N.W.2d 109, 110 (Wis. 1977) (involving defendant who was in and out of consciousness after an accident).

102. United States v. Miller, 425 U.S. 435, 442 (1976).

103. *See* SUZANNE B. MCNICOL, LAW OF PRIVILEGE 342 (1992) (citing the American Medical Association and the World Medical Association's codes).

for a limited purpose and the [person expects that] confidence placed in the third party will not be betrayed."[104]

In sum, the argument that *Miller* governs both medical records and samples is strong, but not conclusive. The statutory patterns, restricting the medical privilege and imposing reporting duties on physicians, lend powerful support to the view that there is no reasonable expectation of privacy in medical records or samples. Admittedly, a minority of cases reject this conclusion[105]—sometimes on dubious grounds[106]—and *Miller* itself has been the target of intense criticism.[107] However, the majority view is that if the private hospital or laboratory obtains a biological sample on its own initiative for lawful medical reasons, its subsequent surrender of the sample to the authorities does not violate any constitu-

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104. *Miller*, 425 U.S. at 443.

105. *See Hardy*, 963 S.W.2d at 525 ("No consensus exists in court decisions on whether an expectation of privacy exists in medical records."); *id.* at 524 (acknowledging a division of sentiment in the Texas cases, then stating that "[f]our out of five [Texas courts] held that society does not recognize as reasonable an expectation of privacy in those kinds of records"); *see also* State v. Nelson, 941 P.2d 441, 448 (Mont. 1997) ("[M]edical records have not been historically protected by the Fourth Amendment's prohibition against unreasonable searches and seizures."); 1 LAFAVE, *supra* note 98, § 2.7(d), at 640.

The minority view that the suspect retains a constitutionally protected privacy expectation in the sample would not necessarily prevent the state from obtaining the medical information or sample. The state usually has to establish founded suspicion or even probable cause to obtain a court order that the hospital or laboratory deliver the record or the sample. *See Nelson*, 941 P.2d at 449 (finding "a compelling state interest" in the form of "probable cause").

106. For example, in *People v. Woodson*, 630 N.Y.S.2d 670 (Sup. Ct. 1995), an unconscious patient was taken to a private hospital. The hospital personnel prepared vials of blood and urine specimens. The grand jury subpoenaed the samples, the hospital turned over both vials, and the authorities conducted toxicological tests. The defendant argued that the authorities' acquisition of the two vials violated the Fourth Amendment and moved to suppress the vials and testimony as to their contents. *Id.* at 671. A New York Supreme Court granted the motion and declared that "[b]y now, it is settled law that a hospitalized defendant retains a Fourth Amendment right in blood and urine samples." *Id.* The court in effect ruled the suspect had an objectively reasonable expectation of privacy in his hospital records. *See id.* at 671–74. However, the reasoning in *Woodson* is dubious. The judge cited *People v. Natal*, 553 N.E.2d 239 (N.Y. 1990), to support the exclusion of the evidence, but *Natal* has nothing to do with blood or urine samples. *Woodson*, 630 N.Y.S.2d at 787. *Natal* involved clothing and personal effects taken from a defendant when he was placed in pretrial confinement. *Natal*, 553 N.E.2d at 240–41. Although the *Natal* court held that the district attorney had abused the subpoena power, the court ruled that "inspection of personal effects previously exposed to police view . . . does not invade any substantial privacy interest." *Id.* at 241. Moreover, the *Woodson* court does not so much as mention, much less evaluate, the possibility that *Miller* is pertinent. Similarly ignoring *Miller*, the Pennsylvania Supreme Court recognized a privacy interest in medical records in *Commonwealth v. Riedel*, 651 A.2d 135, 138–39 (Pa. 1994).

107. *See, e.g.*, 1 LAFAVE, *supra* note 98, § 2.7(d), at 639–40.

tionally protected expectation of privacy.[108] The same is true, even more clearly, of laboratory findings or medical records involving the samples.[109] Although it would be desirable to have additional statutory and regulatory protection for medical records,[110] it is difficult to escape the conclusion that under *Miller* and its progeny, the Fourth Amendment does not confer that protection.[111]

However, the Court's recent decision in *Ferguson v. City of Charleston*[112] complicates the analysis. *Ferguson* involved a challenge to a set of policies and procedures developed by a public hospital, the Medical University of South Carolina (MUSC), and local law enforcement authorities.[113] MUSC was administering diagnostic tests, including screens for cocaine use, to patients receiving prenatal treatment. If a patient tested positive, the MUSC staff referred her for

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108. The courts have employed a variety of rationales to justify this view. Some reason that the suspect had bailed the sample with the private hospital and that as bailee, the hospital "may consent to . . . permit the warrantless search and seizure." People v. Dolan, 408 N.Y.S.2d 249, 252 (Sup. Ct. 1978). Other courts simply assert that if a private hospital properly obtains a sample for medical reasons, as "an independent private citizen" it may "turn[] it over to the police." State v. Enoch, 536 P.2d 460, 461 (Or. Ct. App. 1975). But still other courts invoke *Miller*. *See, e.g.*, Thurman v. State, 861 S.W.2d 96, 98–101 (Tex. Ct. App. 1993) Although *Thurman* involved a subpoena for medical records, the court used broad language, expansive enough to apply to samples as well, and noted that "[c]ourts in other states have reached the same conclusion." *Id.*

109. *See* State v. Gonzalez, 852 P.2d 851 (Or. Ct. App. 1993); State v. Fears, 659 S.W.2d 370 (Tenn. Crim. App. 1983); Conrad v. Texas, No. 14-96-00167-CR, 1997 WL 764527 (Tex. Ct. App. 1997), *cert. denied*, 526 U.S. 1068 (1999); *Thurman*, 861 S.W.2d 96. Many of these courts not only cite *Miller* but also treat it as dispositive. *See* People v. Perlos, 462 N.W.2d 310, 316–17 (Mich. 1990); *Fears*, 659 S.W.2d at 375–76; Gellman, *supra* note 76, at 290–91. In *Nelson*, the Montana Supreme Court found a protected expectation of privacy in medical records under its state constitution. 941 P.2d at 447–49. However, the Montana court pointed out that its cases construing its constitution protect privacy "more strict[ly] than" the cases interpreting the Fourth Amendment to the U.S. Constitution. *Id.* at 447. Indeed, the Montana court noted that "medical records have not been historically protected by the Fourth Amendment's prohibition against reasonable searches and seizures." *Id.* at 448.

110. For a discussion of the principles that might guide the formulation of such legislation, see Lawrence O. Gostin & James G. Hodge, Jr., *Genetic Privacy and the Law: An End to Genetics Exceptionalism*, 40 JURIMETRICS J. 21 (1999). After years of congressional failure to enact a comprehensive medical privacy law during the Clinton Administration, the executive branch has issued rules to protect medical records. *See* Brian Nuterangelo & Susan D. Drake, *Health Care Law: HIPPA Rule and Employers*, NAT'L L.J., Feb. 26, 2001, at B7; Benedict Carey, *Patients Can Rest Easier When It Comes to Medical Privacy Issues*, L.A. TIMES, Apr. 23, 2001, *available at* 2001 WL 2480995.

111. Of course, it would not be unthinkable to extend the Fourth Amendment in that manner. However, that extension would necessitate a doctrinal reformulation and the rethinking of several leading modern precedents, notably *Miller* and its progeny.

112. 121 S. Ct. 1281 (2001).

113. *Id.* at 1284–86.

counseling and treatment.[114] Despite the referrals, the incidence of cocaine use among the patients remained the same.[115] To give patients a stronger incentive to refrain from drug use, MUSC contacted the local law enforcement authorities.[116] Together, they developed the set of policies and procedures in question.[117] Under these procedures, patients meeting certain criteria were tested for cocaine, and a chain of custody for the sample was maintained.[118] In their final form, the procedures provided that if a woman tested positive for cocaine either during pregnancy or after labor, she would be given an opportunity to avoid arrest by consenting to substance-abuse treatment.[119] The document codifying the policy specified the range of possible criminal charges and the logistics of police notification and arrest.[120]

Several women who were arrested challenged the constitutionality of the practice under the Fourth Amendment.[121] A six-justice majority invalidated the program.[122] Six justices agreed that MUSC's surrender of the test results to the police constituted a separate Fourth Amendment intrusion.[123] In response to the public hospital's practice of regularly submitting copies of team documents discussing the women's progress, Justice Stevens wrote that "[t]he reasonable expectation of privacy enjoyed by the typical patient undergoing diagnostic tests in a hospital is that the results of those tests will not be shared with nonmedical personnel without her consent."[124]

Although, on its face, this statement is quite broad, *Ferguson* deals only with a continuing program developed by the police and a public hospital requiring the systematic disclosure of patient records for the "primary purpose" of advancing "the general interest in crime

114. *Id.* at 1284.

115. *Id.*

116. *Id.*

117. *Id.* at 1285.

118. *Id.* at 1291.

119. *Id.* at 1285.

120. *Id.* at 1285, 1291.

121. *Id.* at 1284.

122. Justice Stevens authored the majority opinion, Justice Kennedy filed a concurrence in the judgment, and Justice Scalia filed a dissent in which Chief Justice Rehnquist and Justice Thomas joined. *Id.* at 1284, 1293, 1296.

123. *Id.* at 1284.

124. *Id.* at 1288.

control."[125] The involvement of law enforcement was so "extensive . . . at every stage of the policy"[126] that the hospital was acting "as an institutional arm of law enforcement."[127]

As such, *Ferguson* is distinguishable from the typical fact situation discussed in Part I.A, namely, a case in which medical personnel in the private sector surrender information that they previously obtained for legitimate, health-related reasons. Indeed, in a footnote, Justice Stevens suggested the distinction between the institutional program in *Ferguson* and the problem discussed here.[128] After noting the existence of laws requiring medical personnel to report certain types of criminal activity to the police, Justice Stevens stated:

> While the existence of such laws might lead a patient to expect that members of the hospital staff might turn over evidence acquired in the course of treatment to which the patient has consented, they surely would not lead a patient to anticipate that hospital staff would *intentionally set out to obtain incriminating evidence from their patients for law enforcement purposes.*[129]

If the medical personnel previously obtained the data from the patient during the course of a regular hospital procedure, they could not be said to have "intentionally set out to obtain incriminating evidence . . . for law enforcement purposes."[130] In that situation, where private medical facilities later surrender information to the authorities, *Miller*—not *Ferguson*—presumably would still govern.

C. *Acquiring DNA from Inadvertently Abandoned Samples*

The police also might obtain a suspect's DNA sample surreptitiously, without detaining the person. Saliva deposited on a coffee cup at a restaurant, for example, can be collected and analyzed.[131] Police

125. *Id.* at 1290.

126. *Id.* at 1283.

127. *Id.* at 1294 (Kennedy, J., concurring). For his part, Justice Kennedy stressed the "substantial law enforcement involvement in the policy from its inception." *Id.* (Kennedy, J., concurring). He emphasized that "the active use of law enforcement . . . [was] an integral part of [the] program." *Id.* (Kennedy, J., concurring).

128. *Id.* at 1288 n.13.

129. *Id.* (emphasis added).

130. *Id.*

131. In New York City, police used this tactic to acquire DNA from a suspected serial killer and rapist. Richard Willing, *As Police Rely More on DNA, States Take a Closer Look*, USA TODAY,

unsuccessfully chasing a wounded felon might find sufficient blood has dripped onto the sidewalk for DNA profiling to be conducted. It could be argued that such activity is not a search (and hence requires neither probable cause nor a warrant) because the individual, having abandoned the material in a public place, retains no reasonable expectation of privacy in it. The Supreme Court used this reasoning in *California v. Greenwood*[132] in holding that the Fourth Amendment does not prohibit "the warrantless search and seizure of garbage left for collection outside the curtilage of a home."[133] The Court commented:

> It is common knowledge that plastic garbage bags left on or at the side of a public street are readily accessible to animals, children, scavengers, snoops, and other members of the public.... Moreover, respondents placed their refuse at the curb for the express purpose of conveying it to a third party, the trash collector, who might himself have sorted through respondents' trash or permitted others, such as the police, to do so.[134]

However, depositing DNA in the ordinary course of life when drinking, sneezing, or shedding hair,[135] dandruff,[136] or other cells[137] differs from placing private papers in a container on the street to be collected as garbage. Depositing paper in the trash is generally a volitional act. Someone intent on preserving the secrecy of the papers can shred the papers or dispose of them in other ways that would defeat normal police surveillance. Leaving a trail of DNA, however, is not a conscious activity. The deposition of DNA in public places cannot be avoided unless one is a hermit or is fanatical in using extraordinary

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June 6, 2000, at 1A; *The Crier Report: Mandatory DNA Testing* (Fox television broadcast, Mar. 11, 1999), *available at* 1999 WL 18330169. Similar strategies have yielded samples in Florida, Maryland, and Massachusetts. *See* Jerry Adler & John McCormick, *The DNA Detectives*, NEWSWEEK, Nov. 16, 1998; *Spit Gives DNA Match for Rape Suspect*, FLA. TODAY, Oct. 24, 1998, at B8, *available at* 1998 WL 18648417; Willing, *supra*; Dan Kraut, *Baltimore Cop Charged in Bank Robberies*, May 18, 2000, http://dailynews.yahoo.com/h/ao/20000518/cr/baltimore_cop_charged_in_bank_robberies_1.html, (last visited May 19, 2000) (reporting on suspect from whom saliva specimen was "surreptitiously obtained").

132. 486 U.S. 35 (1988).

133. *Id.* at 37.

134. *Id.* at 40.

135. *See* R. Higuchi et al., *DNA Typing from Single Hairs*, 332 NATURE 543 (1988).

136. *See* Birgit Herber & Kurt Herold, *DNA Typing of Human Dandruff*, 43 J. FORENSIC SCI. 648 (1998).

137. *See* I. Findlay et al., *DNA Fingerprinting from Single Cells*, 389 NATURE 555 (1997).

containment measures. In this setting, the inference of intent to abandon is markedly weaker.

If the police collection of inadvertently deposited DNA cannot be justified solely on an abandonment theory, under *Katz* the question becomes whether society does or should recognize as reasonable the expectation that government agents will not follow one about to obtain and analyze DNA that almost inevitably is left in public places.[138] A case can be constructed that such an expectation exists. The public is extremely concerned with preserving genetic privacy. Many states have enacted legislation to preserve the confidentiality of genetic information, and a few have even labeled a person's genotypes as the property of the individual.[139] Furthermore, *Skinner v. Railway Labor Executives' Ass'n*[140] lends support to this argument. In *Skinner*, the Federal Railroad Administration had promulgated regulations mandating blood and urine tests of employees involved in certain train accidents and authorizing the railroads to administer breath and urine tests on employees who violated particular safety rules. Some provisions authorized breath and urine tests based on a "reasonable suspicion" of drug or alcohol impairment, but others did not require any showing of individualized suspicion. Railway employees alleged that this system violated their Fourth Amendment rights. The Court of Appeals for the Ninth Circuit invalidated the regulations, holding that the drug testing required reasonable suspicion.[141] The U.S. Supreme Court reversed the court of appeals, reasoning that the compelled collection of breath and urine samples was a search but the practice was reasonable because the government had a special need to ensure that railway personnel were not using substances that might cloud their judgment and impair their performance.[142] The majority recognized

138. It might seem that police have no more obligation to secure a warrant before seizing DNA in a place they have right to be than they do to secure a warrant or other order before dusting a crime scene for fingerprints, viewing the site of a rape for semen, or looking for traces of blood on or near the corpse of person who obviously struggled with an assailant. However, these efforts to locate physical or biological evidence that later can be traced to an individual are quite different from the practice of following an individual already suspected of a crime to pick up that person's DNA. In the former situation, the involvement of a magistrate would be pointless, for there is nothing for a magistrate to consider. In the latter, the magistrate could screen the information the police already have to ensure that there is sufficient reason to invade the target's genetic privacy.

139. *See* D.H. Kaye, *Respecting Genetic Privacy: The ASU-SB Conference on Law, Science and Technology*, 40 JURIMETRICS J. 1, 2 (1999).

140. 489 U.S. 602 (1989).

141. *Id.* at 612–13.

142. *Id.* at 620.

that "[u]nlike the blood-testing procedure at issue in *Schmerber*, the procedures prescribed by the . . . regulations for collecting and testing urine samples do not entail a surgical intrusion into the body."[143] Nonetheless, the opinion concluded that urine sampling followed by urinalysis was a search, in part because "chemical analysis of urine, like that of blood, can reveal a host of private medical facts about an employee, including whether he or she is epileptic, pregnant, or diabetic."[144] Similarly, DNA testing can reveal "private medical facts" about the individual.[145]

However, *Skinner* is distinguishable in that urinalysis involves a much more extensive intrusion into privacy: the possible revelation of private information, compelled excretion of bodily fluid, and monitoring the normally private act of excretion.[146] Unlike the collection of blood from the suspect in *Schmerber*, collecting DNA left in public places entails neither a bodily invasion nor a seizure of the person. It seems clear that, in a public restaurant after a suspect departed, the police could pick up a coffee cup used by the suspect and, consistent with the Fourth Amendment, examine it for fingerprints.[147] Courts may find it a small step to conclude that the warrantless collection of inadvertently abandoned DNA does not violate the Fourth Amendment.

Before taking this step, however, courts should consider the extent to which meaningful, personal information that would not be available to private citizens will fall into the hands of government agents interested in accessing this information. When society enters an era in which DNA analyzers are as accessible as home pregnancy-test kits, the argument for an expectation of privacy will be weak. But in a world still at the

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143. *Id.* at 617.

144. *Id.*

145. *See* United States v. Nicolosi, 885 F. Supp. 50, 56 (E.D.N.Y. 1995) (relying on this facet of informational privacy to conclude that compelling a saliva sample for DNA testing is a search or seizure).

146. *See id.* at 55–56.

147. Research revealed no case holding, or even implying, that the collection of a fingerprint in a public area amounts to a Fourth Amendment intrusion in fact. After a person has been arrested, the collection of fingerprints directly from the person with no showing beyond the validity of the arrest itself is routinely upheld. *See* Napolitano v. United States, 340 F.2d 313, 314 (1st Cir. 1964); Smith v. United States, 324 F.2d 879, 882 (D.C. Cir. 1963); State v. Inman, 301 A.2d 348, 354 (Me. 1973); Commonwealth v. Young, 572 A.2d 1217, 1224 (Pa. 1990). For cases applying the abandonment theory to other materials that are at least as problematic as fingerprints, see United States v. Cox, 428 F.2d 683, 687–88 (7th Cir. 1970) (hair cut by prison barber); Venner v. State, 367 A.2d 949, 955–56 (Md. 1977) (contents of hospital bedpan).

threshold of an age of molecular biology, what expectation is reasonable is less obvious. Privacy expectations should turn on the incentives and disincentives for the government to acquire DNA information that is truly sensitive as well as the risk that this information will be used to harm individuals. For law enforcement purposes, there is little incentive to probe areas of the genome that would determine characteristics not discernible to individuals acquainted with a suspect. Identification rarely will be aided by disease prediction, for example, and the risk that police or laboratory personnel will be curious about and well positioned to collect the latter sort of information does not seem large. Rather, there are disincentives to such investigations. The existence of numerous laws restricting the use and release of genetic information on individuals by insurers, employers, and law enforcement personnel is pertinent here.[148] Although further experience with DNA samples in the criminal justice system could lead to a reassessment, for the present the better course is to treat human cells left in public places like fingerprints in deciding what expectation of privacy is reasonable.

D. Securing the Consent of Suspects or Others

1. Voluntariness Under the Fourth Amendment

In addition to compelling individuals to submit DNA samples or acquiring samples indirectly from medical-care providers, researchers, or from other locations, the authorities might simply ask a suspect to provide a sample. Even if the acquisition of the sample constitutes a seizure under the Fourth Amendment and the authorities do not obtain a warrant or court order, a suspect's consent is an adequate justification for a search or seizure.[149] What, then, must authorities do to obtain legally effective consent? When that question arose with respect to waivers of the privilege against self-incrimination embodied in the Fifth Amendment, early Supreme Court cases applied a general voluntariness test.[150] However, in 1966, the Court mandated in *Miranda v. Arizona*[151]

148. *See, e.g.*, MD. ANN. CODE, art. 88B, § 12A(p) (2000) (creating criminal penalties for unauthorized disclosure or receipt of "individually identifiable DNA information contained in the statewide DNA data base system or ... repository"); Kaye, *supra* note 139, at 1–2 (collecting references to genetic privacy and discrimination legislation).

149. *See* Zap v. United States, 328 U.S. 624, 628 (1946).

150. *See* Colorado v. Connelly, 479 U.S. 157 (1986); Ward v. Texas, 316 U.S. 547 (1942); Vernon v. Alabama, 313 U.S. 547 (1941) (citing White v. Texas, 310 U.S. 530 (1940)); Lomax v.

that the police administer specific warnings to a suspect in custody to ensure that any consent to interrogation was voluntary in the specific sense that the suspect's waiver was intelligent and knowing.[152] In particular, police must advise a suspect of the right to remain silent.[153]

The Court has taken a different approach to waivers of one's Fourth Amendment right to be free from unreasonable searches and seizures. In *Schneckloth v. Bustamonte*,[154] the Court confirmed the continued applicability of a general voluntariness test and expressly held that police need not warn a suspect of the right to refuse to consent to a search.[155] The administration of such a warning is simply one factor in the totality of the circumstances that must be considered in determining the voluntariness of the consent.[156] *Schneckloth* sharply distinguished between the Fourth and Fifth Amendment settings. The Court emphasized that while *Miranda* warnings helped to ensure the reliability of any confession by a suspect, the Fourth Amendment exclusionary rule has little or nothing to do with the reliability of the seized evidence.[157] According to the Court, concerns about the reliability of the evidence and the integrity of the fact-finding process justify a more rigorous standard under the Fifth Amendment than under the Fourth.[158]

Although the *Schneckloth* standard is more lax than the Fifth Amendment test,[159] even *Schneckloth* has teeth. In some cases, Fourth Amendment consent has been found involuntary. For example, in *Bumper v. North Carolina*,[160] four police officers went to the house of "a 66-year-old Negro widow . . . located in a rural area at the end of an isolated mile-long dirt road."[161] She met the officers at the front door.

Texas, 313 U.S. 544 (1941) (citing White v. Texas, 310 U.S. 530 (1940)); White v. Texas, 310 U.S. 530 (1940); Brown v. Mississippi, 297 U.S. 278 (1936).

151. 384 U.S. 436 (1966).

152. *Id.* at 445–58, 475–76.

153. *Id.* at 467–73.

154. 412 U.S. 218 (1973).

155. *Id.* at 231–32.

156. *Id.* at 226–27.

157. *Id.* at 241–48.

158. *Id.* at 246–49.

159. Under a state's constitution, a state court can adopt a higher standard and require warnings about the search to be administered for consent to be valid. *See* Cooper v. California, 386 U.S. 58, 62 (1967); Commonwealth v. Walsh, 460 A.2d 767, 771 (Pa. Super. Ct. 1983).

160. 391 U.S. 543 (1968).

161. *Id.* at 546.

One of them announced, "I have a search warrant to search your house" she responded, "Go ahead," and opened the door.[162] In the kitchen, the officers found the rifle that was later introduced in evidence at the trial of her grandson for rape. The Court reversed the conviction because the officers had no search warrant.[163] The Court explained: "When a law enforcement officer claims authority to search a home under a warrant, he announces in effect that the occupant has no right to resist the search. The situation is instinct with coercion—albeit colorably lawful coercion. Where there is coercion there cannot be consent."[164]

Under *Bumper*, consent to submitting a DNA sample would be involuntary if, for instance, the police gave the suspect the impression that there was no alternative other than to provide the sample. However, on balance, consent should be deemed sufficient when the police make it clear that they seek a sample "for criminal investigation purposes"[165] and avoid statements that could mislead the suspect into believing that there is a legal duty to furnish the sample when there is none.[166]

Furthermore, under *Scheckloth*, the suspect can protect his or her privacy by limiting the scope of the consent. In *Florida v. Jimeno*,[167] the Supreme Court acknowledged that consent to an intrusion may be limited in scope.[168] For example, a suspect might authorize the warrantless search of an automobile but refuse to consent to a search of the person.[169] By the same token, a suspect could consent to furnishing a DNA sample only for identification purposes in connection with a specific investigation.[170] It would be helpful if police obtained written or

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162. *Id.*

163. *Id.* at 548–50.

164. *Id.* at 550.

165. Commonwealth v. Walsh, 460 A.2d 767, 773 (Pa. Super. Ct. 1983); *see also* State v. Bailey, 417 A.2d 915, 919 (R.I. 1980) ("The notion of a free and voluntary consent necessarily implies that the person knows what it is he is allowing the police to do."). It has been held that it is not necessary to inform a suspect of the specific investigations for which the sample is desired. Pace v. State, 524 S.E.2d 490, 497–98 (Ga. 1999).

166. People v. Cardenas, 604 N.E.2d 953, 956 (Ill. App. Ct. 1992) (holding consent to be involuntary when the officer created the false impression that there could be a search without the suspect's consent).

167. 500 U.S. 248 (1991).

168. *Id.* at 251.

169. *See* Strong v. United States, 46 F.2d 257, 259 (1st Cir. 1931); Witt v. Commonwealth, 293 S.W. 1072, 1073 (Ky. 1927); State v. Johnson, 71 Wash. 2d 239, 427 P.2d 705 (1967).

170. Where the individual does not state that the *only* use of the sample is to be in connection with a specific investigation, police may be tempted to reuse the information in a subsequent investigation. Indeed, they may even acquire a sample ostensibly for one investigation when their

recorded consent for DNA sampling, but there does not appear to be any constitutional requirement to do so.[171]

2. *Geographic Screening*

Some European countries have solved difficult murder cases by appealing to all local residents to submit to DNA testing.[172] In perhaps the largest such geographic screening, 16,400 men in western Germany were tested in the hunt for an eleven-year-old girl's killer.[173] A thirty-year-old man arrested after his DNA was found to match confessed to raping, stabbing, and killing the girl, as well as to raping another eleven-year-old girl.[174] In the United Kingdom alone, police have conducted 118 such "mass screens," resulting in forty-eight hits and seven convictions.[175]

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actual intent is to use it in another. For instance, in *Washington v. State*, 653 So. 2d 362, 363 (Fla. 1994), a ninety-three-year-old woman was murdered in her bedroom. She had been badly beaten and vaginally and anally raped. *Id.* Anthony Washington was imprisoned at a work-release center two miles from the woman's home. *Id.* He did not show up at his job during the time of the rape, and he sold the woman's gold watch to a coworker. *Id.* The detective investigating the murder did not tell Washington that he suspected him of this murder. *Id.* Instead, he asked Washington for blood and hair samples to use in an unrelated sexual battery case. *Id.* at 364. Washington provided these samples. *Id.* When the state sought to use the samples in the murder case, Washington moved to suppress them. *Id.* The trial court denied the motion, and Washington was convicted of the murder, burglary, and sexual battery. *Id.* The Supreme Court of Florida affirmed the conviction, reasoning: "Washington stated he understood his rights, orally waived them, and freely and voluntarily provided [the detective] with hair and blood samples. [O]nce the samples were validly obtained, albeit in an unrelated case, the police were not restrained from using the samples as evidence in the murder case." *Id.* Applied to situations in which it is reasonably clear that the DNA donor meant to consent to only one use, additional uses of the sample may be problematic. The better rule here might be to presume that consent does not extend beyond the specific investigation called to the donor's attention. Examples of such consent forms are included in CECELIA CROUSE & D.H. KAYE, THE RETENTION AND SUBSEQUENT USE OF SUSPECT, ELIMINATION, AND VICTIM DNA SAMPLES OR RECORDS: A REPORT TO THE NATIONAL COMMISSION ON THE FUTURE OF DNA EVIDENCE (2000).

171. This practice not only would safeguard the suspect's rights, but it also would simplify the task of a judge ruling on a motion to suppress evidence acquired as a result of the search.

172. *See, e.g.*, Fred Barbash, *Crime-Solving by DNA Dragnet; Britain Makes Arrests in Rape Cases After Thousands of "Voluntary" Neighborhood Tests*, WASH. POST, Feb. 2, 1996, at A21, *available at* 1996 WL 3061978; Alex Smith, *Village Takes DNA Tests: Breton Men Give Saliva Samples in Hunt for Cornish Girl's Murderer*, GUARDIAN (London), Oct. 11, 1997, at 7, *available at* 1998 WL 7775322.

173. *DNA Evidence Brings Confession*, ARIZ. REPUBLIC, May 31, 1998, at A20, *available at* 1998 WL 7775322.

174. *Id.*

175. David Werrett, The Strategic Use of DNA Profiling, Address Before the 18th International Congress on Forensic Haemogenetics (Aug. 19, 1999). In these investigations, explicit permission

Geographic screening has been used on a smaller scale in Ann Arbor,[176] Miami,[177] and San Diego.[178] Nothing in the Fourth Amendment prevents the police from approaching everyone in a community and asking for their cooperation. The "dragnet" nature of the inquiry is no obstacle.[179] Consensual contact between a police officer and a citizen is

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was obtained from the individuals who provided DNA samples, and the samples from people who are eliminated as possible suspects were destroyed. *Id.* In late 1999, however, section 64 of the Police and Criminal Evidence Act was amended to permit the retention and use of DNA samples and data with a volunteer's written permission. Home Office, Proposals for Revising Legislative Measures on Fingerprints, Footprints and DNA Samples 11 (July 1999).

176. In 1994, Ann Arbor police investigating a series of rapes reportedly collected blood samples from 160 African-American men in the area. Alice Robinson, *DNA of Innocent Rape Suspects Will Not be Kept: Ann Arbor Resident Filed Civil Lawsuit that Spurred Ruling*, MICH. DAILY ONLINE (Nov. 21, 1997), *at* www.pub.umich.edu/daily/1997/nov/11-21-97/news/news12.html (last visited Mar. 26, 2001).

177. *See* Philip P. Pan, *Pr. George's Chief Has Used Serial Testing Before; Farrell Oversaw DNA Sampling of 2,300 in Fla.*, WASH. POST, Jan. 31, 1998, at B1 (reporting that for "over two months, [Miami] police" searching for the Tamiami Strangler, a man who had been murdering prostitutes, "stopped about 2,300 men driving through an area known for prostitution [along the Tamiami Trail], asked them to voluntarily provide saliva samples," and "followed up on everybody who was a preliminary match and everybody who refused to consent voluntarily"). This effort did not unearth the murderer. He was found after he left a thirty-year-old prostitute in his apartment, naked, bound with duct tape, and screaming for help. DNA testing of a sample from this woman matched that of five of the previous murder-rapes. *See* Lynn Carrillo, *Suspect Fit Serial Killer Portrait: DNA Link to Prostitutes Helps Bolster Case, But Man's Neighbors Stunned*, SUN-SENTINEL (Ft. Lauderdale), June 28, 1995, at 1B.

178. The San Diego police department "tested about 800 men during its search for a serial killer who stabbed six women to death in their homes between January and September 1990." As described in Pan, *supra* note 177, at B1:

> [P]olice canvassed neighborhoods around the crime scenes and asked men matching a general description of a dark-skinned male provided by a witness to voluntarily provide blood or saliva samples . . . .
>
> The killer, a 23-year-old laborer named Cleophus Prince now on death row, declined along with several other men to provide a sample. He later was arrested for breaking into another woman's home and agreed to provide a DNA sample—which matched evidence found at one of the murder scenes.

Id.

In Prince George's County, Maryland, police collected samples from at least fifty male "maintenance men, vendors, nurses and doctors" associated with a hospital in which a fifty-year-old nursing administrator was raped and killed in an office. *See* Richard Willing, *Privacy Issue Is the Catch for Police DNA 'Dragnets,'* USA TODAY, Sept. 16, 1998, at 1A.

179. *Cf.* United States v. Dionisio, 410 U.S. 1, 9 (1973) (finding no infirmity in issuing, without probable cause, grand jury subpoenas to twenty men to secure voice exemplars from them); Davis v. Mississippi, 394 U.S. 721 (1969) (containing no suggestion that the compulsory fingerprinting of twenty-four young men was unconstitutional merely because there was no reason other than their fitting the very general description provided by the victim).

neither a search nor a seizure under the Fourth Amendment.[180] As a legal matter, police may ask anyone to give DNA and, as long as they do not engage in coercion or misrepresentation, the police may collect voluntary samples for analysis.[181] The practice seems less likely to be effective in this country, however, because the number of residents who could choose not to cooperate might be larger. In addition, the drain on police resources in creating what is, in effect, an ad hoc database would be excessive.[182]

E. Inferring Physical Characteristics from Crime-Scene Samples

To help trace the flow of human populations, geneticists and anthropologists have located genetic markers[183] that help distinguish among ancestral populations, and various genes or other DNA sequences are known to have alleles that occur predominantly in certain racial or ethnic groups.[184] In addition, genetic typing permits inferences as to

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180. *Cf. Davis*, 394 U.S. at 727 n.6 (referring to "the settled principle that while the police have the right to request citizens to answer voluntarily questions concerning unsolved crimes they have no right to compel them to answer").

181. *See supra* Part I.D.1. For a description of tactics that may have crossed the line from consent to coercion, see Fred W. Drobner, Comment, *DNA Dragnets: Constitutional Aspects of Mass DNA Identification Testing*, 28 CAP. U. L. REV. 479, 505–06 (2000).

182. It would be possible to retain the samples of volunteers for possible later use, given adequate consent. The constitutionality of establishing more permanent, population-wide databases is addressed in Kaye & Imwinkelried, *supra* note 7, at III.C.2.

183. Human DNA is packaged into twenty-three pairs of chromosomes in cell nuclei. The DNA molecules in the chromosomes are composed of four types of units called "nucleotide base pairs." On average, a chromosome is on the order of 100 million base-pairs long. A "locus" is a location on a chromosome. Some loci involve sequences that are, in effect, instructions for manufacturing specific proteins. These are known as genes. Other loci are not involved in the production of any proteins, and hence, do not produce any observable traits (such as blood types). The distinct variations at the loci that code for proteins—the genes—are known as alleles of those genes. For example, the gene for red blood cell types has four major alleles. By extension, the variations in the order or number of base pairs at the noncoding loci are called DNA alleles. *See, e.g.*, Kaye & Sensabaugh, *supra* note 9, at 491.

Although some 99.9% of the sequence of base-pairs are identical among individuals, some do exhibit substantial variation from one person to another. *Id.* Among these alleles is a class known as "short tandem repeats," or STRs. These noncoding regions vary in length. *Id.* at 494. The shortest have only one or two sets of a specific DNA sequence that is itself between two to seven base pairs long, but the typical STR allele has enough repetitions of the core sequence so that it is 50 to 350 base pairs long. *Id.* at 494 n.38. STRs probably are the most widely used system of alleles for forensic DNA identification. *See id.* at 494.

184. NATIONAL COMMISSION ON THE FUTURE OF DNA EVIDENCE, THE FUTURE OF FORENSIC DNA TESTING: PREDICTIONS OF THE RESEARCH AND DEVELOPMENT WORKING GROUP 60–61 (2000) [hereinafter NCFDNA]; Kelly Owens & Mary-Claire King, *Genomic Views of Human*

inherited disorders and may offer clues to facial or other bodily features.[185] Learning that the person whose DNA was found at a crime scene might have such physical characteristics could well be useful in some criminal investigations.

DNA analysis to conduct such "physical profiling" poses few constitutional problems. The principal issue arises under the Equal Protection Clause of the Fourteenth Amendment. Normally, the government is free to draw whatever reasonable lines it wishes in adopting and enforcing the law. The Internal Revenue Service, for instance, can choose to concentrate its investigations of tax evasion on higher-income taxpayers. Some classifications, however, are suspect.[186] Race is the prototypical example.[187] Imposing the death sentence on the killers of whites but not blacks would be impermissible;[188] likewise, a police officer who adopted a policy of arresting only African-Americans would be depriving those citizens of the equal protection of the law.[189] Does the fact that race is a suspect classification prohibit the government

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History, 286 SCIENCE 451 (1999); M. Klintschar et al., *Is It Possible to Determine the Ethnic Origin of Caucasian Individuals Using Short Tandem Repeat Loci?*, *in* ABSTRACTS OF THE EIGHTEENTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL SOCIETY FOR FORENSIC HAEMOGENETICS 63 (1999) ("[I]t is possible to differentiate between major ethnic groups using forensically relevant short tandem repeat loci.").

185. *See, e.g.*, NCFDNA, *supra* note 184, at 61 ("[D]etermining that a DNA sample was left by a person with red hair, dark skin pigment, straight hair, baldness, or color blindness may be practical soon, if not already."); 1 M. McCulley et al., *Genes and Faces: Classification of Midline Features*, *in* ABSTRACTS OF THE EIGHTEENTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL SOCIETY FOR FORENSIC HAEMOGENETICS 109 (1999).

186. *See, e.g.*, Korematsu v. United States, 323 U.S. 214, 216 (1944). Laws or other state actions that distribute burdens or benefits according to "suspect" classifications are usually, but not invariably, unconstitutional. *Id.* (finding a compelling government interest in confining Japanese-Americans during World War II). The government bears an extremely heavy burden of showing that the classification is necessary to achieve a compelling state interest. *See, e.g.*, *In re* Griffiths, 413 U.S. 717, 721 (1973).

187. Certain other classifications, such as gender, are "quasi-suspect." Craig v. Boren, 429 U.S. 190 (1976). Their use can be justified by a showing of a close enough connection to an important state interest. *Id.* The sex of the source of a biological sample from a crime scene can be ascertained with far greater confidence than can the race of the source. Although this Article does not discuss the use of genetic tests for inferring gender in criminal investigations, the analysis of the constitutionality of testing for race is applicable to testing for sex as well.

188. *See* McCleskey v. Kemp, 481 U.S. 279, 291 n.8 (1987) ("It would violate the Equal Protection Clause for a State to base enforcement of its criminal laws on an unjustifiable standard such as race, religion, or other arbitrary classification.") (internal quotation marks and citation omitted).

189. *Cf.* Hall v. Pa. State Police, 570 F.2d 86, 90–91 (3d Cir. 1978) (reasoning that allegations that the state police directed banks to photograph only blacks entering the banks stated a violation of equal protection).

from conducting or funding research to develop or refine genetic markers for racial identification? Or, when it appears from such markers that the source of the crime-scene DNA is likely to belong to a particular racial or ethnic group, does the Equal Protection Clause prohibit the police from using that fact as an investigative lead and focusing on members of that group?

These questions require an examination of the purpose and impact of the racial classification. That race is a suspect classification does not mean that the government never can inquire into race.[190] To the contrary, the collection and analysis of information about race are commonplace in enforcing the law and in criminological research undertaken or funded by the government.[191] More generally, a great deal of social science and medical research supported or conducted by the government involves the collection of data on race and the analysis of race as a variable of interest.[192] Likewise, if using physical evidence of race to focus an investigation were impermissible, police could not rely on an eyewitness's report that a person fleeing the scene of a crime was Hispanic, on a victim's report that a rapist was white, or on a linguist's analysis of accent or word choice in a recorded death threat that suggested that the caller was African-American.[193] These reports could be in error in any given case, but if they are generally accurate, paying attention to them is not unconstitutional.[194]

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190. For that matter, even race-conscious affirmative-action programs can sometimes be upheld. Associated Gen. Contractors of Ohio, Inc. v. Drabik, 214 F.3d 730 (6th Cir. 2000), *cert denied*, 121 S. Ct. 1089 (2001); Walker v. City of Mesquite, 169 F.3d 973 (5th Cir. 1999), *cert denied*, 528 U.S. 1131 (2000).

191. *See, e.g.*, THOMAS P. BONCZAR & ALLEN J. BECK, BUREAU OF JUSTICE STATISTICS, LIFETIME LIKELIHOOD OF GOING TO STATE OF FEDERAL PRISONS (1997).

192. *See, e.g.*, NATIONAL CENTER FOR HEALTH STATISTICS, HEALTH, UNITED STATES, 1999, WITH HEALTH AND AGING CHARTBOOK tbl.49 (1999), *available at* http://www.cdc.gov/nchs/rd.htm (last visited Apr. 30, 2001).

193. Testimony as to ethnic and racial identifications routinely is admitted in criminal trials. *See, e.g.*, United States v. Card, 86 F. Supp. 2d 1115, 116–19 (D. Utah 2000) (reviewing cases on admissibility of lay testimony of race or ethnicity based on speech patterns).

194. There are few cases on the constitutionality of using race as an identifying feature in criminal investigations, presumably because the validity of the practice always has been taken for granted. *See, e.g.*, Waldron v. United States, 206 F.3d 597, 604 (6th Cir. 2000) (holding that an investigative stop of a bank robber that relied in part on witnesses' statements as to the robber's race was not "illegal 'racial targeting' or 'racial profiling' because '[c]ommon sense dictates that, when determining whom to approach as a suspect of criminal wrongdoing, a police officer may legitimately consider race as a factor if descriptions of the perpetrator known to the officer include race'"). In *Hall*, the Third Circuit held that the Fourteenth Amendment prohibited the police from asking banks to photograph suspicious-looking blacks who entered their establishments. *Hall*, 570

The government can rely on racial information in a criminal investigation because the practice does not unfairly burden any racial group.[195] In cases in which racial classifications have been struck down, the explicit purpose or actual use of the racial classification was to burden or stigmatize a racial group. *Yick Wo v. Hopkins*[196] offers an early illustration. In 1880, San Francisco passed an ordinance requiring that persons obtain a permit before operating laundries in wooden structures. Yick Wo was convicted of operating such a laundry without a permit. The Supreme Court set aside the conviction because it concluded that city officials had issued permits with "an evil eye and an unequal hand."[197] Almost without exception, permits were denied to Chinese and granted to non-Chinese.[198] Thus, the permit requirement, although not explicitly racial, was used to exclude the Chinese from the laundry business. It burdened this group for no legitimate reason.

A different question is presented when racial information is collected and used evenhandedly to advance legitimate state interests and in ways that are not designed to disadvantage any individual because of race. In these situations, courts have held the government can record the racial

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F.2d at 90–91. The constitutional infirmity in this practice, the court reasoned, was that "[t]he police simply instituted a general photographic survey limited to one race." *Id.* at 91. The court indicated that the result would have been otherwise had the practice applied to all races, or had the request been part of an investigation of a crime by a black suspect: "This is not a situation where suspects are being sought on the basis of descriptions which include race as well as other physical characteristics. No crime was under investigation nor was there any information that a robbery was planned." *Id.*

195. *Cf.* Strauder v. West Virginia, 100 U.S. 303, 308 (1879) (stating that the Fourteenth Amendment confers "the right to exemption from unfriendly legislation against [a group] distinctively" on account of race). The continuing vitality of *Strauder* cannot be doubted. *See, e.g.*, J.E.B. v. T.V., 511 U.S. 127, 128 (1994); Georgia v. McCollum, 505 U.S. 42, 44 (1992); Powers v. Ohio, 499 U.S. 400, 402 (1991). Consider also the use of racial information by government doctors on the staff of Veterans Administration hospitals. Suppose that a physician who is considering administering the drug isoniazid to an Asian patient who is either has pulmonary sarcoidosis or pulmonary tuberculosis. *See* Richard I. Kopelman et al., *Clinical Problem Solving: A Little Math Helps the Medicine Go Down*, 341 NEW ENG. J. MED. 435 (1999). Although this therapy improves the chance of survival for tuberculosis (but not sarcoidosis), it can lead to hepatitis. *Id.* at 437. The risk of this complication is about twice as large in Asian men as in other men. *Id.* In weighing the therapeutic benefits against the risks it would be medically inadvisable for the physician to disregard the fact that the patient is Asian. *See id.* at 437–38. Therefore, it is legal for the physician to use race as a factor in diagnosis, prognosis, or treatment.

196. 118 U.S. 356 (1886).

197. *Id.* at 373–74.

198. *See id.*

information. For instance, *Hamm v. Virginia State Board of Elections*[199] involved an equal protection challenge to a Virginia law that required every decree of divorce to recite the race of the spouses. A three-judge district court upheld this record-keeping provision because the racial information served the valid purpose of collecting social statistics and did not single out or burden any racial group.[200] The Supreme Court affirmed without discussion.[201]

Under these principles, governmental sponsorship of research on the variations of particular alleles across races and the investigative use of alleles that are reasonably accurate indicators of race should pass constitutional muster. Two factors are crucial to such constitutionality: No group is singled out for special treatment, and no one is penalized because of hostility toward race.[202] If the police make investigative use

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199. 230 F. Supp. 156 (E.D. Va.), *aff'd sub nom.* Tancil v. Woolls, 379 U.S. 19 (1964) (per curiam).

200. The court wrote:

> [T]he designation of race, just as sex or religious denomination, may in certain records serve a useful purpose, and the procurement and compilation of such information by State authorities cannot be outlawed per se. For example, the securing and chronicling of racial data for identification or statistical use violates no constitutional privilege. If the purpose is legitimate, the reason justifiable, then no infringement results . . . .
>
> Vital statistics, obviously, are aided by denotation in the divorce decrees of the race of the parties. This provision . . . is not objectionable in law. Of course, the advertence must be made in every case, not just in suits involving Negroes.

Id. at 158. Other laws required lists of qualified voters and property owners to be maintained so as to reveal the race of the individuals. The court struck down these requirements because "they serve no other purpose than to classify and distinguish official records on the basis of race or color." *Id.*

201. Tancil v. Woolls, 379 U.S. 19 (1964) (per curiam).

202. Where the government publicizes the race of individuals in a way calculated to disadvantage members of certain racial groups, it offends the Fourteenth Amendment. Thus, in *Anderson v. Martin*, 375 U.S. 399 (1964), individuals wishing to become candidates in an election to the county school board of East Baton, Louisiana, brought an action to enjoin the state from enforcing a statute that required nomination papers and ballots to designate the race of candidates for elective office. *Id.* at 401. On its face, the law applied to all races and was applied evenhandedly. Nonetheless, its only plausible purpose was to invite racial cohesion in elections. As the Court explained:

> [B]y directing the citizen's attention to the single consideration of race or color, the State indicates that a candidate's race or color is an important—perhaps paramount—consideration in the citizen's choice, which may decisively influence the citizen to cast his ballot along racial lines. Hence in a State or voting district where Negroes predominate, that race is likely to be favored by a racial designation on the ballot, while in those communities where other races are in the majority, they may be preferred. The vice lies not in the resulting injury but in the placing of the power of the State behind a racial classification that induces racial prejudice at the polls.

of racial information whenever that information is useful, then all racial groups are treated alike; none is stigmatized or disadvantaged in the enforcement of laws that apply with equal force to members of every race.

It is true that the information could have a disparate impact and lead to the apprehension of more criminals from one race than another—but not because of official (or even unofficial) hostility toward particular races or individual prejudices about those races. Recent years have witnessed outcries against "racial profiling" in policing.[203] The constitutional defect in this practice is that authorities unfairly target minorities for traffic stops or arrests. As in *Yick Wo*, laws that are neutral on their face—that do not explicitly classify people by race—can be applied disproportionately to racial minorities.[204] With DNA samples from crime scenes, however, statistically valid inferences as to race

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Id. at 402.

The use of race as an identifying feature in criminal investigations is quite different. It is not designed to induce or capitalize on racial prejudice, but rather serves the legitimate purpose of enabling authorities to identify and apprehend the perpetrators of crimes. Moreover, as discussed in the text below, the use of DNA markers could serve to reduce the operation of racial prejudice by providing an objective indication of the race of the perpetrator.

These benign characteristics are present even if the DNA genotypes associated with race distinguish among but a handful of races. For example, suppose (unrealistically) that only two groups could be distinguished with reasonable accuracy—individuals of African descent and those of European descent. Deciding that the crime samples in one set of cases probably originated from one group, while those in another set of cases probably came from the other group, would represent an evenhanded application of the available information to all people. It is comparable to using black-and-white surveillance videos of bank robberies. As long as the police consistently focus investigations on individuals with the complexion of those depicted on film, they do not purposefully disadvantage any one group, and the practice would not constitute the invidious discrimination forbidden by the Equal Protection Clause.

203. *See* Jeffrey Goldberg, *The Color of Suspicion*, N.Y. TIMES MAG., June 20, 1999, at 51; Jerry Gray, *Unwelcome Addition to a Legacy*, N.Y. TIMES, May 1, 1999, at A5; Steven A. Holmes, *Clinton Orders Investigation on Possible Racial Profiling*, N.Y. TIMES, June 10, 1999, at A22; Steve Miller, *Ashcroft Demands Profiling Study: Gives Congress Six Months or Says He Will Do It Himself*, WASH. TIMES, Mar. 2, 2001, *available at* 2001 WL 4147940.

204. This risk can be intolerably high when race is itself the factor on which officers rely. Consequently, the Equal Protection Clause may require the use of factors—gang membership, for example—that are not explicitly racial, even though these factors can be highly correlated with race. It is well settled that the use of valid decision-making factors does not violate the Equal Protection Clause even when they have a disparate impact on one race. Hunt v. Crowmartie, 526 U.S. 541, 546 (1999) ("A facially neutral law, on the other hand, warrants strict scrutiny only if it can be proved that the law was motivated by a racial purpose or object, or if it is unexplainable on grounds other than race.") (internal quotation marks and citations omitted); Washington v. Davis, 426 U.S. 229 (1976). When the underlying, nonracial factors are available, they are more accurate indicators than the racial surrogate for them.

cannot lead the authorities to target minorities because of subjective racial stereotypes or prejudices.[205] If anything, by focusing the investigation on the pertinent physical characteristics—whatever they may be—reliance on genetic information in crime-scene samples could correct any tendency to pursue one racial group exclusively or disproportionately. For example, if DNA analysis indicated that the source of a sample was more likely to be Caucasian than African-American, it might help overcome a stereotypical assumption that only blacks need be considered as prime suspects. By providing objective information, DNA analysis could serve as an antidote to the objectionable form of "racial profiling" in police work.

Of course, this is not to say that the government should institute a research program to develop more precise DNA markers for racial identity or that police should use existing markers that are demonstrated to be informative as to race. The conclusion is simply that these are policy choices to be made about a developing technology—these options are not foreclosed by the Constitution.

II. DNA ANALYSIS IN PROSECUTIONS

A. Standards and Procedures for Deciding Admissibility

1. Novel Scientific Methods

Two major standards exist for deciding whether scientific findings will be admitted into evidence: the "general-acceptance" test and the "sound-methodology" standard.[206] If a timely objection is raised, the judge must determine whether the applicable standard has been met. The general-acceptance standard was first articulated in an influential 1923 federal court of appeals case, *Frye v. United States*.[207] In jurisdictions that follow *Frye*, the proponent of the scientific evidence typically must establish that the underlying theory and methodology are generally accepted within the relevant portions of the scientific community.

The sound-methodology standard is derived from phrases in the Federal Rules of Evidence. In *Daubert v. Merrell Dow Pharmaceuticals,*

205. By "racial information," this Article is simply referring to genetic markers that are far more common within one "racial group" than another.

206. The description of these standards is drawn from NRC II, *supra* note 1, at 171–73.

207. 293 F. 1013 (D.C. Cir. 1923).

Inc.,[208] the U.S. Supreme Court held that these rules implicitly jettison general acceptance as an absolute prerequisite to the admissibility of scientific evidence.[209] Instead of the *Frye* test, the Court prescribed a broader framework for deciding whether proposed testimony has sufficient scientific validity and reliability to be admitted as relevant "scientific knowledge" that would "assist the trier of fact."[210] In that framework, the lack of general acceptance weighs against admissibility but is not invariably fatal. It is circumstantial evidence that the technology has not been studied widely or that the bulk of the specialists who have studied the technique have found it wanting. The Court discussed other factors that might be considered. Its nonexhaustive list includes the extent to which the theory and technology have been tested, the existence of a body of peer-reviewed studies, and the known error rates of the procedure.[211] Although the trend in the states appears to be toward the *Daubert* view,[212] there still are jurisdictions that adhere to *Frye*.[213]

Labels like "general acceptance" and "sound methodology" are just that—labels. Cases decided in each jurisdiction help to define the scientific community in which the degree of scientific acceptance is to be ascertained, the extent of disagreement that can be tolerated, the information that may be used to gauge the extent of consensus, and the specific factors other than general acceptance that bear on relevance and helpfulness. The degree of scientific consensus is important to the admissibility of scientific evidence in all jurisdictions, and pretrial hearings in hotly contested cases have lasted months and generated thousands of pages of testimony probing the opinions of experts on various aspects of DNA profiling. The courts have examined affidavits or testimony from scientists selected by the parties, specific papers in

208. 509 U.S. 579 (1993).

209. *Id.* at 589.

210. *Id.* at 592.

211. *Id.* at 593–94.

212. Heather G. Hamilton, Note, *The Movement from* Frye *to* Daubert*: Where Do the States Stand?*, 38 JURIMETRICS J. 201, 209 (1998) (noting that by December 15, 1997, thirty-three states had adopted the *Daubert* standard).

213. *See, e.g.*, Logerquist v. McVey, 1 P.3d 113, 124–33 (Ariz. 2000); People v. Leahy, 882 P.2d 321, 323 (Cal. 1994); Murray v. State, 692 So. 2d 157, 161 (Fla. 1997); People v. Miller, 670 N.E.2d 721, 731 (Ill. 1996); People v. Wernick, 674 N.E.2d 322, 324–24 (N.Y. 1996); Commonwealth v. Blasioli, 713 A.2d 1117, 1119 (Pa. 1998); State v. Copeland, 130 Wash. 2d 244, 262, 922 P.2d 1304, 1315 (1996).

scientific periodicals, the writings of science journalists, the body of court opinions, and other scientific and legal literature.

In particular, the history of the judicial treatment of DNA evidence can be divided into at least five phases.[214] The first phase was one of rapid and sometimes uncritical acceptance. The first generation of DNA typing tests examined certain Restriction Fragment Length Polymorphisms (RFLPs) known as Variable Number Tandem Repeats (VNTRs). Bacterial "restriction enzymes" can be used to cut the strands of the DNA molecule when they encounter certain, short sequences of bases ("restriction sites").[215] The resulting fragments vary in their lengths; some have more base pairs between two adjacent restriction sites. One class of such length polymorphisms is due to repetitions of "core sequences" some fifteen to thirty-five base pairs long.[216] These core sequences are repeated end-to-end different numbers of times in different individuals. Because of the many repeats, these VNTR alleles typically extend for thousands of bases.[217] Between each pair of restriction sites, an individual usually has two fragments of distinct lengths (one from each chromosome). The two lengths can be measured by electrophoresis, a process that sorts fragments by length.[218]

Initial praise for RFLP testing in homicide, rape, paternity, and other cases was effusive. Indeed, one judge proclaimed "DNA fingerprinting" to be "the single greatest advance in the 'search for truth' . . . since the advent of cross-examination."[219] In this first wave of cases, expert testimony for the prosecution rarely was countered, and courts readily admitted RFLP findings.[220]

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214. This history of the judicial reception of DNA evidence is adapted from 1 CHARLES T. MCCORMICK, MCCORMICK ON EVIDENCE § 205 (John W. Strong ed., 5th ed. 1999).

215. The nucleotide bases that connect the two helical strands of the DNA molecule often are referred to by the first letters (A, T, C, and G) of their names. The A on one strand always pairs with the T on another, and the C with a G, so that the base pairs are like a spiral staircase with four types of rungs (AT, TA, CG, GC). *See, e.g.*, Kaye & Sensabaugh, *supra* note 9, at 560. The bonds between the bases are weak, however, and the two strands can be separated by heating or chemicals. When a restriction enzyme is applied to the single-stranded DNA, it cuts the strand at sites that are several base pairs long. *See, e.g.*, D.H. Kaye, Bible *Reading: DNA Evidence in Arizona*, 28 ARIZ. ST. L.J. 1035, 1044–45 (1996).

216. *See, e.g.*, Kaye & Sensabaugh, *supra* note 9, at 494.

217. *See id.* at 562.

218. *See, e.g.*, *id.* at 501.

219. People v. Wesley, 533 N.Y.S.2d 643, 644 (County Ct. 1988).

220. *See, e.g.*, Andrews v. State, 533 So. 2d 841, 847–51 (Fla. Dist. Ct. App. 1988); *Wesley*, 533 N.Y.S.2d at 643–59; State v. Woodall, 385 S.E.2d 253, 259–62 (W. Va. 1989) (taking judicial notice of general scientific acceptance where there was no expert testimony, but holding that

In a second wave of cases, however, defendants pointed to problems at two levels—controlling the experimental conditions of the analysis and interpreting the results.[221] Some scientists questioned certain features of the procedures for extracting and analyzing DNA employed in forensic laboratories. It became apparent that determining whether RFLPs in VNTR loci in two samples actually match can be complicated by measurement variability[222] or missing or spurious bands.[223] Despite these concerns, most cases continued to find forensic RFLP analyses to be generally accepted,[224] and a number of states have provided for admissibility of DNA tests by legislation.[225] Concerted attacks by

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inconclusive results were properly excluded as irrelevant); Thomas M. Fleming, Annotation, *Admissibility of DNA Identification Evidence*, 84 A.L.R.4th 313 (1991).

221. For a comprehensive survey of possible sources of error and ambiguity in VNTR profiling, see William Thompson & Simon Ford, *The Meaning of a Match: Sources of Ambiguity in the Interpretation of DNA Prints*, *in* FORENSIC DNA TECHNOLOGY 93 (Mark A. Farley & James J. Harrington eds., 1990).

222. Electrophoresis involves the application of an electric field that pulls shorter fragments through a gelatinous material more rapidly than longer fragments. Thus, in a fixed time, shorter alleles run farther on the "gel," as it is called, than the longer fragments. But the separation process is not exact. Two fragments that are very close in size may not be distinguishable, and the distance that a fragment travels varies slightly from one run to the next. Because of this measurement error inherent in the system the lengths are not known precisely. *See, e.g.*, NRC II, *supra* note 1, at 139–42.

223. When the many copies of single-stranded DNA fragments extracted from a sample of many cells have been separated on the electrophoretic gel, they are transferred to a sheet of nylon that is easier to manage. The restriction fragments of interest are identified with a "probe"—a short stretch of single-stranded DNA that binds to the core sequence of the desired fragments. The probe includes a radioactive or chemical "tag" that "lights up" to mark the fragments to which it is bound. For example, if a nylon membrane with radioactively tagged fragments is placed next to sheets of suitable photographic film, the radiation will expose the film in two separate "bands" adjacent to the two regions where fragments of the two lengths have migrated. *See, e.g.*, Kaye & Sensabaugh, *supra* note 9, at 501–02. But laboratory artifacts or contamination can produce extra bands or missing bands. *See, e.g.*, United States v. Yee, 134 F.R.D. 161 (N.D. Ohio 1991), *aff'd sub nom.* United States v. Bonds, 12 F.3d 540 (6th Cir. 1993); Christopher Anderson, *DNA Fingerprinting on Trial*, 342 NATURE 844 (1989); William Thompson & Simon Ford, *Is DNA Fingerprinting Ready for the Courts?*, NEW SCIENTIST, Mar. 31, 1990, at 38; Kolata, *supra* note 2.

224. *See, e.g.*, *Yee*, 134 F.R.D. at 166–67; State v. Pennington, 393 S.E.2d 847, 852–54 (N.C. 1990) (accepting uncontradicted expert testimony that false positives are impossible); Glover v. State, 787 S.W.2d 544, 548 (Tex. Ct. App. 1990) (finding analysis admissible in light of other decisions where "[a]ppellant did not produce any expert testimony").

225. MD. CODE ANN., CTS. & JUD. PROC. § 10–915 (1998) ("In any criminal proceeding, the evidence of a DNA profile is admissible to prove or disprove the identity of any person."); MINN. STAT. ANN. § 634.25 (West Supp. 2001) The statute states:

> In a . . . criminal trial or hearing, the results of DNA analysis . . . are admissible in evidence without antecedent expert testimony that DNA analysis provides a trustworthy and reliable method of identifying characteristics in an individual's genetic material upon a showing that the offered testimony meets the standards for admissibility set forth in the Rules of Evidence.

defense experts of impeccable credentials, however, produced a few cases rejecting specific proffers on the ground that the testing procedure was not sufficiently rigorous.[226] Moreover, a minority of courts, perhaps concerned that DNA evidence might well be conclusive in the minds of jurors, added a "third prong" to the general acceptance standard.[227] This augmented *Frye* test requires not only proof of the general acceptance of the ability of science to produce the type of results offered in court, but also a showing of the proper application of an approved method on the particular occasion.[228] Whether this inquiry is properly part of the special screening of scientific methodology, however, is debatable.[229]

Id.; *see also* Kenneth E. Melson, *Legal and Ethical Considerations*, *in* DNA FINGERPRINTING: AN INTRODUCTION 189, 199–200 (Lorne T. Kirby ed., 1990).

226. *See* State v. Schwartz, 447 N.W.2d 422, 428 (Minn. 1989) (recognizing that "DNA typing has gained general acceptance in the scientific community," but "the laboratory in this case did not comport" with "appropriate standards"); People v. Castro, 545 N.Y.S.2d 985, 996 (Sup. Ct. 1989) (stating that principles of DNA testing have been generally accepted, but "[i]n a piercing attack upon each molecule of evidence presented, the defense was successful in demonstrating to this court that the testing laboratory failed in its responsibility to perform the accepted scientific techniques and experiments"); Colin Norman, *Maine Case Deals Blow to DNA Fingerprinting*, 246 SCIENCE 1556 (1989); Rorie Sherman, *DNA Tests Unravel?*, NAT'L L.J., Dec. 18, 1989, at 1, 24–25.

Effective December 1, 2000, Federal Rule of Evidence 702 was amended to require that the proponent show both the expert used a reliable methodology and the expert "has applied the principles and methods reliably to the facts of the case." The Advisory Committee Note states:

> The amendment specifically provides that the trial court must scrutinize not only the principles and methods used by the expert, but also whether those principles and methods have been properly applied to the facts of the case. As the court noted in In re Paoli R.R. Yard PCB Litig., 35 F.3d 717, 745 (3d Cir. 1994), "any step that renders the analysis unreliable . . . renders the expert's testimony inadmissible. *This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.*"

Id. (emphasis in original)

227. This innovation was introduced in *Castro*, 545 N.Y.S.2d at 995–99. It soon spread. *See* United States v. Two Bulls, 918 F.2d 56, 61 (8th Cir. 1990) ("[I]t was error for the trial court to determine the admissibility of the DNA evidence without determining whether the testing procedures . . . were conducted properly."), *vacated for reh'g en banc, app. dismissed due to death of defendant*, 925 F.2d 1127 (8th Cir. 1991); *Ex parte* Perry, 586 So. 2d 242, 248 (Ala. 1991). For cases declining to graft a "third prong" onto *Frye*, see, for example, State v. Bible, 858 P.2d 1152, 1179–84 (Ariz. 1993); Hopkins v. State, 579 N.E. 2d 1297, 1302–04 (Ind. 1991); State v. Vandebogart, 616 A.2d 483, 490 (N.H. 1992); State v. Cauthron, 120 Wash. 2d 879, 888–90, 846 P.2d 502, 505–07 (1993).

228. Later, some courts insisted on such a showing as part of the demonstration of scientific soundness required under *Daubert*. *See, e.g.*, United States v. Martinez, 3 F.3d 1191, 1197–99 (8th Cir. 1993).

229. For an analysis concluding that such matters are better handled, not as part of the special test for scientific evidence, but as aspects of the balancing of probative value and prejudice, see

A different attack on DNA profiling that began in cases during this period proved far more successful and led to a third wave of cases. Even if the laboratory has found the true VNTR profile in the sample and has correctly determined that it matches the defendant's, there is some chance that the match is a coincidence because the perpetrator actually was someone else whose VNTR profile happens to be the same as the defendant's. To dismiss this possibility as remote, prosecutors called on experts to testify that the probability of a coincidentally matching VNTR profile (often called a "random-match probability") is infinitesimal. However, these estimates relied on a simplified population-genetics model for the frequencies of VNTR profiles that treats each race as a large, randomly mating population. Some prominent scientists claimed that the applicability of the model had not been adequately verified.[230] They suggested that within a broad population group such as Caucasians, subgroups such as Italian-Americans and Swedish-Americans tend to mate among themselves and might have very different frequencies for the VNTR alleles. Such a population structure could cause the simplified estimates to understate (or overstate) the profile frequency for Caucasians derived from data that fail to account for the effects of the subpopulations. A heated debate spilled over from courthouses to scientific journals and convinced the supreme courts of several states that general acceptance was lacking.[231] A 1992 report of the National Academy of Sciences proposed a more "conservative" computational method as a compromise,[232] and this seemed to undermine the claim of scientific acceptance of the less conservative procedure that was in general use.[233]

At this juncture, the debate was poised to enter a fourth phase. In response to the population-genetics criticism and the 1992 NAS report[234]

Margaret A. Berger, *Laboratory Error Seen Through the Lens of Science and Policy*, 30 U.C. DAVIS L. REV. 1081 (1997).

230. *See* Kaye, *supra* note 217, at 128; Thompson, *supra* note 5, at 22. In the light of the totality of information on the distribution of various genes in populations, the criticism of the simple random-mating model may have been overblown. *See* Bernard Devlin & Kathryn Roeder, *DNA Profiling: Statistics and Population Genetics*, *in* 1 MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY 710 (David Faigman et al. eds., 1997).

231. *See* NRC II, *supra* note 1, at 205–11 (tabulating cases); Kaye, *supra* note 5, at 101.

232. NATIONAL RESEARCH COUNCIL COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE, DNA TECHNOLOGY IN FORENSIC SCIENCE (1992) [hereinafter NRC I].

233. *See* David H. Kaye, *The Forensic Debut of the National Research Council's DNA Report: Population Structure, Ceiling Frequencies and the Need for Numbers*, 96 GENETICA 99 (1995).

234. NRC I, *supra* note 232.

came an outpouring of both critiques of the report and new studies of the distribution of VNTR alleles in many population groups. Relying on the burgeoning literature, a second National Academy panel concluded in 1996 that the usual method of estimating frequencies of VNTR profiles in broad racial groups was sound.[235] In the fourth phase of judicial scrutiny of DNA evidence, the courts almost invariably returned to the earlier view that the probabilities estimated with the random-mating model (or minor variations of it) are generally accepted and scientifically valid.[236]

The fifth phase of the judicial evaluation of DNA evidence is well underway. Harnessing the Polymerase Chain Reaction (PCR) enables laboratories to produce millions of identical copies of DNA fragments even from samples too small for RFLP typing.[237] With these in hand, many DNA polymorphisms can be analyzed quickly and unambiguously.[238] Consequently, the RFLP methods "are being rapidly replaced" with PCR-based methods.[239] As results obtained with new methods enter the courtroom, it becomes necessary to ask whether each such method rests on a solid scientific foundation or is generally accepted in the scientific community.[240] Sometimes, the answer will be obvious even

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235. NRC II, *supra* note 1, at 156–59. The 1996 report provides more refined methods for estimating allele frequencies in ethnic subpopulations.

236. *See, e.g.*, People v. Soto, 981 P.2d 958, 974 (Cal. 1999) ("Several developments since the filing of *Barney* indicate the controversy over population substructuring and use of the unmodified product rule has dissipated."); People v. Miller, 670 N.E.2d 721, 731–32 (Ill. 1996) ("[W]hile there has been some controversy over the use of the product rule in calculating the frequency of a DNA match, that controversy appears to be dissipating."); Armstead v. State, 673 A.2d 221, 238 (Md. 1996) ("[T]he debate over the product rule essentially ended in 1993."); Commonwealth v. Fowler, 685 N.E.2d 746, 748–50 (Mass. 1997) (stating that the product rule with and without ceilings for VNTRs now meets test of scientific reliability in light of 1996 NRC Report), *departing from* Commonwealth v. Lanigan, 596 N.E.2d 311, 314–17 (Mass. 1992) (reasoning that dispute over population structure evinces lack of general acceptance); 1 MCCORMICK *supra* 214, § 205, at 761.

237. *See, e.g.*, Kaye & Sensabaugh, *supra* note 9, at 563–64.

238. For a description of one such system, *see infra* note 274.

239. NCFDNA, *supra* note 184, at 16; *see also supra* note 183 (describing STRs).

240. *See, e.g.*, Harrison v. State, 644 N.E.2d 1243, 1251–52 (Ind. 1995) (reversing due to lack of a *Frye* hearing on PCR-based method). *But see* State v. Scott, No. 01C01-9708-CR-00334, 1999 WL 547460, at *8–10 (Tenn. Crim. App. July 28, 1999) (holding, in unpublished opinion, that state statute providing that "the results of DNA analysis . . . are admissible in evidence without antecedent expert testimony that DNA analysis provides a trustworthy and reliable method of identifying characteristics in an individual's genetic material upon a showing that the offered testimony meets the standards of admissibility set forth in the Tennessee Rules of Evidence obviated the need for a hearing on the scientific soundness of mitochondrial DNA testing).

without an extensive pretrial hearing.[241] The opinions are practically unanimous in holding that the more commonly used PCR-based procedures satisfy these standards.[242]

In sum, in little more than a decade, DNA typing has made the transition from a novel set of methods for identification to a relatively mature and well studied forensic technology. However, one should not lump all forms of DNA identification together. New techniques and applications continue to emerge. These range from the use of new genetic systems and new analytical procedures to the typing of DNA from plants and animals.[243] Before admitting such evidence, it will be necessary to inquire into the biological principles and knowledge that would justify inferences from these new technologies or applications.[244] For example, a court's prior approval of RFLP testing by gel electrophoresis[245] or reverse dot blot testing[246] of PCR-amplified frag-

241. For example, a procedure may be so similar to accepted protocols that acceptance or validity can be inferred from previous cases. *See* United States v. Johnson, 56 F.3d 947, 952–53 (8th Cir. 1995) (holding, in response to a defense expert's testimony that a police department's variation on the FBI protocol for RFLP-VNTR testing had not been validated, that the variation did not preclude admission where an FBI analyst testified that the difference was of no significance); People v. Oliver, 713 N.E.2d 727, 734 (Ill. Ct. App. 1999) ("[T]he minor variations . . . in the . . . second RFLP test did not render it a new scientific technique for the purposes of *Frye*."). In general, trial courts have considerable "latitude in deciding *how* to test an expert's reliability, and to decide whether or when special briefing or other proceedings are needed to investigate reliability." Kumho Tire Co., Ltd. v. Carmichael, 526 U.S. 137, 152 (1999) (emphasis in original).

242. People v. Allen, 85 Cal. Rptr. 2d 655, 658–60 (Ct. App. 1999) (STR testing); Commonwealth v. Rosier, 685 N.E.2d 739, 741–43 (Mass. 1997) (same); Commonwealth v. Vao Sok, 683 N.E.2d 671, 672–73 (Mass. 1997) (finding PCR-based DQ, Polymarker, and D1S80 analysis "meet the test of scientific reliability"); State v. Jackson, 582 N.W.2d 317, 325–26 (Neb. 1998) (STR testing); State v. Harvey, 699 A.2d 596, 616–33 (N.J. 1997) (finding DQ and Polymarker tests generally accepted); State v. Lyons, 924 P.2d 802, 805–16 (Or. 1996) (finding DQ admissible under relevancy standard); State v. Moeller, 548 N.W.2d 465, 479–84 (S.D. 1996) (finding DQ admissible under *Daubert* standard). For descriptions of these tests, see Kaye & Sensabaugh, *supra* note 9; NCFDNA, *supra* note 184. *See also supra* notes 214–39.

243. George Sensabaugh & D.H. Kaye, *Non-human DNA Evidence*, 39 JURIMETRICS J. 1 (1998).

244. For suggestions to assist in this endeavor, *see id.*; Kaye & Sensabaugh, *supra* note 9, at 549–59.

245. Gel electrophoresis is described *supra* notes 222, 223.

246. Reverse dot blot testing "tests for the presence of a specific sequence. The procedure involves the use of probes specific for that particular DNA sequence. The analyst adds known probes . . . . The dot blot test is binary in character; there are only two possible outcomes, and they indicate whether or not the sequence is present. If the [sequence is present], color will develop; if the [sequence is absent], no color will develop at the DNA spot . . . ." 2 PAUL C. GIANNELLI & EDWARD J. IMWINKELRIED, SCIENTIFIC EVIDENCE § 18-3(C), at 18 (3d ed. 1999).

ments containing the HLA DQ-α gene[247] does not dictate the conclusion that the court also must accept testing at STR loci[248] or mitochondrial DNA sequencing.[249] The newer technologies are gaining judicial approval,[250] but a court should not confer approval until it is satisfied that the specific technology satisfies the applicable standard.

2. *Proficiency-Test Records*

In a study, the researchers empirically verify the ability of the technology to identify features of DNA molecules. In contrast a proficiency study tests how competently the laboratory's analysts apply a technology that has been validated.[251] The purpose of proficiency testing is to uncover difficulties that a particular technician or a particular laboratory might be encountering in applying established methods.

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247. Human Leukocyte Antigen (HLA) is an "[a]ntigen (foreign body that stimulates an immune system response) located on the surface of most cells (excluding red blood cells and sperm cells). HLAs differ among individuals and are associated closely with transplant rejection." Kaye & Sensabaugh, *supra* note 9, at 570. DQA is "[t]he gene that codes for a particular class of Human Leukocyte Antigen (HLA). This gene has been sequenced completely and can be used for forensic typing." *Id.* at 568. Indeed, "[t]he first use of PCR-based typing for forensic application . . . employed the HLA-DQA1 locus (formerly called the DQ-)." NCFDNA, *supra* note 184, at 17.

248. For descriptions of STR loci, see *supra* note 183; GIANNELLI & IMWINKELRIED, *supra* note 246, § 18-3(C), at 21.

249. Most DNA-typing techniques analyze DNA found in the chromosomes within cell nuclei. Mitochondrial testing analyzes DNA "found in the energy-producing material surrounding the cell nucleus." GIANNELLI & IMWINKELRIED, *supra* note 246, § 18-2, at 3. A mitochondrion is "[a] structure . . . within nucleated . . . cells that is the site of the energy producing reactions within the cell. Mitochondria contain their own DNA (often abbreviated as mtDNA), which is inherited only from mother to child." Kaye & Sensabaugh, *supra* note 9, at 571. Because there are hundreds of mitochondria in a cell, but only one nucleus, mtDNA sequencing can be used with samples containing too little nuclear DNA for PCR amplification to work. *Id.* at 495.

250. *See, e.g.*, State v. Underwood, 518 S.E.2d 231 (N.C. Ct. App. 1999) (approving use of mitochondrial DNA sequencing); State v. Ware, No. 03C01-9705CR00164, 1999 WL 233592 (Tenn. Crim. App. Apr. 20, 1999) (holding that notwithstanding testimony from a defense expert that mtDNA sequencing had not been adequately validated for forensic use, the FBI's mtDNA testing was properly admitted under the scientific soundness standard); *see also* Leigh Jones, *mtDNA Ruled Reliable in Rape Trial*, N.Y.L.J., Sept. 7, 2000; *supra* note 242.

251. Proficiency testing in forensic genetic testing is designed to ascertain whether an analyst can correctly determine genetic types in a sample the origin of which is unknown to the analyst but is known to a tester. Proficiency is demonstrated by making correct genetic typing determinations in repeated trials, and not by opining on whether the sample originated from a particular individual. Proficiency tests also require laboratories to report random-match probabilities to determine if proper calculations are being made. *See* Kaye & Sensabaugh, *supra* note 9, at 511.

Proficiency testing raises a variety of legal issues. It has been suggested that participation in a program of proficiency testing ought to be a prerequisite to the admission of evidence from a forensic laboratory,[252] that proficiency-test results should be admissible to show how likely it is that the laboratory erred in the test at bar,[253] and that random-match probabilities ought to be inadmissible unless they are combined with proficiency-test results to estimate the probability of a false match. If the second suggestion is followed, and the defense is allowed to introduce evidence of proficiency tests to suggest that the laboratory is prone to err, a further question arises: Should the prosecution be permitted to present testimony that the defense has not retested or even requested the opportunity to retest the samples?[254]

a. Proficiency Testing As a Prerequisite to Admission

The first suggestion, that courts condition admissibility on proficiency testing, is a departure from the usual practice. As indicated in the previous section, the scientific-validity and general-acceptance standards relate to the capacity of an analytical procedure to generate accurate results when properly applied, and not to whether the individual or institution using a valid or generally accepted method is skilled and careful or is instead careless and prone to error.[255] Of course, the latter issue can be of paramount importance, but usually it is said to be a matter affecting the weight of the evidence rather than its admissibility.[256]

252. *See, e.g.*, Barry C. Scheck, *DNA and* Daubert, 15 CARDOZO L. REV. 1959, 1979–87 (1994); William C. Thompson, *Accepting Lower Standards: The National Research Council's Second Report on Forensic DNA Evidence*, 37 JURIMETRICS J. 405, 417 (1997).

253. *See, e.g.*, Jonathan J. Koehler, *Error and Exaggeration in the Presentation of DNA Evidence at Trial*, 34 JURIMETRICS J. 21, 37–38 (1993); Scheck, *supra* note 252, at 1984 n.93.

254. *Cf.* James Wooley & Rockne P. Harmon, *The Forensic DNA Brouhaha: Science or Debate?*, 51 AM. J. HUM. GENETICS 1164 (1992) (urging defense experts who criticize laboratory procedures to do their own tests).

255. *See* United States v. Shea, 957 F. Supp. 331, 340–41 (D.N.H. 1997).

256. *See* Edward J. Imwinkelried, *The Case Against Evidentiary Admissibility Standards that Attempt to "Freeze" the State of a Scientific Technique*, 67 U. COLO. L. REV. 887 (1996). In extreme cases, where the laboratory departs so grossly from accepted practices that the reliability of its findings are in serious doubt, the court may well exclude the evidence on the ground that its probative value is too slight to warrant its admission.

b. The Admissibility of Errors on Proficiency Tests

The second suggestion, that testimony about proficiency-test results be used to reveal the chance of error in the case at bar, presupposes that such evidence is admissible at trial.[257] In its 1992 report, a committee of the National Academy of Sciences took the position that "laboratory error rates must be continually estimated in blind proficiency testing and must be disclosed to juries."[258] There is authority that when the prosecution introduces testimony about the probability of a coincidentally matching profile, the defendant is entitled to introduce testimony about the laboratory's proficiency tests.[259] Indeed, it has been held that the opponent must be allowed to cross-examine one laboratory representative about errors committed by other analysts at the laboratory.[260]

In contrast, in a report published in 1996, a second committee of the National Academy of Sciences declined to take a position on whether evidence of laboratory error rates, as estimated from proficiency studies, should be admissible at trial.[261] However, the report's discussion of proficiency testing raises questions about the probative value of such evidence. For example, the report notes that "[t]he pooling of proficiency-test results across laboratories" could mislead a jury and "penalize the better laboratories."[262] It adds that even a test of the same laboratory might be outdated, because the laboratory may have taken

257. The discussion of admissibility in this section is limited to the guilt phase of a case. In many jurisdictions, the formal rules of evidence are not binding during the sentencing phase. *See, e.g.*, FED. R. EVID. 1101(d)(3). Moreover, the U.S. Supreme Court has indicated that during the sentencing stage of a capital case, the Constitution requires the sentencer to "consider[], *as a mitigating factor*, any [logically relevant] aspect for a defendant's character or record and any of the circumstances of the offense that the defense proffers as a basis of a sentence less than death." Lockett v. Ohio, 438 U.S. 586, 604 (1978) (emphasis in original). Although the past performance of the laboratory is neither an aspect of a defendant's character or record nor a circumstance of the offense, a capital defendant might argue that the sentencer also must be able to consider all conceivable weaknesses in the state's proof of the offense.

258. NRC I, *supra* note 232, at 89.

259. *See* United States v. Porter, No. F06277-89, 1994 WL 742297 (D.C. Super. Ct., Nov. 17, 1994) (discussing evidence of the laboratory error rate).

260. Williams v. State, 679 A.2d 1106, 1116–20 (Md. 1996).

261. The report stated that the committee had chosen to limit its remarks to the question of "what aspects of the procedures used in connection with forensic DNA testing are scientifically valid." NRC II, *supra* note 1, at 185.

262. *Id.* at 86.

corrective action.[263] In these circumstances, the testimony could be vulnerable to an objection under Federal Rule of Evidence 403, which requires the exclusion of evidence whose probative value is substantially outweighed by the danger of prejudice, confusion of the issues, or undue consumption of time.[264]

A further objection is that the testimony represents inadmissible character evidence.[265] If the theory of logical relevance is merely that the laboratory's past commission of errors increases the probability that the laboratory erred on the occasion in question, then the theory amounts to forbidden character reasoning.[266] This is precisely the theory of logical relevance generally banned by Federal Rule of Evidence 404.[267] Moreover, to the extent that proficiency-test results constitute evidence of specific acts introduced to show a general tendency to make mistakes, they seem to run afoul of Rule 405, which forbids this form of character

263. *Id.* ("A laboratory is not likely to make the same error again."); *see also* NRC I, *supra* note 232, at 89 (recognizing that "errors on proficiency tests do not necessarily reflect permanent probabilities of false-positive or false-negative results").

264. *Cf.* United States v. Lowe, 954 F. Supp. 401, 415–16 (D. Mass. 1996), *aff'd*, 145 F.3d 45 (1st Cir. 1998) (rejecting the argument that an expert *must* present an error rate from proficiency tests along with the random-match probability).

265. *See* Edward J. Imwinkelried, *Coming to Grips with Scientific Research in* Daubert*'s "Brave New World": The Courts' Need to Appreciate the Evidentiary Differences between Validity and Proficiency Studies*, 61 BROOK. L. REV. 1247, 1273–78 (1995). A number of jurisdictions have abolished the character-evidence prohibition as it applies to a defendant's character in certain types of cases such as rape or child abuse. *See* FED. R. EVID. 413–15; CAL. EVID. CODE §§ 1108–1109. In these jurisdictions that allow the prosecution to rely on an accused's past misconduct as circumstantial proof of the charged offense, the defense conceivably could argue that the differential treatment of the accused's inculpatory misconduct and the exculpatory proficiency test results violates the equal protection guarantee. *See, e.g.*, Nettles v. State, 683 So. 2d 9, 12 (Ala. Crim. App. 1996). However, the constitutional attacks on character-evidence restrictions on defense evidence have failed. EDWARD J. IMWINKELRIED & NORMAN M. GARLAND, EXCULPATORY EVIDENCE: THE ACCUSED'S CONSTITUTIONAL RIGHT TO INTRODUCE FAVORABLE EVIDENCE, 435–72 (2d ed. 1996).

266. *See, e.g.*, Moorhead v. Mitsubishi Aircraft Int'l, 828 F.2d 278, 287 (5th Cir. 1987) (holding that lower court erred by admitting pilot's low marks at flight school refresher course); *see generally* 1 MCCORMICK, *supra* note 214, § 186.

267. Federal Rule of Evidence 404(a) provides that "[e]vidence of a person's character or a trait of his character is not admissible for the purpose of proving action in conformity therewith on a particular occasion." Section (b) of the rule recognizes certain exceptions to this blanket rule of exclusion, but none are apposite here. There also is an exception permitting a witness's opponent to impeach the witness by questioning the witness about prior untruthful acts. FED. R. EVID. 608(b). However, those acts relate to the witness's character trait for untruthfulness, rather than the trait of competence or proficiency. The Federal Rules expressly carve out the exception for untruthfulness, but there is no comparable exception for the character trait of competence or proficiency.

evidence.[268] One might argue that the character rules do not apply to entities such as a laboratory. However, the language of the rules is broad enough to extend to businesses and other entities;[269] and the cases have generally construed the statutes as reaching entities as well as natural persons.[270]

This issue is rarely recognized as a character-evidence problem in the trial court,[271] but a trial judge might find it difficult to justify overruling a properly phrased character-evidence objection when the theory of relevance is nothing more than a general tendency of the laboratory to make mistakes. If there is a consensus that the jury sometimes needs the proficiency-test results as an antidote to overwhelmingly small random-match probabilities, then the federal and state rules governing character evidence should be altered to give the trial court the discretion to admit the evidence.[272]

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268. Federal Rule of Evidence 405(a) provides that "[i]n all cases in which evidence of character or a trait of character of a person is admissible, proof may be made by testimony as to reputation or by testimony in the form of an opinion. On cross-examination, inquiry is allowable into relevant specific instances of conduct." FED. R. EVID. 405(a). Section (b) permits specific act evidence only when character is "in issue"—a term of art that has no application to the tendency of laboratory personnel to make mistakes in performing DNA tests. *See* 1 MCCORMICK, *supra* note 214, § 187.

269. Federal Rule of Evidence 404 refers to a "person," and the accompanying Advisory Committee Note states that the drafters drew on the California character statutes. FED. R. EVID. 404. California Evidence Code § 175 defines "person" as including a "firm, association, organization, partnership, business trust, corporation, limited liability company, or public entity." CAL. EVID. CODE § 175. Moreover, the complex of character rules includes the habit doctrine, and Federal Rule of Evidence 406, codifying that doctrine, expressly applies to "an organization." FED. R. EVID. 406.

270. *See generally* 1 EDWARD J. IMWINKELRIED, UNCHARGED MISCONDUCT EVIDENCE § 2:04 (rev. ed. 1999); *see also* Susanna M. Kim, *Characteristics of Soulless Persons: The Applicability of the Character Evidence Rule to Corporations*, 2000 U. ILL. L. REV. 763.

271. *But see* United States v. Shea, 957 F. Supp. 331, 344 n.42 (D.N.H. 1997) ("The parties assume that error rate information is admissible at trial. This assumption may well be incorrect. Even though a laboratory or industry error rate may be logically relevant, a strong argument can be made that such evidence is barred by Fed. R. Evid. 404 because it is inadmissible propensity evidence."); Unmack v. Deaconess Med. Ctr., 967 P.2d 783, 784–86 (Mont. 1998) (going to the brink of explicitly holding that the character evidence prohibition bars testimony about prior incidents of unskillful conduct).

272. Courts also generally have not addressed the impact of the character-evidence ban on expert testimony about the conditions under which eyewitness identifications are likely to be in error. Such testimony is unusual, and exclusion almost invariably is upheld on appeal. In the rare cases where appellate courts have held that the failure to admit the evidence was an abuse of discretion, they have not mentioned the rule against character evidence. *See* State v. Chapple, 660 P.2d 1208, 1217–24 (Ariz. 1983); People v. McDonald, 690 P.2d 709, 715–27 (Cal. 1984). Of course, much of this type of testimony falls outside the character-evidence rule. Thus, the rule does not ban testimony that "weapons focus" interferes with the accuracy of eyewitness identifications any more than it bans testimony that handling DNA samples from the suspect and the crime scene

Moreover, both the bench and bar should appreciate that in some circumstances proficiency tests of the laboratory involved in the case should be held admissible without relaxing the ban on character evidence. The ban applies only when the sole theory of logical relevance is that the existence of errors in the past suggests a tendency to err that might affect the result in the case at bar. There might be situations in which the defense can use the test data at trial on an entirely different theory of logical relevance. Assume, for instance, that the experts in a case disagree over whether a peak or a band observed in a DNA test is due to an allele or is an artifact.[273] Evidence that spurious peaks or bands have occurred under similar circumstances in proficiency tests of the laboratory on known samples would lend support to the defense theory that the peak or band in the pending case is an artifact.[274] In this situation, proficiency-test data are relevant because they provide information about the operating characteristics of the DNA test at that particular laboratory.[275]

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without taking precautions against cross-contamination can produce false matches. On the other hand, testimony that people err in their identifications a specified fraction of the time resembles testimony about the incidence of medical mistakes in hospitals, the safety record of airlines, and the like. These error statistics the law traditionally excludes.

273. Artifacts in RFLP testing with gel electrophoresis and visualization by autoradiography are mentioned *supra* note 222.

274. STR typing uses capillary electrophoresis, in which much smaller amounts of DNA are drawn through sieving material in an exquisitely thin tube. A smaller STR fragment travels through this capillary faster than a longer one. The fragments are labeled with a fluorescent dye and a laser continuously illuminates a detection window near the end of the capillary. When the laser light strikes an allele passing by the window, the dye fluoresces, and a charged coupled device (CCD) in a camera responds to the intensity of the fluorescent light. The signal is flat before the allele passes by, peaks when the allele is in the window, and then drops back to the zero level. The allele size is determined by software that compares the time at which the peak appears to the times measured for a "ladder" of fragments whose lengths are known. *See* NCFDNA, *supra* note 184, at 52–53.

275. Of course, even when the proficiency test data would be admissible and the defense has a legitimate need to discover this type of information, there might be means of satisfying the need other than by furnishing proficiency-test results. By way of example, a sampling of the laboratory's case work could meet the need. However, in most cases permitting discovery of proficiency-test data may be preferable. It will likely be more convenient for the laboratory to reveal the proficiency test data, because that data have already been compiled and giving the defense access to actual case work could compromise the privacy of the persons involved in those cases. When the defense needs to discover information about the operating characteristics of a laboratory's test for a purpose other than merely establishing the laboratory's general error rate, the data could prove to be admissible at trial; hence, the courts would not be justified in denying discovery of proficiency-test results on the ground that such discovery cannot lead to the production of admissible evidence at trial.

c. *The Use of Proficiency Tests To Modify Random-Match Probabilities*

The third argument relating to proficiency testing is that estimates of the probability that a randomly selected person would have the DNA type found in a crime-scene sample should be inadmissible unless accompanied by or blended with the laboratory's error rate.[276] The 1996 committee observed that combining the probability of a random match with the probability of error "would deprive the trier of fact of the opportunity to evaluate separately the possibility that the profiles match by coincidence as opposed to the possibility that they are reported to match by reason of laboratory or handling error."[277] The committee took the position that "a calculation that combines error rates with match

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276. Combining the random-match probability with the probability of a false-positive laboratory error according to the rules governing conditional probabilities would give the jury an estimate of the probability that the laboratory would report a match if the source of the crime-scene DNA was not the defendant. To see how this might be done requires a few symbols. Let T stand for the DNA type of the crime-scene sample, and let R_T be the event that the laboratory reports this type when it tests a sample. Let S be the hypothesis that a defendant is the source of the crime-scene sample, and let –S be the hypothesis that someone else is. Finally, let D_T be the event that defendant's DNA actually is type T, and D_{-T} be the event the defendant's DNA is of some other type. Then the chance that a person who is not the source of this sample would have DNA of type T is $P(D_T|-S)$, where $P(D_T|-S)$ stands for the conditional probability of D_T given –S. Suppose further that the chance that the laboratory would report that this individual is type T when he is not is $P(R_T|D_{-T})$. Then the probability of a reported match when the defendant is not the source is

$$P(R_T|-S) = P(R_T|D_T)P(D_T|-S) + P(R_T|D_{-T})P(D_{-T}|-S) \quad (1)$$

But $P(R_T|D_T)$ is the probability that the laboratory would report type T given that the defendant's DNA is type T. At a well-run laboratory, the probability of a true positive is very close to 1. Likewise, $P(D_{-T}|-S)$ is the probability that a defendant's DNA would not be type T given that the defendant is not the source of the type T DNA from the crime-scene. Since type T is rare, this probability also is close to one. Consequently, a good approximation for the probability of a reported match when the defendant is not the source is

$$P(R_T|-S) \cong P(D_T|-S) + P(R_T|D_{-T}) \quad (2)$$

It follows from (2) that when random-match probabilities are orders of magnitude smaller than estimates of the chance of a laboratory error of some kind, the possible error rate derived from proficiency testing dominates the combined error risk:

$$\text{if } P(R_T|D_{-T}) >> P(D_T|-S), \text{ then } P(R_T|-S) \cong P(R_T|D_{-T}) \quad (3)$$

See Thompson, *supra* note 252, at 421 n.59 (1997). For example, if the risk of a false positive is 1/10,000, and the chance that the defendant shares the DNA type of the sample by coincidence is 1/1,000,000, it follows from (2) that

$$P(R_T|-S) \cong 1/1{,}000{,}000 + 100/1{,}000{,}000 = 101/1{,}000{,}000$$

Compared to the effect of the false positive probability, the impact of the random-match probability on the chance of reported match is a negligible one part in a hundred for this example.

277. NRC II, *supra* note 1, at 85.

probabilities is inappropriate."[278] The reasoning supporting the committee's position essentially sounds under Federal Rule of Evidence 403.[279] If anything, the Rule 403 objection is more substantial here than when it is urged as a basis for excluding testimony offered to impeach the laboratory's competence. In this situation, the questions about the validity of industry-wide error rates and the staleness of even the laboratory's own tests are equally applicable and call into question the probative worth of the testimony. Moreover, there is a heightened risk that the jury will be confused. Error rates and random-match probabilities relate to distinct hypotheses, and a lay juror may find it difficult to understand the significance of a computation which merges the rates and the probability. That mode of computation could place even greater strain on the jurors' ability to comprehend the body of evidence submitted to them.[280] The few courts that have addressed the argument that error rates should be used to the exclusion of random-match probabilities have not been persuaded.[281]

d. *The Opportunity To Retest As a Response to Defense Arguments About Proficiency Testing*

While defense counsel originated the first three suggestions, the fourth suggestion related to proficiency testing has been made by prosecutors. The thrust of this suggestion is that when the defense is allowed to introduce evidence of proficiency tests of the laboratory employing the prosecution's expert to suggest that the laboratory is prone to err, the prosecution should be permitted to present testimony that the defense has not retested or even requested the opportunity to retest the samples analyzed by the prosecution's expert.

The testimony would be logically relevant under several theories. First, if a defense expert testifies that the laboratory result is untrust-

278. *Id.* at 87.

279. *See generally* Margaret A. Berger, *Laboratory Error Seen Through the Lens of Science and Policy*, 30 U.C. DAVIS L. REV. 1081 (1997).

280. Jason Schklar & Shari Seidman Diamond, *Juror Reactions to DNA Evidence: Errors and Expectancies*, 23 LAW & HUM. BEHAV. 159, 179 (1999) (concluding that separate figures are desirable in that "[j]urors ... may need to know the disaggregated elements that influence the aggregated estimate as well as how they were combined in order to evaluate the DNA test results in the context of their background beliefs and the other evidence introduced at trial").

281. *See, e.g.*, Armstead v. State, 673 A.2d 221, 245–46 (Md. 1996) (rejecting the argument that the introduction of a random-match probability deprives the defendant of due process because the error rate on proficiency tests is many orders of magnitude greater than the match probability).

worthy, the failure to retest would be relevant to impeach the defense expert's credibility on the ground that a scientist who truly doubted the accuracy of the analysis normally would have retested the samples to resolve the matter.[282] Inasmuch as replication is a crucial and common feature of scientific inquiry,[283] it could be argued that neglecting to retest is prior inconsistent conduct. On this theory, the defense would be entitled to a limiting instruction to the effect that the expert's failure to retest is not offered to show that the test result is correct, but only to demonstrate that the defense expert is not sincere in asserting that it is flawed.[284]

The probative value of a failure to retest in showing an expert's insincerity, however, is open to question. It is not uncommon for scientists to question in print or otherwise the adequacy of another researcher's experiment before undertaking to replicate it. And even if such opinions were unheard of in the course of ordinary science, the expert may have been retained for the limited purpose of giving an opinion on the adequacy of the testing that was done rather than redoing that testing. Nevertheless, the inference of insincerity need not be particularly strong for the "inconsistent" conduct to be a proper, logically relevant subject for cross-examination.[285]

Second, if the defense expert offers an opinion that the laboratory's results may be in error, the expert's failure to request or conduct an independent test would be relevant to suggest that the jury should give less weight to that opinion.[286] The prosecution could argue to the jury that an expert who fails to use a more definitive and readily available procedure for ascertaining whether the initial test results are correct has not been thorough in evaluating those results, and that such experts

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282. This theory does not apply if the defense introduces the proficiency-test data by cross-examining the prosecution's experts rather than producing its own expert.

283. *See, e.g.*, Bert Black et al., *Science and the Law in the Wake of* Daubert*: A New Search for Scientific Knowledge*, 72 TEX. L. REV. 716, 776–78 (1994); George Rice et al., *Male Homosexuality: Absence of Linkage to Microsatellite Markers at Xq28*, 284 SCIENCE 665 (1999).

284. FED. R. EVID. 105.

285. The impeaching statement or conduct "need only bend in a different direction." JOHN M. MCNAUGHT & HAROLD FLANNERY, MASSACHUSETTS EVIDENCE: A COURTROOM REFERENCE 13-5 (1988).

286. Thus, in *People v. Oliver*, 713 N.E.2d 727 (Ill. App. Ct. 1999), the State was allowed to show that a defense expert who questioned the results of DNA tests had done no testing of his own. *See id.* at 736 ("[I]t was proper for the prosecution to bring out on cross-examination that the defense criticisms of the prosecution's expert witnesses were not based on any independent testing that it had done.").

deserve little credence because the basis for the opinion is not as complete as it could be. Again, the inference may be debatable, but the standard of relevance, particularly on cross-examination, is lenient.[287]

Third, whether or not a defense expert discusses proficiency tests, the prosecution could argue that the defense's failure to retest (or to request a retest) amounts to an admission of the accuracy of the initial test by conduct by the defendant.[288] The courts have applied the admission-by-conduct theory to a litigant's failure to present evidence when "it would be natural" for the litigant to introduce such testimony.[289] The prosecution might urge that it would be natural for a defendant affected by a false match to seek retesting and that it would be natural for a DNA expert who entertained serious doubts about the accuracy of a prior test to retest the samples.[290]

In short, there are reasonable arguments for permitting the prosecution to raise the issue of retesting when a defendant questions the laboratory's ability to type DNA samples correctly. But even if the inquiry is probative of the insincerity or lack of thoroughness of the expert, or an admission by the defendant, there are potential objections to this counterthrust by the prosecution. One objection is that the inquiry is inconsistent with the prosecution's burden of proof.[291] To reinforce the allocation of the burden to the government, some courts generally forbid prosecution comment on the defense failure to produce evidence.[292] The argument runs that the defense is entitled to rely on the burden and has no obligation to present any evidence at trial. According to this line of argument, it is improper to convert the defense's failure to present testimony into prosecution evidence.[293] Under this line of authority, the

287. FED. R. EVID. 401; United States v. Casares-Cardenas, 14 F.3d 1283, 1287 (8th Cir.) ("Relevance is established by any showing, however slight, that makes it more or less likely . . . ."), *cert. denied*, 513 U.S. 849 (1996); United States v. Nason, 9 F.3d 155, 162 (1st Cir. 1993) ("The threshold for relevance is very low under Federal Rule of Evidence 401.").

288. 2 MCCORMICK, *supra* note 214, § 264.

289. *Id.* § 264, at 174.

290. On this theory, the defense is not entitled to a limiting instruction; an admission by conduct qualifies as substantive evidence. *Id.*; FED. R. EVID. 105.

291. People v. Harbold, 464 N.E.2d 734, 741 (Ill. App. Ct. 1984) ("[A]rguments which diminish the presumption of innocence are forbidden.").

292. Hayes v. State, 660 So. 2d 257, 265–66 (Fla. 1995); People v. Wills, 502 N.E.2d 775, 777–78 (Ill. App. Ct. 1986); State v. Primus, 535 S.E.2d 152, 156–57 (S.C. Ct. App. 2000).

293. A related argument looks to the privilege against self-incrimination. *Griffin v. California*, 380 U.S. 609, 614 (1965), teaches that the prosecution may not comment on the accused's invocation of the privilege. However, a prosecutor's statement that the defense has not introduced

defense could bar prosecution comment about the defense's failure to retest the DNA sample. However, even in such a jurisdiction, if the defense overreached, prosecution comment might be permitted as an invited response.[294] In addition, some jurisdictions reject that line of authority and allow comment on the defense's failure to present exculpatory evidence,[295] so long as the trial judge clearly instructs the jury that the prosecution has the ultimate burden of proof.

A further objection is that the admission of the testimony is inconsistent with the defendant's attorney-client privilege. A number of jurisdictions apply the attorney-client privilege when, as part of trial preparation, defense counsel hires an expert to evaluate private information from the defendant, such as the defendant's mental or physical condition.[296] The Advisory Committee Note to draft Federal Rule of Evidence 503 endorsed the application of the attorney-client privilege to experts'[297] and some courts have gone to the length of invoking the theory even when the expert did not evaluate information realistically originating from the defendant.[298] Based on these authorities, the defense might contend that the attorney-client privilege applies to a defense expert's retest of a DNA sample. The gist of the objection would be that if the result of a retest would be privileged, it is wrong-minded to penalize the defense for failing to retest.

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rebuttal expert testimony would not amount to impermissible comment. Courts have held that similar statements from the prosecution were improper only when the defendant was the only potential witness who could contradict the prosecution. *See* Bergmann v. McCaughtry, 65 F.3d 1372, 1377 (7th Cir. 1992). In a case involving DNA, the prosecutor's comments would relate to potential rebuttal testimony by an expert witness rather than any testimony from the accused.

294. *See* Wise v. State, 751 A.2d 24, 33–35 (Md. Ct. Spec. App. 2000).

295. *See* Van Woudenberg *ex rel.* Foor v. Gibson, 211 F.3d 560, 570 (10th Cir. 2000) ("The prosecutor may ... comment on the defendant's failure to present evidence or call witnesses."); People v. Guzman, 96 Cal. Rptr. 2d 87, 91 (Ct. App. 2000).

296. *See* Miller v. District Court, 737 P.2d 834, 838 (Colo. 1987); State v. Pratt, 398 A.2d 421, 422–26 (Md. 1979); Van White v. State, 990 P.2d 253, 269–71 (Okla. Crim. App. 1999); State v. Riddle, 964 P.2d 1056, 1063, *modified*, 969 P.2d 1032 (Or. Ct. App. 1998); Note, *Disclosures by Criminal Defendant to Defense-Retained Psychiatrist Held Within Scope of Attorney-Client Privilege Which Defendant Does Not Waive by Pleading Insanity*, 9 U. BALT. L. REV. 99, 111 (1979).

297. As enacted, Rule 503 leaves the recognition and development of privileges under federal law to the courts. FED R. EVID. 503. The original draft would have codified and defined the privileges. FEDERAL RULES OF EVIDENCE 229–57 (West Group 2000). Its description of the attorney-client privilege remains useful to courts as they continue to define and refine that privilege. *See generally* AMERICAN BAR ASSOCIATION, EMERGING PROBLEMS UNDER THE FEDERAL RULES OF EVIDENCE 108–14 (David A. Schlueter ed., 3d ed. 1998).

298. *Riddle*, 964 P.2d at 1063–64 (regarding accident-reconstruction expert).

As with the other suggestions related to proficiency testing, the case law offers little guidance. In principle, it would seem that once the defense has sharpened the issue of the prosecution expert's use of proper test procedures, the prosecution should be allowed to elicit testimony about the defense's failure to retest at least to probe the basis for the expert's opinion and as circumstantial evidence of defendant's belief that retesting would not yield a different result. The fact that the prosecution has the burden of persuasion does not make such inferences impermissible.[299] The constitutional requirement for proof beyond a reasonable doubt regulates the quantum of proof the prosecution must present, but no court has invoked the requirement to preclude the prosecution from introducing an otherwise admissible item of evidence. In appropriate circumstances, the majority of courts permit prosecutors to comment on a defendant's failure to produce evidence such as an available witness who would presumably corroborate the defendant's testimony.[300]

Neither should the attorney-client privilege pose an insurmountable barrier. Certainly, the prosecution cannot comment on a defendant's decision to exercise a constitutional privilege,[301] and comment on a defendant's failure to produce a witness is often forbidden when the defendant stands in a privileged relationship with the witness.[302] Consequently, it might be justifiable to apply the attorney-client privilege to a defense expert's actual analysis of material that has become available because of the defendant's exercise of the right to prepare a defense with the assistance of counsel. Perhaps material that both emanates from the defendant and is still confidential would fall into this category. However, these conditions do not seem to be satisfied in

299. Thus, in *Fluellen v. Campbell*, 683 F. Supp. 186 (M.D. Tenn. 1987), defense counsel argued that the state's case was weakened by the fact that it failed to have blood tests performed, and the prosecutor remarked in rebuttal, "if he . . . thinks that is such good evidence, why didn't he request that it be done?" *Id.* at 189. The federal district court found that "this comment in no way imposed upon the jury a presumption which conflicted 'with the overriding presumption of innocence with which the law endows the accused and which extends to every element of the crime.'" *Id.* (quoting Morissette v. United States, 342 U.S. 246, 275 (1952)).

300. *See* Alan Stephens, Annotation, *Adverse Presumption or Inference Based on Party's Failure to Produce or Examine Family Members Other than Spouse—Modern Cases*, 80 A.L.R.4th 337, 344 (1990); Alan Stephens, Annotation, *Adverse Presumption or Inference Based on Party's Failure to Produce or Examine Friend—Modern Cases*, 79 A.L.R.4th 779, 785–86 (1990).

301. Most, but not all, jurisdictions also forbid comment on the invocation of a statutory or common law privilege. *See* 1 MCCORMICK, *supra* note 214, § 74.1, at 307–08.

302. *See, e.g.*, Alan Stephens, Annotation, *Adverse Presumption or Inference Based on Party's Failure to Produce or Examine Spouse–Modern Cases*, 79 A.L.R.4th 694, 701–02 (1990).

this setting. The DNA sample that the defendant suggests has been improperly analyzed might be crime-scene material that was not obtained from the defendant, or it could be a sample that the prosecution lawfully acquired from the defendant. In these situations, the attorney-client privilege should not preclude adverse comment on the defense's failure to retest.

B. Extending the Period of Statutes of Limitations

The power of DNA evidence has prompted proposals to create an exception to the statute of limitations for sexual assault when DNA profiling links the suspect to the assault.[303] Moreover, some prosecutors have attempted to avoid the tolling of the statute by filing "John Doe" arrest warrants based solely on a description of the unnamed assailant's DNA.[304] However, devising a workable "DNA exception" that would respect the interests of defendants and society in defining a point after

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303. In May 1998, for example, the Illinois Senate approved House Bill No. 2257, which provides:

> [I]f the identity of the accused is unknown and at the time of the offense physical evidence is collected that is capable of being tested for its DNA characteristics which would identify the accused, a prosecution for predatory criminal sexual assault of a child, criminal sexual assault or aggravated criminal sexual assault may be commenced at any time.

1997 H.B. 2257, 90th Gen. Assembly (Ill. 1998); *see also, e.g.*, 2000 S.B. 2347, 209th Leg., 2d Sess. (N.J. 2001) (eliminating the statute of limitations for prosecuting criminal sexual contact and endanger-ing the welfare of child "if the identity of the defendant may be determined by physical evidence capable of forensic deoxyribonucleic (DNA) testing"); Staff and Wire Reports, 77th Legislature, FT. WORTH STAR-TELEGRAM, Apr. 24, 2001, at 6, *available at* 2001 WL 5148152 (reporting the signing of legislation "that ends the statute of limitations for sexual assault if a DNA sample from the attacker is available but no one has been apprehended"); *cf.* 2001 S.B. 152, 141st Gen. Assem. (Del. 2001) (providing that "[i]n any indictment for a crime in which the identity of the accused is unknown it is sufficient to describe the accused as a person whose name is unknown but who has a particular DNA profile").

304. *See, e.g.*, Richard Willing, *Mystery Suspects Charged Through DNA*, USA TODAY, Apr. 3, 2000, at 3A, *available at* 2000 WL 5773965 (reporting that "California, New York, Oklahoma, Utah and Wisconsin have filed such DNA-based charges so far" and that "[s]imilar charges are imminent in two more states, and prosecutors say dozens more could be filed by year's end"). The first case to be commenced on the basis of such charges is pending in Sacramento. *See* Erin Hallissy & Charlie Goodyear, *Databank Match Brings Arrest on DNA Warrant*, S.F. CHRON., Oct. 25, 2000, at A3, *available at* 2000 WL 6494988; Richard Willing, *Police Expand DNA Use, Charge Man with Rape Using Only Genetic Profile*, USA TODAY, Oct. 25, 2000, at 1A, *available at* 2000 WL 5793574.

which litigation no longer can be commenced is a formidable challenge.[305]

Statutes of limitations serve a variety of purposes. Most obviously, they protect individuals against the risk that they will unable to assemble adequate evidence for a defense because too much time has passed since the alleged crime was committed. With time, memories fade, evidence is misplaced, witnesses become harder to locate, and the accused's ability to defend himself is reduced.[306] Thus, the Supreme Court has described statutes of limitations as "the primary guarantee against bringing overly stale criminal charges."[307] In addition, they give innocent (as well as guilty individuals) a certain peace of mind and encourage the police to move on to more recent cases that are more likely to be solved and for which punishment would be more effective.[308]

A DNA exception attends only to the first justification for statutes of limitations. If a comparison of the defendant's DNA with the trace evidence DNA collected many years ago were to establish conclusively that the defendant is guilty,[309] then it could be argued that any degradation in the defendant's ability to mount a defense would be harmless because it could not affect the outcome of the trial. For example, even when a defendant's alibi witness had died after the

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305. *See* Jonathan W. Diehl, Note, *Drafting a Fair DNA Exception to the Statute of Limitations in Sexual Assault Cases*, 39 JURIMETRICS J. 431 (1999). Portions of this Article's discussion of statutes of limitations are adapted, without further attribution, from this note.

306. United States v. Marion, 404 U.S. 307, 321 (1971).

307. United States v. Ewell, 383 U.S. 116, 122 (1966); *see also Marion*, 404 U.S. at 322; MODEL PENAL CODE § 1.06 cmt. 1, at 86 (1985); Tyler T. Ochoa & Andrew J. Wistrich, *The Puzzling Purposes of Statutes of Limitation*, 28 PAC. L.J. 453, 458 (1997). The Due Process Clause of the Fifth Amendment also provides protection, but only when the defendant establishes that the delay not only substantially prejudiced the defense, but also that it was a tactical ploy by the prosecutor. *See* United States v. Lovasco, 431 U.S. 783, 790 (1977); *Marion*, 404 U.S. at 324. The Speedy Trial Clause of the Sixth Amendment offers the defendant no protection against preindictment delay. *See Marion*, 404 U.S. at 313.

308. The need for specific deterrence, incapacitation, and retribution usually fades with time. *See* MODEL PENAL CODE § 1.06 cmt. 1, at 86.

309. DNA evidence does not grow stale with the passage of time. Even ancient DNA sometimes can be analyzed successfully. *See, e.g.*, ANCIENT DNA: RECOVERY AND ANALYSIS OF GENETIC MATERIAL FROM PALEONTOLOGICAL, ARCHAEOLOGICAL, MUSEUM, MEDICAL, AND FORENSIC SPECIMENS (B. Herrmann & S. Hummel eds., 1994); Richard Willing, *Fear Keeps Up as DNA Science Speeds Forward*, USA TODAY, Mar. 29, 2000, at 26A, *available at* 2000 WL 577365 (reporting a case in Britain in which a thirty-seven-year-old saliva stain on a postage stamp helped exonerate a man hung in 1962 for murder). However, the ability of fragments of the DNA molecule to remain intact virtually indefinitely under certain conditions is not dispositive. Indeed, if the prosecution relies on DNA profiling of a stain shortly after a fairly fresh crime-scene sample first was collected, it is not even pertinent.

statutory period, if no reasonable jury could have believed the alibi in the face of the DNA proof, the availability of the witness could not have resulted in an acquittal.

The premise that DNA evidence is dispositive, however, is not always true. First, there are cases in which a defendant might succeed in raising a reasonable doubt about the reported results of the DNA tests. This situation would arise, for instance, when there is reason to think that samples were switched or cross-contaminated in the laboratory or in the collecting and handling of the trace evidence before it reached the laboratory. Many years later, the police officers and laboratory personnel involved could be impossible to locate, and the written records remaining might be inadequate to resolve these claims.

Second, even if one were to conclude that such cases are too rare to be an obstacle to creating an exception to the statute, DNA evidence can be conclusive only as to one factual issue—whether the DNA in the trace evidence somehow originated from the defendant. Without more, proof of that factual issue ordinarily falls far short of demonstrating guilt for every type of sexual assault. Thus, a defendant's semen might be present on an alleged victim's clothing or a bedsheet even if there had been no penetration, and it would be expected to be found in a vaginal swab if the sex had been consensual.[310]

The legislature might try to respond to these concerns by confining the DNA exception to cases in which identity is the only issue that needs to be resolved.[311] But which cases are these? Can a defendant avoid the extension of the period of limitations by conceding his identity as the source of the trace evidence but alleging that he reasonably believed that the woman invited his actions, that he was acting under duress, or the like? Should the court be required to find that these defenses have no basis in fact for the prosecution to proceed after the statute has run? It might be possible to draft a suitably sensitive DNA exception to the

310. For reports of successful consent defenses in sexual assault cases involving DNA evidence, see *Smith v. State*, 734 N.E.2d 706, 708 (Ind. Ct. App. 2000) (observing that the defendant who had advanced a consent defense at a previous trial for rape had been acquitted despite the DNA evidence against him in that case); Dean Wise, *Jury Acquits Man of Rape*, YORK DAILY REC., Oct. 25, 2000, at C04, *available at* 2000 WL 27979596 (reporting that although the state of Maryland established that "the chances of the semen having come from a [randomly selected] man other than Vinson within the African-American population was one in 2.3 quadrillion," and although the defendant denied the allegation of intercourse, he had had a previous intimate relationship with the alleged victim for eighteen months).

311. The requirement in some bills that "the identity of the accused [be] unknown" points in this direction. *See supra* note 303.

statute of limitations, but the task is not so simple as, initially, it might appear to be.

In contrast, the situation is much simpler when a defendant brings forward DNA evidence in a case involving a single rapist that shows that the DNA in the trace evidence is not his. If that evidence is believed, then he is not the guilty party. But while DNA evidence can be conclusive of innocence, DNA evidence is not logically sufficient to prove guilt. Because identity is not the only element of the offense and because there are affirmative defenses that can be pled, even when the state brings forward incontestable DNA evidence of identity, the defendant might not be guilty of sexual assault. Consequently, it would be consistent to advocate an extension of the period in which post-conviction relief can be sought[312] while opposing an extension of the statute of limitations.

CONCLUSION

This Article has canvassed a wide variety of issues. Some are constitutional in nature, others are statutory, and still others arise at common law. The character of the issues ranges from substantive criminal law to procedure to evidence. While the issues are diverse, they share two related common denominators. One is their relative novelty, and the other is the consequent paucity of case law analyzing the issues. In the past decade, a dizzying array of DNA technologies—from gel electrophoreses of single-locus RFLPs, to PCR-based studies of STRs, to mitochondrial DNA sequencing—has materialized in American court-rooms. The predictable result has been a proliferation of evidentiary issues. Yet, several important questions have received little in the way of careful consideration. This Article has identified and ventured answers to these questions. As stated at the outset, despite their novelty, some of these issues admit of relatively clear answers. In other cases, though, their resolution will demand a sophisticated balancing of competing public policy considerations. If the criminal justice system is to realize the full potential of DNA technology while maintaining its essential fairness, the system must come to grips with these issues in short order.

312. For recommended procedures of handling requests for DNA testing after conviction, see NATIONAL COMMISSION ON THE FUTURE OF DNA EVIDENCE, REPORT AND RECOMMENDATIONS POSTCONVICTION RELIEF (1999).