THE DEMOGRAPHICS OF GENETIC SURVEILLANCE: FAMILIAL DNA TESTING AND THE HISPANIC COMMUNITY

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For years, law enforcement personnel have compared DNA found at crime scenes with that of a convicted offender. Recently, a new technique has begun to focus on the genetic similarity of biological relatives. Now, if a crime scene sample partially matches the DNA profile of a previous offender, law enforcement can investigate and possibly arrest that person's family members. This process is called familial DNA testing and will significantly increase the amount of genetic information contained in the FBI's Combined DNA Index System (CODIS), which consolidates local, state, and federal DNA databanks into a uniform body of data.

This Note argues that familial DNA testing will disproportionately affect the Hispanic community. Familial testing, which uses biological relatedness as the trigger for criminal investigation and DNA extraction, ensures that groups with more children and large families relative to other groups will be at higher risk for genetic surveillance. This is especially true given the dynamics of the CODIS search process, which creates a cumulative, generational effect that is likely to replicate previous search outcomes. As a result, demographic trends ensure that innocent members of the Hispanic community will disproportionately experience privacy invasions as a result of familial testing.

The Note then examines likely constitutional challenges to familial testing under the Fourteenth and Fourth Amendments, concluding that a Fourth Amendment probable cause argument provides the best hope of redress.

Introduction

The use of DNA databanks for law enforcement purposes is nothing new. Law enforcement has a long history of using DNA databanks interlinked through the FBI's Combined DNA Index System (CODIS)[1] to compare the genetic identities of convicted offenders with DNA profiles left at crime scenes.[2] Recently, those calling for expanded use of DNA evidence have focused on the close genetic similarity of biological rela-

1. Henry T. Greely et al., Family Ties: The Use of DNA Offender Databases to Catch Offenders' Kin, 34 J.L. Med. & Ethics 248, 250–51 (2006) (discussing use of CODIS in managing and comparing DNA profiles).

2. A "match" between a crime scene sample and the genetic profile of a convicted offender in the databank system traditionally occurs when twenty-six gene variations, or alleles, match at specified loci along the chromosome. See, e.g., John M. Butler, Forensic DNA Typing 93 (2001). Comparisons of this nature have proven useful in identifying and arresting serial offenders across state lines by consolidating data from multiple databanks into coherent, searchable indices accessible by all fifty states and the federal government. See, e.g., Andrew Watson, A New Breed of High-Tech Detectives, 289 Science 850, 851 (2000).

tives.[3] Research by professors at Harvard and the University of California at Berkeley suggests that the genetic similarity of close relatives might be useful for law enforcement, as a partial match between DNA collected from a crime scene and the DNA of a convicted offender may reveal the relative of the convict as a possible suspect.[4] Rather than matching a background profile at twenty-six alleles, a partial match occurs when only thirteen alleles are common.[5] When a partial match occurs, law enforcement personnel can then locate the convicted offender's relatives and collect or extract their DNA samples for comparison with the crime scene sample. Thus far, at least one successful use of familial DNA testing has occurred in the United States.[6]

While familial testing potentially affects the privacy rights of every person whose relative is a suspect, perhaps an even greater concern is that these threats to privacy will not be distributed equally throughout the population.[7] The databank system, representing the convergence of DNA profiles collected over the course of many years, is not racially neutral.[8] Instead, years of disproportionately high arrest and conviction rates have created a data field in which African Americans are overrepresented.[9] While troubling, a related concern that has yet to receive sufficient attention is the degree to which demographics, which also drive databank system configurations, may produce similarly disproportionate outcomes for the Hispanic community.[10] As the demographic group with the highest rate of natural population growth, each profile input from a

3. Margaret A. Berger, Expert Testimony in Criminal Proceedings: Questions *Daubert* Does Not Answer, 33 Seton Hall L. Rev. 1125, 1136 (2003) ("[C]lose relatives, especially full siblings, have more genes in common than non-relatives and may match at the loci being sampled. . . . [N]othing can alter the reality that maternal relatives share the same mtDNA profile."); see also Office of Justice Programs, U.S. Dep't of Justice, Identifying Victims Using DNA: A Guide for Families 4 (2005), available at http://www.ncjrs.gov/pdf files1/nij/209493.pdf (on file with the *Columbia Law Review*) [hereinafter DOJ, Identifying Victims] (noting that "[t]he ability to match victims to their relatives depends on how closely related they are to the victim" and explaining that "[t]he most useful DNA samples are from close blood relatives . . . because DNA of close relatives is more similar than the DNA of more distant relatives"); Frederick R. Bieber et al., Finding Criminals Through DNA of Their Relatives, 312 Science 1315, 1315 (2006) ("Although all individuals have some genetic similarity, close relatives have very similar DNA profiles because of shared ancestry.").

4. See Bieber et al., supra note 3, at 1315 ("[Data] demonstrate that kinship analysis would be valuable now for detecting potential suspects who are the parents, children, or siblings of those whose profiles are in forensic databases.").

5. See, e.g., Watson, supra note 2, at 851.

6. A rapist and murderer was convicted twenty years after the crimes were committed when a partial allele match occurred between a databank profile and his brother's DNA. Greely et al., supra note 1, at 249.

7. See discussion infra Part II.

8. See Greely et al., supra note 1, at 258.

9. Id.

10. This Note relies on the definition of "Hispanic" provided by the U.S. Census Bureau, which provides that a person of Hispanic origin may be of any race. U.S. Census Bureau, U.S. Dep't of Commerce, Guidance on the Presentation and Comparison of Race

Hispanic defendant is likely, on average, to lead investigators relying on familial testing to a higher number of genetic relatives than if the profile had been obtained from a non-Hispanic person.[11]

Disproportionate distribution of privacy violations is nearly inevitable in such a system. The Hispanic community, like the African American community, is subject to disproportionate arrest and conviction rates,[12] such that familial DNA testing will have an especially significant impact on Hispanic people. Under familial testing, Hispanics will be more likely than other demographic groups to be added to the databank system, more likely to partially match a sample once it is added to the database, and, therefore, will be more likely to be targeted by law enforcement for DNA sample collection. Nonetheless, familial DNA testing will likely survive a constitutional challenge under the Equal Protection Clause, but is likely to be rejected under the probable cause requirement of the Fourth Amendment.

This Note examines familial DNA databank searches as they relate to the genetic privacy of U.S. residents. Part I discusses the development of the national CODIS databank system and how the search process functions. Part II argues that familial DNA testing will exploit demographic trends affecting the Hispanic community to create dire implications for privacy. Part III evaluates two constitutional arguments that are likely to be brought against familial DNA testing, concluding that the most effective challenge to such testing most likely rests in the Fourth Amendment doctrine of probable cause.

I. The New Genetic Surveillance

This Part traces the development of DNA databanks and familial testing as they have changed and grown over time. Part I.A examines the CODIS DNA databank system as an expanding network that compiles increasing numbers of genetic profiles from the states. Part I.B briefly discusses the mechanics of forensic DNA testing and the use of databanks to find commonality among genetic samples. Part I.C focuses on the threat

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and Hispanic Origin Data (2003), available at http://www.census.gov/population/www/socdemo/compraceho.html (on file with the *Columbia Law Review*).

11. See discussion infra Part II.

12. See Bureau of Justice Statistics, U.S. Dep't of Justice, Criminal Offender Statistics, at http://www.ojp.usdoj.gov/bjs/crimoff.htm#lifetime (last revised Sept. 6, 2006) (on file with the *Columbia Law Review*) (indicating that lifetime chance of going to prison is 18.6% for African Americans, 10% for Hispanics, and 3.4% for whites as of 2005). Based on current rates of first incarceration, it is predicted that 32% of African American males, 17% of Hispanic males, and 5.9% of white males will enter state or federal prison during their lifetime. Id.; see also Bureau of Justice Statistics, U.S. Dep't of Justice, Prison Statistics, at http://www.ojp.usdoj.gov/bjs/prisons.htm (last revised Jan. 21, 2007) (on file with the *Columbia Law Review*) (indicating that by the end of 2004, 3,145 African American males were sentenced to prison per 100,000 African American males in the United States, as compared to 1,244 Hispanic males per 100,000 Hispanic males and 471 white males per 100,000 white males).

that familial DNA testing will actively create suspects by exposing previously anonymous groups of biologically related individuals to surveillance.

A. *The CODIS DNA Databank System*

In 1989, Virginia became the first state to develop a DNA databank for retaining the genetic material of convicted felons.[13] As of 1998, all states had followed Virginia's lead by creating their own DNA databank systems, with different requirements for when a profile must be added.[14] DNA databanks were originally established to monitor serial, violent felons.[15] Since then, several states have expanded the reach of their DNA databanks, with some requiring DNA samples to be added from those persons convicted of nonviolent felonies, while other states take samples from arrestees who have not been convicted of any crime.[16]

Today, the interlinked nature of state and federal DNA databanks permits comprehensive searching of DNA collections without regard to geographic boundaries. Each state is free to define the parameters of its own databank composition, but once information is contained in a state database it becomes accessible to other states as well as to the federal government.[17] Of central importance to this integration is

13. Jacqueline K.S. Lew, Note, The Next Step in DNA Databank Expansion? The Constitutionality of DNA Sampling Former Arrestees, 57 Hastings L.J. 199, 205–06 (2005).

14. See, e.g., Jill C. Schaefer, Comment, Profiling at the Cellular Level: The Future of the New York State DNA Databanks, 14 Alb. L.J. Sci. & Tech. 559, 581–82 (2004) (arguing that different requirements for profile inclusion in state databanks may lead to injustice when profiles are combined at federal level, if, for example, state that only requires profiles of felons to be registered searches for nonfelons in federal system); Robin Cheryl Miller, Annotation, Validity, Construction, and Operation of State DNA Database Statutes, 76 A.L.R.5th 239 (2000) (discussing state DNA databank laws).

15. See, e.g., State v. Olivas, 856 P.2d 1076, 1090 (Wash. 1993) (Utter, J., concurring) ("[N]onconsensual DNA testing of convicted sex and violent offenders is clearly related to the normal need for law enforcement."); see also Bob Barr, A Tyrant's Toolbox: Technology and Privacy in America, 26 J. Legis. 71, 79 (2000) (explaining that DNA databases "are powerful tools for catching repeat offenders"); Jean Peters-Baker, Challenging Traditional Notions of Managing Sex Offenders: Prognosis Is Lifetime Management, 66 UMKC L. Rev. 629, 665 (1998) ("The creation of DNA databanks is [intended] to provide additional protections to the community from serious repeat offenders, such as the sexual predator released on probation or parole.").

16. See Tania Simoncelli & Barry Steinhardt, California's Proposition 69: A Dangerous Precedent for Criminal DNA Databases, 34 J.L. Med. & Ethics 199, 202 (2006). The two states authorizing DNA profiling from arrest are Virginia (samples are taken for any violent felony arrest) and Texas (samples are taken for some violent felonies). Id.

17. As Sarah V. Hart, Director of the U.S. Department of Justice National Institute of Justice explains,

> State laws determine which offenses require a DNA sample to be taken from convicted offenders. Those laws differ as to which offenses require offenders to provide a sample and as to whether the requirement to provide a sample applies equally to persons already convicted of an offense or only to newly-convicted offenders.

CODIS,[18] which began as a pilot program in 1990 and was formally authorized in 1994 with the passage of the DNA Identification Act.[19] CODIS has been operational since 1998.[20]

The FBI markets CODIS as a "distributed database" linking information from local, state, and national databases into a coherent whole.[21] CODIS software consolidates information collected by the Local DNA Index System (LDIS) on the microlevel, the State DNA Index System (SDIS) operated by the governments of the fifty states, and the National DNA Index System (NDIS), which compiles DNA samples from individual SDIS labs.[22] As the "automated DNA information processing and telecommunications system that supports NDIS," CODIS is the backbone of the national databank system.[23] By 2004, all fifty states had linked their individual databanks to CODIS.[24]

CODIS software permits crime scene DNA samples recovered by state and local law enforcement to be checked against the NDIS index.[25] Data from the local, state, and national levels "form a system of interconnected 'libraries' against which samples of unknown origin are compared."[26] As of March 2007, NDIS contained 4,138,015 DNA samples.[27]

As promised in 2000, "[t]he FBI Laboratory is committed to building an infrastructure throughout the U.S. to support the CODIS program

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Justice for Sexual Assault Victims: Using DNA Evidence to Combat Crime: Hearing Before the Subcomm. on Crime and Drugs of the S. Comm. on the Judiciary, 107th Cong. (2002) (statement of Sarah V. Hart, Director, National Institute of Justice), available at http://www.ojp.usdoj.gov/nij/speeches/dnatest.htm (on file with the *Columbia Law Review*).

18. Fed. Bureau of Investigation, CODIS: Mission Statement & Background, at http://www.fbi.gov/hq/lab/codis/program.htm (last visited Mar. 1, 2007) (on file with the *Columbia Law Review*) [hereinafter FBI, CODIS Background].

19. Pub. L. No. 103-322, 108 Stat. 2065 (1994) (codified as amended in scattered sections of 42 U.S.C.).

20. FBI, CODIS Background, supra note 18.

21. Fed. Bureau of Investigation, U.S. Dep't of Justice, The FBI's Combined DNA Index System Program: CODIS 2 (2000), available at http://www.fbi.gov/hq/lab/codis/brochure.pdf (on file with the *Columbia Law Review*) [hereinafter FBI, CODIS Brochure].

22. See Nat'l Inst. of Justice, U.S. Dep't of Justice, Using DNA to Solve Cold Cases 10 (2002), available at http://www.ncjrs.gov/pdffiles1/nij/194197.pdf (on file with the *Columbia Law Review*).

23. Fed. Bureau of Investigation, Federal Bureau of Investigation Privacy Impact Assessment: National DNA Index System (DNS) (Feb. 24, 2004), at http://foia.fbi.gov/ndispia.htm (on file with the *Columbia Law Review*) [hereinafter FBI, National DNA Index System].

24. Tania Simoncelli & Helen Wallace, Expanding Databases, Declining Liberties, 19 GeneWatch 2 (2006), available at http://www.gene-watch.org/genewatch/articles/19-1TSHW.html (on file with the *Columbia Law Review*).

25. Id.

26. Randall S. Murch, Forensic Perspective on Bioterrorism and the Proliferation of Bioweapons, *in* Firepower in the Lab: Automation in the Fight Against Infectious Diseases and Bioterrorism 203, 211 (Scott P. Layne et al. eds., 2001).

27. This figure is composed of 160,582 Forensic Profiles and 3,977,433 Convicted Offender Profiles. CODIS: Statistical Map, at http://www.fbi.gov/hq/lab/codis/clickmap.htm (last visited Mar. 1, 2007) (on file with the *Columbia Law Review*).

and will continue to work with State and local forensic laboratories to achieve the full potential of this investigative tool."[28] State and local DNA labs now share information vertically with the FBI as well as horizontally among themselves, thereby consolidating otherwise segregated bodies of data into a coherent infrastructure that is most appropriately labeled a "system."[29] Few hurdles impede the speed of a search—it now takes only 500 microseconds to search 100,000 DNA profiles.[30] As will be seen, privacy concerns are inherent in a system "in which databases can be 'mined' in a millisecond using super-fast computers, in which extensive information can, or potentially could, be gleaned from DNA."[31]

B. *The Databank Search Process*

Databank searches of DNA profiles collected from crime scenes seek common strings of alleles existing at loci on the human chromosome.[32] Most DNA databanks compare short-tandem repeat (STR) sequences to determine if two DNA samples are likely to originate from the same source.[33] STR testing operates by comparing different permutations of the four base nucleotides, A (adenine), T (thymine), G (guanine), and C (cytosine).[34] Differences among DNA profiles are detected when permutations of these four bases are distinct.[35] STR analysis examines multiple loci and counts the repeated base sequence units, which vary by individual and are revealed through the polymerase chain reaction (PCR) method,[36] which produces millions of copies of STR loci to reveal the

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28. FBI, CODIS Brochure, supra note 21, at 4.

29. See, e.g., Jason Tarricone, Note, "An Ordinary Citizen Just Like Everyone Else": The Indefinite Retention of Former Offenders' DNA, 2 Stan. J. C.R. & C.L. 209, 216 (2005) (describing three level system). As Michelle Hibbert explains, "This national DNA database will allow law enforcement officers to search all state databases simultaneously instead of searching fifty separate DNA databases." Michelle Hibbert, DNA Databanks: Law Enforcement's Greatest Surveillance Tool?, 34 Wake Forest L. Rev. 767, 772 (1999). The search process for samples within the system is streamlined, such that a state databank can be "automatically searched" if doing so will assist any criminal investigation. Id. at 779.

30. Troy Duster, Explaining Differential Trust of DNA Forensic Technology: Grounded Assessment or Inexplicable Paranoia?, 34 J.L. Med. & Ethics 293, 298 (2006).

31. United States v. Kincade, 379 F.3d 813, 842 (9th Cir. 2004) (Gould, J., concurring); see also discussion infra Part II.

32. See Tarricone, supra note 29, at 214–15 (describing how DNA testing uses allele comparisons to identify matches); see also Amade M'Charek, The Human Genome Diversity Project: An Ethnography of Scientific Practice 80 n.38 (2005) (describing alleles).

33. David R. Paoletti et al., Assessing the Implications for Close Relatives in the Event of Similar but Nonmatching DNA Profiles, 46 Jurimetrics J. 161, 161–62 (2006).

34. Nat'l Inst. of Justice, U.S. Dep't of Justice, The Future of Forensic DNA Testing: Predictions of the Research and Development Working Group 10 (2000), available at http://www.ncjrs.gov/pdffiles1/nij/183697.pdf (on file with the *Columbia Law Review*).

35. Id.

36. PCR "works as a kind of biological copying machine" by amplifying even a tiny sample millions of times until there is sufficient material for testing. Gina Smith, The Genomics Age: How DNA Technology Is Transforming the Way We Live and Who We Are

number of each repeat.[37] As between two DNA samples, a complete match would occur when the alleles at all twenty-six loci are common. A "partial match" under CODIS standards exists where thirteen of twenty-six alleles are common at the thirteen "core" CODIS loci.[38]

However, these advanced testing methods are not nearly as accurate as is often believed. Michelle Hibbert notes that laboratory error rates for DNA sample comparison are between 1% and 5%, in stark contrast to the claim that DNA testing is accurate at the level of one part to 100 million.[39] Hibbert cites another study indicating that jurors are often swayed by misleading accounts of the accuracy of DNA testing, obscuring the reality that "'the risk of false positive laboratory errors is several orders of magnitude larger'" than typically believed.[40] Additional errors at the profile input stage risk causing situations where innocent persons are erroneously matched to index samples.[41] All of these inaccuracies are likely to be amplified given the federal government's efforts to speed up state DNA sample collecting and analysis.[42] As the collection of DNA

76 (2004). PCR can now produce effective comparisons "from a mere 600 cells containing about a nanogram of DNA; a speck of blood just 2 square millimeters in size will do nicely." Watson, supra note 2, at 851. A newer form of analysis, mitochondrial testing (mtDNA), can test even smaller samples, but has not yet been frequently utilized by CODIS laboratories. See, e.g., Frederika A. Kaestle et al., Database Limitations on the Evidentiary Value of Forensic Mitochondrial DNA Evidence, 43 Am. Crim. L. Rev. 53, 57–58 (2006) (explaining that nuclear DNA has been "identified by the FBI as particularly suitable for forensic testing and used by the FBI to generate the profiles contained in the Combined DNA Index System (CODIS)," while mtDNA testing looks for differences between "Hypervariable Region 1" and "Hypervariable Region 2" within mtDNA).

37. See Charles I. Lugosi, Punishing the Factually Innocent: DNA, Habeas Corpus and Justice, 12 Geo. Mason U. Civ. Rts. L.J., 233, 246–47 (2002) (explaining how PCR produces millions of copies of DNA sequence for examination).

38. The thirteen alleles used in finding a partial match with CODIS are FGA, vWA, D3S1358, CSF1PO, TPOX, THO1, D18S51, D21S11, D8S1179, D7S820, D13S317, D5S818, D16S539. Nat'l Inst. of Justice, U.S. Dep't of Justice, Solicitation for CODIS STR Analysis of States' Collected Convicted Offender DNA Samples app. E (2000), available at http://www.ncjrs.gov/pdffiles1/nij/sl413apcde.pdf (on file with the *Columbia Law Review*) [hereinafter Nat'l Inst. of Justice, Solicitation].

39. Hibbert, supra note 29, at 803–04.

40. Id. at 805 (quoting Jonathan J. Koehler et al., The Random Match Probability in DNA Evidence: Irrelevant and Prejudicial?, 35 Jurimetrics J. 201, 216 (1995)).

41. Id. at 806.

42. Governmental pressure for quick and constant expansion of the databank system is unlikely to carry favorable implications for test accuracy. See Samuel Lindsey et al., Communicating Statistical DNA Evidence, 43 Jurimetrics J. 147, 149–50 (2003). A year 2000 CODIS brochure has no qualms about making system expansion an explicit goal, stating, "[t]he FBI hopes that eventually, all 50 states will include all felony offenses" as triggering offenses for DNA sampling. FBI, CODIS Brochure, supra note 21, at 3. In the same year, the Commission on the Future of DNA Evidence issued a solicitation to state laboratories urging them to conduct STR testing on DNA samples that had been collected but had not been analyzed with STR technology as of March 31, 2000. Nat'l Inst. of Justice, Solicitation, supra note 38, at 1. The possibility of federal funding offered an incentive for the states to reduce testing backlog, "so that the resulting DNA profiles [could] be entered into State and national DNA databases as expeditiously as possible." Id. While backlog

input triggers[43] expands, higher search error rates may follow.

While all DNA profile tests are games of probability[44] rather than infallible barometers of identity, partial allele searches are especially problematic because they amplify the probabilistic element of a match. Relaxing the stringency of allele matching introduces a heightened degree of uncertainty into the process by expanding the number of potential matches and requiring less commonality between profiles.[45] Unlike traditional testing, which compares crime scene samples to known, singular defendants,[46] familial testing stretches match probabilities to cast the net of genetic surveillance over entire families. The problem is determining when a partial match is strong enough to justify investigating the relatives of a convicted offender. Familial searching is insufficiently accurate in this area, as "the requisite threshold of similarity [between DNA samples] tends to be ambiguously defined and described in terms such as matches needing to 'be very, very close' (Virginia), 'appear useful' (California), or be at 21 or more out of 26 alleles (Florida)."[47]

As input triggers[48] expand, system data sets will continue to grow. Higher search error rates can be expected to follow, as larger background indices multiply the risk of false matches as well as of human error at the input or analysis stage.[49] This increased risk of error is in addition to possible inaccuracies associated with the lower allele commonality requirement for partial as opposed to complete matches.[50]

C. *Familial Testing as a Threat to Privacy*

1. *Forensic Detargeting.* — While traditional DNA searches remain important to law enforcement, the emerging process of familial testing

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remains, the FBI's goal of expanding the CODIS system has been realized, as thirty-four states now collect DNA samples from all felons, twenty-eight collect from juvenile offenders, thirty-eight collect from persons with misdemeanor convictions, and at least two collect from individuals who have been arrested for certain offenses. Simoncelli & Steinhardt, supra note 16, at 202.

43. A similar term, "trigger mechanism," which refers to conduct resulting in inclusion in a DNA databank, was coined by Paul E. Tracy & Vincent Morgan, Big Brother and His Science Kit: DNA Databases for 21st Century Crime Control?, 90 J. Crim. L. & Criminology 635, 669 (2000).

44. Hibbert, supra note 29, at 805 (citing Jonathan J. Koehier et al., The Random Match Probability in DNA Evidence: Irrelevant and Prejudicial?, 35 Jurimetrics J. 201, 216 (1995)) (showing that series of error rates make any DNA profile test somewhat random).

45. CODIS only requires thirteen alleles to be common to identify a partial match through familial testing, as compared to twenty-six common alleles needed for a direct match. Watson, supra note 2, at 851.

46. See, e.g., Roberto Iraola, The DNA Analysis Backlog Elimination Act of 2000, 40 Crim. L. Bull. 369, 370 (2004) (noting that DNA testing was originally used to find matches "between a convicted offender on file in the system and evidence at the scene of a crime").

47. Paoletti et al., supra note 33, at 163 (citing Richard Willing, Suspects Get Snared by a Relative's DNA, USA Today, June 8, 2005, at 1A).

48. See supra note 43 and accompanying text.

49. See supra note 42.

50. See supra note 45.

raises unique constitutional and policy concerns. Previously, when a crime scene DNA sample failed to match confidently with a background sample contained in a databank, it was generally a dead end for law enforcement.[51] Familial searching uproots this simplicity by permitting investigation and sample collection for what would be considered a nonmatch in traditional terms, extending surveillance to previously exempt persons. An accurate term may be forensic "detargeting," as familial testing replaces the traditional targeting of a singular, known defendant[52] by widening the net to a class of biological relatives,[53] many of whom are likely to be innocent of the crime.[54] Inherent in this expansion from the known individual to the previously unknown group is a shift from merely identifying a suspect to actively creating groups of suspects. It can now be accurately stated that "[c]omputerized searching [through CODIS] converts crime laboratories into investigatory agencies,"[55] as neutral comparison analysis of DNA profiles is morphing into an active search for identities.

2. *Specific Privacy Consequences of Familial Testing.* — Two broad consequences for genetic privacy arise from the use of familial genetic testing. The first consequence is that familial testing, in order to identify the one suspect who was actually present at a crime scene, requires the collection of DNA samples from all of a felon's relatives. Such collection potentially violates the privacy of innocent persons[56] and may subject them to undue harassment, surveillance,[57] and DNA sample collection. The defining characteristic of the sample collection consequence is that it is short term

51. See, e.g., Mark A. Rothstein & Meghan K. Talbott, The Expanding Use of DNA in Law Enforcement: What Role for Privacy?, 34 J.L. Med. & Ethics 153, 153 (2006) (noting that familial testing is new, "second-generation" application of DNA databanks situated within context of "a new stage of DNA forensics"). Previous search regiments looked for a match between known convicted offenders and background indices, such that a nonmatch, rather than a partial match implicating genetic relatives, was the search outcome.

52. See supra note 46.

53. See generally Frederick R. Bieber, Turning Base Hits into Earned Runs: Improving the Effectiveness of Forensic DNA Data Bank Programs, 34 J.L. Med. & Ethics 222, 223–24 (2006).

54. While data are not available on this point, it seems unlikely that many cases will exist where entire groups of biological relatives end up being guilty parties.

55. Victor W. Weedn, DNA Analysis, *in* Forensic Science and Law: Investigative Applications in Criminal, Civil, and Family Justice 418, 427 (Cyril H. Wecht & John T. Rago eds., 2006).

56. Sample collection can be forcible or passive. Forcible extraction is an obvious concern, as it requires physical invasion of a suspect's body. Elizabeth E. Joh, Reclaiming "Abandoned" DNA: The Fourth Amendment and Genetic Privacy, 100 Nw. U. L. Rev. 857, 864 (2006). Passive collection involves following a convict's relative until he or she "abandons" genetic material, and, while lacking a physical intrusion, remains troubling from a surveillance perspective, as it entails monitoring by law enforcement. Duster, supra note 30, at 297.

57. See Duster, supra note 30, at 297 (explaining that once person becomes suspect, "the police can literally follow that person around and collect samples of their 'abandoned' DNA").

in nature because it can operate independently of permanent profile retention by the databank system. The privacy violations occur during DNA collection or extraction, which infringe on an innocent person's autonomy but do not, in and of themselves, expand system data sets.[58] As such, sample collection may be accurately characterized as a short-term, targeted privacy invasion based on genetic similarity to a previously convicted person.

The second privacy consequence involves the actual retention of DNA samples taken from innocent family members and the input of these genetic profiles into the databank system. If the indefinite retention of DNA profiles is problematic from an informational privacy standpoint, then the retention of the underlying biological sample should be especially worrisome. DNA samples, while supposedly limited to noncoding ("junk") strands that cannot reveal private medical information,[59] may nonetheless be more effectively utilized in the future.[60] Failure to destroy a sample after profile extraction leaves open the possibility of harvesting additional information from the sample at a future time.[61] The risk of additional information extraction remains so long as genetic material is retained and profiles are "permanently placed on file in federal cyberspace."[62]

While samples extracted for CODIS are noncoding STRs (microsatellites) not believed to contain medically significant information, it remains uncertain whether science will eventually uncover further uses for this genetic material.[63] In explaining that noncoding DNA effects cellular

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58. For a discussion of how DNA databanks can infringe on privacy rights and "bodily integrity," see Jonathan Kimmelman, Risking Ethical Insolvency: A Survey of Trends in Criminal DNA Databanking, 28 J.L. Med. & Ethics 209, 209 (2000).

59. See, e.g., Amitai Etzioni, A Communitarian Approach: A Viewpoint on the Study of the Legal, Ethical and Policy Considerations Raised by DNA Tests and Databases, 34 J.L. Med. & Ethics 214, 217 (2006) ("[P]roponents of DNA databases argue that the DNA profiles kept and stored by law enforcement—the thirteen STR loci—do not provide any meaningful information about individuals, aside from allowing us to determine whether two samples have come from the same person.").

60. Dissenting in *United States v. Kincade*, Judge Reinhardt argued:

> The startling advance of technology has magnified the power of the initial search authorized by the DNA Act, such that the invasion of privacy is vastly more significant that [sic] we might have previously assumed. Here, the DNA placed in the CODIS database contains sensitive information, and no one can say today what future uses will be made of it once it is entered into governmental files; certainly, today's restrictions provide no guarantees regarding future governmental uses.

379 F.3d 813, 867 (9th Cir. 2004) (Reinhardt, J., dissenting).

61. See, e.g., Bieber, supra note 53, at 223–24. Bieber notes that sample retention leaves open the possibility of future testing of genetic material, even though most statutes do not currently permit this. Id.

62. *Kincade*, 379 F.3d at 843 (Reinhardt, J., dissenting).

63. See, e.g., Steven C. Henricks, A Fourth Amendment Privacy Analysis of the Department of Defense's DNA Repository for the Identification of Human Remains: The Law of Fingerprints Can Show Us the Way, 181 Mil. L. Rev. 69, 77 (2004) (suggesting that

protein syntheses in unknown ways, Steven C. Henricks argues that the potential for future information discovery creates a privacy interest as compelling as the need to protect code producing DNA.[64] Likewise, it has been argued that as bioinformatics technologies continue to advance, noncoding microsatellites may be used to reveal information ranging from health status to racial identity.[65]

The system architects who engineered DNA databanks created an infrastructure designed for the isolated purpose of retaining data on convicted felons.[66] Departure from this original purpose has been triangular in form, as a once narrow intent has steadily broadened outward from the pinpoint goal of tracking violent, previously convicted felons.[67] System expansion has been fueled by an increasingly pronounced one-way current of data flow—information frequently enters the system, and very infrequently leaves. At its core, this reluctance to destroy samples once profiles are entered may be a symptom of the expansionist mentality, supported by the perception that "[the databank system's] utility theoretically increases proportionally as the amount of data contained in it expands."[68]

Increased information retention was prefigured by the nature of the system, which serves as a data collection network optimistically conceived for the unrealistically compressed purpose of comparing crime scene DNA profiles to those of previously convicted offenders.[69] This narrow purpose has been expanded by surveillance creep, which exploits the creation of a stable foundation to ease the manner by which system machinery can branch out into new, broader areas that may transcend the origi-

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technological advances may enable extraction of significant information from noncoding STRs).

64. Id.

65. R.E. Gaensslen, Should Biological Evidence or DNA Be Retained by Forensic Science Laboratories After Profiling? No, Except Under Narrow Legislatively-Stipulated Conditions, 34 J.L. Med. & Ethics 375, 376 (2006).

66. See, e.g., Gerald D. Robin, DNA Evidence in Court: The Odds Aren't Even, Crim. Just., Fall 2004, at 8, 57 (1994) ("DNA databank statutes are designed to enable authorities to identify and apprehend repeat offenders, solve serial crimes, investigate cases of missing persons, and deter recidivism as offenders come to realize that, even without witnesses, they cannot avoid being detected by their genetic 'smoking gun.'").

67. See Debra A. Herlica, Note, DNA Databanks: When Has a Good Thing Gone Too Far?, 52 Syracuse L. Rev. 951, 952–53 (2002) (describing possible spread of DNA collection to include, for example, minor criminals and all arrested individuals).

68. Tracy & Morgan, supra note 43, at 643. This perception has propelled the mentality that "[a] key element of utilizing CODIS fully is to make certain that as many offenders as possible are entered into the database." Barry A.J. Fisher, Techniques of Crime Scene Investigation 216 (2003). Pressure for rapid system expansion will be aided by "the low cost of looking for partial matches," which will motivate law enforcement personnel to "increasingly request information on partial matches" when complete matches are absent. Greely et al., supra note 1, at 253–54.

69. See, e.g., Robin, supra note 66, at 57 (noting that states have enacted "DNA databank statutes" designed to "deter recidivism as offenders come to realize that, even without witnesses, they cannot avoid being detected by their genetic 'smoking gun'").

nal design.[70] Further building is uncomplicated once ground has been broken, while the advent of the first databank provides kinetic force for future expansions, as seen by the progressive broadening of databank input triggers.[71] Failure to challenge expansion at each interval normalizes the process, sliding toward an outcome where "[t]he fishbowl will look like home."[72] This progressive growth increasingly threatens the privacy of the innocent.

Much apart from the course of expansion, the dynamics of the search process contain significant potential to threaten privacy. The new machine animated by partial allele searches is especially dangerous because it grows from preexisting data and, as a result, is likely to replicate the conclusions embedded in that data. The outputs created by system use will not be uniform across social groups, as existing statistical realities intervene to shape how partial matches affect different segments of society. Partial allele searches are likely to produce two mutually supportive problems that exist on opposite ends of the search spectrum, both at the input and output stages.

II. The Effects of Demographic Trends on Familial DNA Searches: Implications for the Hispanic Community

This Part discusses the unique issues facing the Hispanic community as a result of familial DNA testing. Part II.A examines privacy risks constructed by the use and interpretation of genetic information at databank input and output stages. It then explains the potential for demographics to modify and steer databank search outcomes. Part II.B focuses on the particular demographic trends affecting the Hispanic community. Part II.C.1 applies the demographic information from Part II.B to databank searches through two equations, and Part II.C.2 interprets the results of the equations, demonstrating that familial DNA testing is uniquely destructive to the privacy of the Hispanic community.

A. *Processing Genetic Information at Databank Input and Output Stages*

An immense body of evidence revealing racial disproportionality within criminal arrest and conviction rates has been established over the years.[73] In general, African Americans are arrested and convicted of

70. For a general discussion of surveillance creep and the function of surveillance technology, see Gary T. Marx, Seeing Hazily (but Not Darkly) Through the Lens: Some Recent Empirical Studies of Surveillance Technologies, 30 Law & Soc. Inquiry 339, 385–87 (2005).

71. See, e.g., Simoncelli & Steinhardt, supra note 16, at 202.

72. United States v. Kincade, 379 F.3d 813, 873 (9th Cir. 2004) (Kozinski, J., dissenting).

73. The following statistics illustrate the racial disparity present in criminal arrest and conviction rates. In 2005, African Americans accounted for 48.6% of the arrestees for murder and nonnegligent manslaughter cases, as compared to whites, who composed 49.1% of arrestees. Of the persons arrested for robbery in 2005, 56.3% were African

crimes at a rate far exceeding that of other races, especially whites. Recently, an article by Henry T. Greely and others has applied evidence of racially disproportionate conviction rates to CODIS to claim that "the Offender Index is not racially neutral."[74] Instead, African Americans compose "at least forty percent" of the Index,[75] such that familial testing will render about 17% of African American citizens findable through the system as compared to only about 4% of the Caucasian population.[76] The result is that more than four times as much of the African American population as the white population is under surveillance through CODIS.[77]

What Greely and his colleagues have described can be properly classified as a data input problem, as past profile inputs have created a mass of data likely to implicate future search outcomes. An underlying influence in CODIS searches is that the production of the suspect is invariably controlled, at least in part, by the existing body of searchable DNA profiles within current indices. Sample inputs are never relegated to the proverbial dust bin. Instead, current sample inputs exist in an active interplay with the production of future suspects because each new sample subtly directs data flows toward members of the group represented by that sample.

The Hispanic community is not entirely immune from the input problem facing the African American community. While African Americans currently face more overrepresentation in DNA databanks than any

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American, as compared to the 42.2% of arrestees in such cases who were white. Forcible rape is the only violent crime for which whites were arrested significantly more often than African American defendants, with whites composing 65.1% of arrestees and African Americans composing 32.7% of arrestees in such cases. Fed. Bureau of Investigation, U.S. Dep't of Justice, Crime in the United States 2005, at tbl.43, at http://www.fbi.gov/ucr/05cius/data/table_43.html (last visited Mar. 16, 2007) (on file with the *Columbia Law Review*) [hereinafter FBI, Arrests by Race].

The significance of this data is glaringly clear when compared to approximate relative population sizes in 2005. The total U.S. population in 2005 was approximately 295,507,000 people, 38,056,000 of which were African American and 236,924,000 of which where white. U.S. Census Bureau, U.S. Dep't of Commerce, Statistical Abstract of the United States 17 tbl.15 (2006), available at http://www.census.gov/prod/2005pubs/06statab/pop.pdf (on file with the *Columbia Law Review*) (providing population by race estimates). The white population was more than six times the size of the African American population in 2005, yet whites made up only a slightly greater percentage (one-half percentage point) of arrestees for murder and nonnegligent homicide in 2005 than did African Americans. For robbery, 14.1% more African Americans than whites were arrested, despite the striking size difference between the two populations. Forcible rape appears to be the exception, with 32.4% more white arrestees than African American arrestees in 2005. However, even this statistic fails to accurately track relative population size, as 32.7% of arrestees for rape were African American, even though they composed less than 13% of the U.S. population in 2005. See FBI, Arrests by Race, supra, tbl.43.

74. Greely et al., supra note 1, at 258.

75. Id.

76. Id. at 259.

77. Id.

other group, the Hispanic population is increasingly subjected to criminal arrest and conviction at disproportionately high rates. According to the U.S. Department of Justice, the likelihood of an African American person going to a state or federal prison during his lifetime was 18.6%.[78] For Hispanics, the number was 10%, as compared to 3.4% for non-Hispanic whites.[79] More importantly, as of 2001 Hispanics were being imprisoned at a faster rate than any other group, increasing from 10.9% of all state and federal inmates in 1985 to 15.6% in 2001.[80]

The Hispanic community will be uniquely victimized by the multiplication of data outputs. The criticism that CODIS will continue to isolate African American defendants identifies a past data problem, as risks of privacy violations affecting African Americans are caused by data input and retention that began years ago. In contrast, a predictive critique that anticipates future trends in data accumulation will look down the road to study long-term demographic trends. This type of critique is necessary because familial DNA testing is inherently rooted in reproductive biology—the group of potential investigative targets reacts to population changes. For example, the search configuration for African Americans might resemble the form of A + A + A = B, as inputs built up over time steer search outputs toward a given result. For Hispanics, the system predominantly operates in the form of A = B + B + B, as demographics expand the number of outputs created by a single given input.

The risk to the Hispanic community is that the steadily increasing input problem, mirroring that which has afflicted African Americans for years, will coalesce with the output problem created by rapid population growth. If this occurs, Hispanics will be more likely than any other group to be entered into DNA databanks and will face a higher risk of being wrongfully ensnared in the criminal justice system once a relative has been entered. The relevant demographic information, examined in the next section, substantiates this threat.

B. *Specific Demographic Trends Affecting the Hispanic Community*

Current birth rate trends indicate that the Hispanic population is growing faster than any other group in the United States. A U.S. Census Bureau study of population growth between 2000 and 2004 revealed that the nonwhite Hispanic population grew by 17% during that four-year period.[81] In contrast, the African American population grew by 5% over

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78. Bureau of Justice Statistics, U.S. Dep't of Justice, Criminal Offenders Statistics, at http://www.ojp.usdoj.gov/bjs/crimoff.htm#lifetime (last modified Sept. 6, 2006) (on file with the *Columbia Law Review*).

79. Id.

80. The Sentencing Project, Hispanic Prisoners in the United States 1 (2003), available at www.sentencingproject.org/pdfs/1051.pdf (on file with the *Columbia Law Review*).

81. U.S. Census Bureau, U.S. Dep't of Commerce, Population Profile of the United States: Race and Hispanic Origin in 2005, at 2 tbl.1 (2006), available at http://www.

the same period, and the non-Hispanic white population grew by 1%, causing the overall population of non-Hispanic whites to decline from 70% to 67% of the total population.[82]

A more recent Census Bureau report found that the Hispanic community is growing much faster than other groups in the United States, with a 3.3% population increase from July 1, 2004 to July 1, 2005.[83] Hispanics accounted for 49% of total U.S. population growth for the same period, representing 1.3 million of the 2.8 million national total.[84] Of the 1.3 million person increase, 800,000 persons resulted from natural births, and 500,000 persons immigrated to the country.[85] An additional report stated that one out of every seven persons in the United States was Hispanic in 2005, a number that was anticipated to grow "because of immigration and a birth rate outstripping that of non-Hispanic blacks and whites."[86]

Statistics regarding family size are also noteworthy. Nonnuclear family arrangements have certainly reduced the predictive quality of studies focusing on traditional family units, but examining relative family sizes among groups can still provide a general picture of biological relations. While recognizing that studies of the "family" should only be applied as rough approximations of related trends, it is valuable to consider the number of children per family unit among particular groups.

A Census Bureau study of the number of children under the age of eighteen within families of particular racial and ethnic groups from 1990 to 2004 reveals several important findings. First, the Hispanic population[87] is more likely than any other group to have family units with three or more children under the age of eighteen.[88] In 1990 and 1995, 19% of Hispanic families had three or more children under the age of eigh-

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census.gov/population/pop-profile/dynamic/raceho.pdf (on file with the *Columbia Law Review*) [hereinafter U.S. Census Bureau, Population Profile]. The four-year period studied was from April 1, 2000 to July 1, 2004. Id.

82. Id.

83. Press Release, U.S. Census Bureau, Nation's Population One-Third Minority 1 (May 10, 2006), available at http://www.ime.gob.mx/investigaciones/2006/migracion/Nations%20Population%20One-Third%20Minority.pdf (on file with the *Columbia Law Review*).

84. Id.

85. "Natural" population growth is births minus deaths. Id. at 20.

86. Hispanic Minority Growing, N.Y. Times, June 9, 2005, at A20 (reporting on population statistics collected by U.S. Census Bureau).

87. In this study the Hispanic population may include any race, and is not limited to nonwhite Hispanic persons. See U.S. Census Bureau, The 2006 Statistical Abstract 5 (2006), available at http://www.census.gov/compendia/statab/2006/2006edition.html (on file with the *Columbia Law Review*) (explaining method used in census for collecting data on and classifying Hispanic respondents).

88. See id. at 55 tbl.62 (indicating that for married couple families in 2004, 1,220,000 out of 6,227,000 Hispanic families had three or more children under age of eighteen, as compared to 3,559,000 out of 44,197,000 families for whites and 480,000 out of 4,146,000 African American married couple families).

teen.[89] In 2000 and 2004 the number declined to 18%,[90] but given the high growth rate of the Hispanic population, it is likely that this minimal decline reflects differing family and household configurations rather than a declining birthrate. To compare, 9% of white families had three or more children under eighteen over the entire period.[91] In 1990 and 1995, 14% of African American families had three or more children under eighteen, which declined to 12% in 2000 before rising to 13% in 2004.[92] Hispanic families are therefore more than twice as likely as white families to have more than three children under the age of eighteen, and about 1.4 times more likely than African American families over the studied period.[93]

The data on household sizes also confirm the notion that Hispanic people often have relatively large family structures, causing them to be disproportionately affected by familial DNA testing. Like data on family size, average household sizes can be viewed as a rough proxy for the purpose of assessing comparative numbers of biological relatives among groups. Household size is a suitable proxy if it is assumed that those in households are biologically related, which will be true in many, but not all, instances. Household size data from 2004 reveals that 22.8%, or 2,671,000, Hispanic households contained five people or more.[94] In contrast, only 7.6%, or 6,150,000, non-Hispanic white households contained five or more people.[95] The number is 11.4%, or 2,193,000, for nonwhite, non-Hispanic households.[96] If household size roughly approximates the number of biological relatives among social groups, then it follows that Hispanic people, on average, have more biological relatives than non-Hispanic people. Even a comprehensive study of demographics from 2000 attempting to refute the "myth" that the Hispanic community has larger families and more children than other groups conceded the following:

> In every age group, Hispanic women have more children than White women, and in most age groups they also have more children than Black women. The total fertility rate for Hispanic women is 2,977. This figure means that if the current birth rates at every age were to continue indefinitely into the future, 1,000

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89. Id.

90. Id.

91. Id.

92. Id.

93. The number 1.40 was found by dividing the average percentage of Hispanic families with three or more children under eighteen for the entire period (18.5) by the equivalent percentage for African American families (13.25) and rounding to the nearest hundredth.

94. U.S. Census Bureau, U.S. Dep't of Commerce, Current Population Survey, Annual Social and Economic Supplement tbl.4.1 (2004), available at http://www.census.gov/population/socdemo/hispanic/ASEC2004/2004CPS_tab4.1.pdf (on file with the *Columbia Law Review*).

95. Id.

96. Id.

> Hispanic women now aged 15 years old would have given birth to 2,977 babies by the time they reached the end of their biological childbearing years. For Black women, the number is 2,427, and for White women the number is 1,984. When asked how many babies they expect to have, Hispanic women expect more babies (2,331 per thousand) than Black women (2,136 babies) or White women (2,098). Only 5.7 percent of Hispanic women expect to have no births during their lifetimes, compared with 9.3 percent of both Black and White women.[97]

The implication for familial DNA testing is clear—a partial match between a crime scene sample and an index sample from a Hispanic defendant will, on average, lead investigators to more biological relatives than if the sample had been from a person of another group.

C. *The Mathematics of Familial DNA Searches: Comparing Outcomes Among Demographic Groups*

1. *Methodology.* — Comparing the number of children under the age of eighteen in the households of various groups confirms that the invasive nature of familial DNA testing affects the Hispanic community more acutely than other communities. Data from the U.S. Census Bureau reveal that in 2003 the average number of children under the age of eighteen per family was as follows: for non-Hispanic whites, 1.84; for African Americans, 1.87; and for Hispanics, 1.93.[98] Assume that the DNA of one person in each of the three groups is run through a DNA databank system and reveals a partial allele match. The question becomes: On average, how many relatives of each group will face the risk of being subjected to temporary privacy violations or permanent surveillance through familial DNA testing?

The following method of determining the potential number of innocent persons subjected to investigation and surveillance per generation may provide an approximate answer to this question:

$X_1 = S - C;$
$X_2 = X_1 + S*A;$
$X_3 = X_2 + H_2*A;$

Where X_n represents generations of family members;
S is the number of original relatives;
C is the number of persons eventually convicted of the crime at issue for each group;
A is the average number of children under the age of eighteen for the given demographic group;

97. Hispanics in the United States: An Agenda for the Twenty-First Century 13 (Pastora San Juan Cafferty & David W. Engstrom eds., 2000) (footnotes omitted).

98. U.S. Census Bureau, U.S. Dep't of Commerce, America's Families and Living Arrangements: 2004, at tbl.AVG3, available at http://www.census.gov/population/www/socdemo/hh-fam/cps2004.html (last revised June 29, 2005) (on file with the *Columbia Law Review*).

H_n represents the number of additional potential partial allele hits attributed to a new generation, e.g., $X_2 - X_1$.

To examine how demographics will drive system expansion, assume that there are three groups of four individuals of any sex, with one group composed of non-Hispanic whites, one of African Americans, and one of Hispanics. Of those groups, assume that each of the four people will produce the number of offspring equal to the average number of children under the age of eighteen per family for his or her demographic group.[99] Let C = 1 for all groups, representing the eventual conviction of one member of each group for a hypothetical crime.

Finally, note the constant quality of A in subsequent generations. The complexity of determining the boundaries of generations, coupled with problems in correlating relative population growth to the average number of children under the age of eighteen per household, makes it difficult to calculate an adjustment factor that would change the value of A. However, if population growth trends are indicative, it is likely that the Hispanic population would have a higher adjustment for subsequent generations as compared to the other racial and ethnic groups. If anything, the calculations that follow are likely to be conservative.

For each group in generation 1, X = 4 – 1 = 3, as one group member is eventually convicted of the crime. This leaves the remaining, innocent three members as potential targets of investigation and DNA extraction. In expanding to generation 2, the number of potential law enforcement targets among the group of non-Hispanic whites is represented by:

$X_2 = (4 - 1) + 4*1.84 = 10.36.$

10.36 represents the average number of innocent persons subjected to a risk of genetic surveillance following a partial allele match for one member of a group of four non-Hispanic whites. For the group of four African Americans, the number of potential targets within two generations is:

$X_2 = (4 - 1) + 4*1.87 = 10.48.$

For the Hispanic group, two generations yield an average number of potential targets in the amount of:

$X_2 = (4 - 1) + 4*1.93 = 10.72.$

In general, a partial allele match for one person in a two-generation family containing the average number of children under the age of eighteen for the relevant demographic group is least threatening to whites, moderately threatening to African Americans, and most threatening to Hispan-

99. Also assume that all tests are conducted with nuclear DNA samples, which are derived from cell nuclei and inherited from both parents, as opposed to mitochondrial DNA, which is inherited only from the mother and passed to maternal relatives. DOJ, Identifying Victims, supra note 3, at 5–7.

ics. The number of innocent relatives who can be targeted by surveillance is relatively close across the three groups when two generations are considered. The stratification grows more rapidly in the third generation.

To add a third generation, assume that the children of the original four people in each group now have children of their own. In calculating the average number of potential targets for generation three, the white group will yield a total[100] of:

> $X_3 = 10.36 + (X_2 - X_1)*1.84 = 10.36 + (10.36 - 3)*1.84 = 23.90.$
>
> The number of targets after three generations of the African American group is represented by:
>
> $X_3 = 10.48 + (X_2 - X_1)*1.87 = 10.48 + (10.48 - 3)*1.87 = 24.47.$
>
> In the Hispanic group, three generations yield an average number of potential targets equal to:
>
> $X_3 = 10.72 + (X_2 - X_1)*1.93 = 10.72 + (10.72 - 3)*1.93 = 25.85.$

As these figures reveal, more members of the Hispanic community than the African American and white communities will be subjected to investigation following a given CODIS search. Demographics drive this result, as the average number of white children produced by generation 2 is equal to (10.44 – 3)*1.86, or 13.84, as compared to 15.21 African American children and 15.37 Hispanic children. These figures represent the difference in population size between generations 1 and 2, as multiplied by the average number of children generation 2 is likely to produce (generation 3). Adding this term, which represents the increase in potential hits from generation 2 to generation 3, to the number of average hits in generation 2 (which takes into account the hits created by generation 1) yields the total average number of hits per group after three generations.

Of great importance is that the growing level of disparity between output levels of potential investigative targets increased with each new generation. Hispanics were exposed to a risk of surveillance approximately 3% higher than whites and 2% higher than African Americans after two generations.[101] After three generations, the difference increased to 5% more Hispanics than African Americans placed at risk, and 8% more Hispanics than whites.

Fertility rates seem to confirm these results. Using similar formulae, but replacing A with average birthrate data, supports the finding that the Hispanic community will face an increasingly disproportionate number

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100. Numbers are rounded to the hundredth place.

101. Outcomes of percentage calculations were rounded to the nearest hundredth.

of privacy invasions following a partial allele match. For 2004, Hispanic women had a fertility rate of 97.8, as compared to 58.4 for non-Hispanic whites and 67 for non-Hispanic African Americans.[102] Also in 2004, the number of children born to Hispanic women of forty to forty-four years was 2.3, as compared to approximately 1.85 children for African American and non-Hispanic white women.[103]

The following formulae, which calculate potential partial match hits per group based on birthrate, confirm the results reached above:

$X_1 = M + F$

$X_2 = M_1 + F_1 + A$

$X_3 = X_2 + [(X_2 - P_2)*1/2]*A$

Where X_n represents generations;

M_n represents mothers per generation;

F_n represents fathers per generation;

P_n represents $M_n + F_n$;

A represents the average number of children per woman in each group.

Assume that there are three women: One woman is Hispanic, one is African American and non-Hispanic, and one is white and non-Hispanic. Assume for ease of calculation that F and M each equal 1 in X_1, such that P_1 will equal 2 for all groups. Also assume that 50% of children are male and 50% are female. This is represented by multiplying the end result by 0.5, which deducts the male children from the calculation for the next generation. The following results are provided:

X_2 for both the white and African American groups is equal to 3.85 as compared to 4.3 for the Hispanic group.

X_3 for the white woman and the African American woman = $3.85 + [(3.85 - 2)*1/2]*1.85 = 5.6$.

X_3 for the Hispanic group = $4.3 + [(4.3 - 2)*1/2]*2.3 = 6.9$.

These results comply with the figures derived from the average number of children under eighteen per household per group. As seen above,

102. Child Trends Databank, Birth and Fertility Rates 9 tbl.1, available at http://www.childtrendsdatabank.org/pdf/79_PDF.pdf (last visited Feb. 25, 2007) (on file with the *Columbia Law Review*).

103. See U.S. Census Bureau, U.S. Dep't of Commerce, Fertility of American Women: June 2004, at 3 (2005), available at http://www.census.gov/prod/2005pubs/p20-555.pdf (on file with the *Columbia Law Review*). The study reports that the average number of children born to African American and non-Hispanic white women in 2004 ranged from 1.8 to 1.9. Id. The calculations to follow will use the average of this range, or 1.85.

after three generations, approximately 19% more Hispanic people than non-Hispanic white or African American people are exposed to DNA collection following a partial allele match. Over time it can be predicted that the output multiplication issue affecting the Hispanic community will incrementally produce more testable targets of Hispanic origin than of other groups. This is the generational effect built into the DNA databank system.

2. *Interpretation of Results.* — The above projections have not come close to representing the totality of the problem. The explosive potential of demographic trends is predicted to accelerate in the future. One projection anticipates that the growth rate of the Hispanic population may exceed 2% annually until the year 2030.[104] Moreover, until mid-century, the Hispanic community will add more people to the U.S. population than all other racial and ethnic groups combined.[105] By 2050, the U.S. Hispanic population is projected to reach 95,508,000, as compared to 31,366,000 in the year 2000.[106]

The conditions outlined above make the Hispanic population uniquely susceptible to a ballooning risk of privacy invasions and genetic surveillance as DNA profiles accumulate. The speed at which DNA databanks acquire Hispanic profiles is going to accelerate at a disproportionately high rate for several reasons. First, the Hispanic population is growing rapidly,[107] which means DNA databanks will hold an increasingly large number of profiles from Hispanic people even if the number of partial matches identifying Hispanic profiles remains constant over time. In addition, Hispanics are the fastest-growing group being imprisoned in the United States, a trend that, if it continues, will ensure a steady stream of new Hispanic profiles to be consistently added to DNA databanks.[108]

Finally, like the African American community, the Hispanic population is subject to embedded system multipliers that converge to amplify disproportionate risks of privacy violations from DNA databanks. In addition to high population growth relative to other groups, the Hispanic community contains, and will continue to contain, a disproportionately large number of young people, who commit crimes at higher rates than older persons.[109] Likewise, the Hispanic community experiences a rela-

104. U.S. Census Bureau, U.S. Dep't of Commerce, Current Population Reports: Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050, at 1 (1996), available at http://www.census.gov/prod/1/pop/p25-1130/p251130.pdf (on file with the *Columbia Law Review*).

105. Id.

106. Id. at 17 tbl.M.

107. See, e.g., Press Release, U.S. Census Bureau, supra note 83.

108. See The Sentencing Project, supra note 80, at 1.

109. See, e.g., Thomas D. Stucky, Urban Politics, Crime Rates, and Police Strength 78 (2005); Hung-En Sung, The Fragmentation of Policing in American Cities 49 (2002). In 2004, only 5% of the Hispanic population was aged 65 or over, as compared to 15% for non-Hispanic whites and 8% for African Americans. U.S. Census Bureau, Population Profile, supra note 81, at 4.

tively high degree of poverty[110] and is concentrated largely in urban centers.[111] To the extent that these factors may increase the odds of being incarcerated, they will steer disproportionate numbers of young Hispanics into the databank system, at which point the output effect will expose disparately high numbers of biological relatives to privacy invasion. With such grave consequences for genetic privacy, the question becomes, "What can be done to reverse the trends already in motion?"

III. Constitutional Challenges to Genetic Surveillance

This Part addresses two possible constitutional objections that could be raised as a defense to familial DNA testing. Part III.A considers the Equal Protection Clause of the Fourteenth Amendment as a first possible objection, but concludes that such an argument is unlikely to succeed despite strong evidence that familial testing will exacerbate ethnicity-based disparities in DNA databank systems. Part III.B discusses a second constitutional objection based on the Fourth Amendment's probable cause limitation on search and seizure. This Part concludes that the Fourth Amendment provides the strongest constitutional ammunition for attacking familial DNA testing. Part III.C addresses the stigmatic harm that can be expected to occur if genetic identity is used as a proxy for wrongdoing.

A. *The Equal Protection Clause and Statistical Disparity*

Plaintiffs alleging disproportionate harm allocated along racial or ethnic lines often invoke an equal protection remedy. However, constitutional claims asserting harm based on statistical disproportionality have never achieved much progress following *Washington v. Davis*, in which the U.S. Supreme Court established the principle that a racially disproportionate impact "is not the sole touchstone of an invidious racial discrimination forbidden by the Constitution."[112] While "an invidious discriminatory purpose may often be inferred from the totality of the relevant facts, including the fact, if it is true, that the law bears more heavily on one race than another," the Court has never invalidated a law on equal protection grounds merely "because it may affect a greater proportion of one race than of another."[113] Instead, an actionable equal protection claim requires that the disparate impact be traced to a discriminatory purpose.[114] A statistical disparity maligning one race or ethnic group to a greater

110. The U.S. Census Bureau provides that 21.8% of Hispanics were below the poverty line in 2005, as compared to 24.9% of African Americans and 8.3% of whites. U.S. Census Bureau, U.S. Dep't of Commerce, Historical Poverty Tables, at http://www.census.gov/hhes/www/poverty/histpov/hstpov2.html (last visited Mar. 26, 2007) (on file with the *Columbia Law Review*).

111. John W. Frazier et al., Race and Place 30–31 (2003).

112. 426 U.S. 229, 242 (1976).

113. Id.

114. Id. at 239–40.

extent than others is not constitutionally significant unless it grew from an intent to disproportionately allocate burdens. As a result, the underlying law will survive provided that it is an otherwise legitimate act of government.[115]

Familial DNA testing, despite producing disparate levels of privacy violations along racial and ethnic lines, will likely withstand equal protection review provided that a particular group is not subjected to sample collection at a rate so suspiciously disproportionate as to raise an inference of discriminatory intent. The *Davis* Court, citing *Yick Wo v. Hopkins*,[116] acknowledged that, "[a] statute, otherwise neutral on its face, must not be applied so as [to] invidiously . . . discriminate on the basis of race."[117] In *Yick Wo*, the Court invalidated a facially neutral statute making it a misdemeanor to establish a laundry business in a building not made of brick or stone without first obtaining the consent of the San Francisco Board of Supervisors.[118] The stated purpose of the statute was to prevent fires in wooden buildings, which, on its face, was a legitimate exercise of California's police powers.[119] In finding that the facially neutral statute was nonetheless unconstitutional by virtue of its unequal administration,[120] the Court established the principle that a law "fair on its face and impartial in appearance" can nonetheless violate the Equal Protection Clause "if it is applied and administered by public authority with an evil eye and an unequal hand, so as practically to make unjust and illegal discriminations between persons in similar circumstances."[121]

Familial DNA testing, like the application approval process in *Yick Wo*, will inevitably produce an unequal result, as the biological relatives of convicted African Americans and Hispanics will face an increasingly high risk of privacy invasion. Nonetheless, it is extremely unlikely that the *Yick Wo* principle of unequal administration will prove sufficient to satisfy the *Davis* requirement for familial DNA testing. *Yick Wo* is somewhat of an aberration in equal protection law because the unequal outcome was wholly detached from any rational, justifying purpose. In contrast, most cases where a plaintiff has used statistical evidence to demonstrate inequality have failed to convince the Court of an underlying discriminatory purpose, for reasons provided in *McCleskey v. Kemp*.[122]

In *McCleskey*, an African American man convicted of murdering a police officer challenged his death sentence on the grounds that a statistical

115. Id. at 242.

116. 118 U.S. 356 (1886).

117. *Davis*, 426 U.S. at 241.

118. *Yick Wo*, 118 U.S. at 356, 374.

119. Id. at 367.

120. The Board denied all 200 applications filed by Chinese petitioners, while accepting eighty applications from non-Chinese petitioners. It is not clear how many total requests were made. Id. at 374; see also Michael I. Meyerson, Political Numeracy: Mathematical Perspectives on Our Chaotic Constitution 94–95 (2002).

121. *Yick Wo*, 118 U.S. at 373–74.

122. 481 U.S. 279 (1987).

study of death sentence administration in Georgia revealed underlying racial inequality.[123] In filing a petition for writ of habeas corpus, McCleskey used a statistical study to argue that the administration of the death penalty in Georgia was racially biased.[124] McCleskey sought to raise an inference of purposeful discrimination by focusing not on his own conviction, but by distilling overarching patterns of disparity from the greater administration of the death sentence.

Unmoved by McCleskey's arguments, the Court articulated a particularity requirement that refined the discriminatory intent principle from *Davis*.[125] Justice Powell, writing for the majority, rejected the notion that statistical evidence of systemic racial discrimination is sufficient to prove unequal treatment in individual cases.[126] He explained, "to prevail under the Equal Protection Clause, McCleskey must prove that the decisionmakers in *his* case acted with discriminatory purpose. He offers no evidence specific to his own case that would support an inference that racial considerations played a part in his sentence."[127] Statistical evidence of placement within an unequal system is therefore inadequate to substantiate a claim of unequal treatment absent a showing of particular discrimination affecting the individual litigant.

Powell's opinion also indicates that the Court was unwilling to open the floodgates to statistical evidence of racial discrimination, as doing so would unleash profound challenges to accepted legal structures. Powell explained, "McCleskey's claim that these statistics are sufficient proof of discrimination, without regard to the facts of a particular case, would extend to all capital cases in Georgia, at least where the victim was white and the defendant is black."[128] This explanation indicates an apprehension toward a far-reaching decision that could expose a wide array of legal structures to constitutional attack through statistical evidence. In his dissent, Justice Brennan characterized Powell's opinion as being motivated by the fear that accepting statistical evidence of systemic discrimination amounted to "an invitation to descend a slippery slope" that would call the legitimacy of the criminal justice system into question.[129] The Court was simply unwilling to extend the Equal Protection Clause that far.

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123. Id. at 282–83.

124. Id. at 286. The Baldus study examined 2,000 murder cases in Georgia during the 1970s and concluded that killers of white victims received the death sentence in 11% of cases as compared to 1% for those convicted of killing African Americans. The study also found that the death penalty was used in 22% of cases with an African American defendant and a white victim, as compared to 3% of cases with a white defendant and a black victim. Id. According to the study, prosecutors argued in favor of the death penalty in 70% of cases involving African American defendants and white victims, as opposed to 19% of cases with a white defendant and a black victim. Id. at 287.

125. Id. at 292–93.

126. Id.

127. Id.

128. Id. at 293.

129. Id. at 339 (Brennan, J., dissenting).

In the context of familial DNA testing, there is little hope for successfully arguing that constitutionally significant discrimination is a hidden poison within DNA databank laws. Plaintiffs challenging familial DNA testing and databank configuration under the Equal Protection Clause will face a number of challenges that the plaintiff in *Yick Wo* avoided.[130] First, unlike the situation in that case, the government will simply argue that statistics are neutrally reflective of objective information regarding criminal justice and demographics. While the disparity in *Yick Wo* was wholly unprincipled,[131] the state will be able to argue that databank configurations and resultant familial test results are the natural byproduct of objective data collection. This argument will likely appeal to the undercurrent of Powell's *McCleskey* opinion, as the Court is unlikely to expose the criminal justice system to a potentially infinite number of new claims based on systemic discrimination. *McCleskey* is also noteworthy in that it reveals a reluctance to judicially sanction the critique that the criminal justice system is subject to bias and inequality. Second, the *Yick Wo* permit approval process centered the dispute in human hands, as the Board of Supervisors had discretion to accept or deny a permit request. DNA databanks are distinct in that data flows into the system pursuant to statutory mandates that certain criminals be added to databanks, which removes the human choice factor. Moreover, while the degree of disproportionality in *Yick Wo* was astounding, the situation with DNA databanks appears more reasonable, as all people satisfying input triggers have their DNA added to the system, regardless of race or ethnicity. The extreme level of disparity in *Yick Wo* is simply absent. Finally, *Yick Wo*, mainly due to the aberrant facts in that case, is largely a historical relic that has not been widely utilized in subsequent Supreme Court decisions. As a result, the Equal Protection Clause is unlikely to carry much hope for redress.

B. *The Fourth Amendment as an Effective Constitutional Shield*

1. *Limitations on Search and Seizure.* — A traditional privacy-based Fourth Amendment challenge to familial DNA testing may be the most obvious source of a judicial remedy. However, courts have steadily insulated DNA testing from constitutional challenge. The one unique facet of familial testing is that it expands surveillance over a convict's relatives, who are not inevitably guilty of a crime. Courts have often upheld the constitutionality of DNA databanks on the grounds that they contained

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130. The intense disparity presented in *Yick Wo* made it a "remarkably easy" case to resolve on statistical evidence. Meyerson, supra note 120, at 94–95.

131. As Angelo N. Ancheta explains:

> *Yick Wo* was a case that turned on numbers. No mathematicians or social scientists were needed as expert witnesses because the statistical data pointing to racial discrimination were so glaring that the Supreme Court could infer the board's discriminatory motives. *Yick Wo* was not a "disparate impact" case in the contemporary sense. The Board of Supervisors had every intention of discriminating against Chinese laundry owners, as the numbers showed.

Angelo N. Ancheta, Scientific Evidence and Equal Protection of the Law 96 (2006).

profiles from convicted offenders, who forfeit a legitimate expectation of privacy by virtue of their convictions.[132] The situation with familial testing is distinct because the biological relatives of a convict have not done anything to forfeit their right to privacy, such that forcible DNA extraction potentially violates constitutional protections available to noncriminals.[133] Despite the potential of a successful claim based on privacy invasions of innocent persons, this Note will discuss another strand of the Fourth Amendment that has received little to no attention in the familial DNA context. That area is probable cause, which may provide the relatives of convicted offenders with an effective weapon against DNA collection.

For any probable cause limitation to succeed, it must be directed at something constituting a search under the Fourth Amendment. While forcible DNA extraction involves a physical invasion of the body and is clearly a constitutionally actionable search, a more difficult issue is posed by nonforcible collection. A constitutionally significant search reveals information not exposed to the public, which is problematic for challenging nonforcible DNA collection, as genetic material is constantly deposited in public places.[134] In addressing the especially problematic issue of "abandoned" DNA, Tracey Maclin draws an analogy to *Kyllo v. United States*, where the Court found that aiming a thermal imaging machine at a home constituted a search, as information about the home's interior normally inaccessible without a physical invasion was revealed through sense-enhancing technology.[135] Maclin argues that the *Kyllo* holding, if expanded beyond the context of the home, provides reason to classify DNA testing as a search under the Fourth Amendment, "even if DNA, like heat emanations, is technically exposed to the public."[136]

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132. See, e.g., Simoncelli & Steinhardt, supra note 16, at 204 (explaining that courts have found "convicted felons [to] have a 'diminished expectation' of privacy").

133. As one commentator has explained:

> Gathering information about a databanked criminal's sibling runs afoul of the justification that databanked criminals, by virtue of being criminals, have surrendered a degree of privacy and, therefore, it is acceptable to have their genome digitized for all law enforcement officers to share. The Supreme Court has repeatedly held that criminals cannot expect the same measure of privacy as a non-offending citizen while they are under government incarceration or probation. But where a law enforcement agency, either purposefully or incidentally, gathers information about a non-banked individual by comparing a DNA artifact to his or her sibling's profile digitized in the system, the state is intruding on the privacy of an individual who likely has not committed any act warranting this level of genomic intrusion.

Hibbert, supra note 29, at 785–86 (citation omitted).

134. Joh, supra note 56, at 867 ("[L]eaving DNA in public places cannot be avoided.").

135. See Tracey Maclin, Is Obtaining an Arrestee's DNA a Valid Special Needs Search Under the Fourth Amendment? What Should (and Will) the Supreme Court Do?, 33 J.L. Med. & Ethics 102, 106 (2005) (noting that Court has found such action constitutes search).

136. Id. at 106.

In his blistering dissent in *United States v. Kincade*, Judge Kozinski refers to the *Kyllo* decision, remarking that, "[n]ew technologies test the judicial conscience."[137] While providing great crime reduction potential, technological innovations, like heat sensors and DNA databanks, "often achieve these ends by intruding, in ways never before imaginable, into the realms protected by the Fourth Amendment."[138] Typically, these intrusions result from conducting searches without a reasonable inference of wrongdoing, which is at the heart of probable cause limitations on search and seizure.

Probable cause and its various derivatives require that some sense of wrongdoing precede a search.[139] In *Alabama v. White*, Justice White, writing for the majority, explained, "[w]e have held that probable cause means 'a fair probability that contraband or evidence of a crime will be found.'"[140] Justice Rehnquist commented in *Ornelas v. United States* that while probable cause is not reducible to specific criteria, it nonetheless will exclude a search unless "the known facts and circumstances are sufficient to warrant a man of reasonable prudence in the belief that contraband or evidence of a crime will be found."[141] Therefore the core of probable cause is that a reasonable belief in criminality must precede any search. Likewise, reasonable suspicion, the less stringent counterpart of probable cause triggered by a reasonable belief that a crime is in progress or inevitable, requires "a particularized and objective basis" for suspecting criminal activity prior to executing a search.[142]

Both probable cause and reasonable suspicion are relaxed under the "special needs" exception, born of Justice Blackmun's concurrence in *New Jersey v. T.L.O.*, in which he stated that courts can substitute a balancing of privacy interests against law enforcement objectives "in those exceptional circumstances" where warrant and probable cause requirements are "impracticable."[143] The Ninth Circuit used a similarly amorphous exception in *Kincade*, in which the court affirmed a parolee's conviction for violating the terms of his release by refusing to tender blood samples for DNA testing.[144] In departing from the typical "special

137. 379 F.3d 813, 871 (9th Cir. 2004) (Kozinski, J., dissenting).

138. Id.

139. The language in Justice Scalia's dissent in *Ornelas v. United States* is noteworthy. Scalia states, "the Court suggests that an appellate court should give 'due weight' to a trial court's finding that an officer's inference of wrongdoing (*i.e.*, his assessment of probable cause to search) was reasonable." Ornelas v. United States, 517 U.S. 690, 705 (1996) (Scalia, J., dissenting).

140. 496 U.S. 325, 330 (1990) (quoting Illinois v. Gates, 462 U.S. 213, 238 (1983)).

141. 517 U.S. at 696.

142. Id. (internal quotation marks omitted).

143. 469 U.S. 325, 351 (1985) (Blackmun, J., concurring).

144. United States v. Kincade, 379 F.3d 813 (9th Cir. 2004) (plurality opinion). DNA samples were required from parolees pursuant to the DNA Analysis Backlog Elimination Act of 2000, Pub. L. No. 106-546, 114 Stat. 2726 (codified at 42 U.S.C. § 14135 (2000)).

needs" exception[145] for conducting a search without probable cause or reasonable suspicion,[146] the *Kincade* plurality applied the "totality of the circumstances" balancing test from *T.L.O.* to rule in favor of the DNA extraction.[147]

In attacking the root of the totality of the circumstances test, Judge Reinhardt's *Kincade* dissent noted that *United States v. Knights*, the Supreme Court case cited by the plurality as precedent for the standard, upheld warrantless searches of a probationer's home as a parole condition and "clearly decided the Fourth Amendment question outside of the 'special needs' framework."[148] Reinhardt explained that the *Knights* majority specifically limited the application of the totality of the circumstances test to situations where the target of the search enjoys a diminished expectation of privacy, such as parolee status.[149] Reinhardt then quoted the following passage from the *Knights* majority opinion:

> "When an officer has reasonable suspicion that a probationer subject to a search condition is engaged in criminal activity, there is enough likelihood that criminal conduct is occurring that an intrusion on the probationer's significantly diminished privacy interests is reasonable. The same circumstances that lead us to conclude that reasonable suspicion is constitutionally sufficient also render a warrant requirement unnecessary."[150]

Reading this passage in the context of language from the *Knights* plurality that the suspicionless search at issue "was reasonable under [the Court's] general Fourth Amendment [totality of the circumstances] approach,"[151] Reinhardt argued that this language implied an adherence to

145. The special needs exception originates in Justice Blackmun's concurrence in *New Jersey v. T.L.O.* 469 U.S. at 351 (Blackmun, J., concurring). The special needs test, which dispenses with warrant requirements, states that "[o]nly in those exceptional circumstances in which special needs, beyond the normal need for law enforcement, make the warrant and probable-cause requirement impracticable, is a court entitled to substitute its balancing of interests for that of the Framers." Id.

146. The reasonable suspicion test, created in Terry v. Ohio, 392 U.S. 1, 27 (1968), replaces probable cause as the test for a valid search where a law enforcement official reasonably believes a suspect has a weapon. The application of reasonable suspicion has subsequently expanded far beyond the weapons context. See, e.g., E. Martin Estrada, Criminalizing Silence: *Hiibel* and the Continuing Expansion of the *Terry* Doctrine, 49 St. Louis U. L.J. 279, 286–87 (2005).

147. *Kincade*, 379 F.3d at 832 (plurality opinion). The totality of the circumstances test has been explained by the Supreme Court as follows:

> The touchstone of the Fourth Amendment is reasonableness, and the reasonableness of a search is determined "by assessing, on the one hand, the degree to which it intrudes upon an individual's privacy and, on the other, the degree to which it is needed for the promotion of legitimate governmental interests."

United States v. Knights, 534 U.S. 112, 118–19 (2001) (quoting Wyoming v. Houghton, 526 U.S. 295, 300 (1999)).

148. 379 F.3d at 861 (Reinhardt, J., dissenting) (quoting *Knights*, 534 U.S. at 117–18).

149. Id.

150. Id. at 861–62 (quoting *Knights*, 534 U.S. at 121).

151. 534 U.S. at 118.

individualized suspicion of wrongdoing because "the presence of *some level* of suspicion has always been a given and a *sine qua non* [in totality of the circumstances cases]."[152] Citing *Illinois v. Gates*, where the Supreme Court "reaffirm[ed] the totality-of-the-circumstances analysis that traditionally has informed probable cause determinations,"[153] Reinhardt argued that the test is naturally intertwined with, rather than distinct from, probable cause and its less stringent derivatives.[154] Indeed, the petitioner in *Kincade*, as a parolee, had already been convicted of a crime and therefore entertained reduced expectations of privacy.[155]

Reinhardt's analysis is bolstered by cases examining the role of law enforcement objectives in controlling the scope of constitutional searches. The Supreme Court has rejected the invocation of the special needs exception where the purpose for a search was related to the general interest of crime control.[156] In *City of Indianapolis v. Edmond*, the Court found that drug interdiction checkpoints established by the City of Indianapolis violated the Fourth Amendment, as the special needs exception does not immunize "[traffic] stops justified only by the generalized and ever-present possibility that interrogation and inspection may reveal that any given motorist has committed some crime."[157] While refusing to provide a rigid list of circumstances in which the special needs exception would apply, the Court noted that such application would require some "exigenc[y]," such as "an imminent terrorist attack or [a need] to catch a dangerous criminal who is likely to flee by way of a particular route."[158] As Reinhardt commented, "[n]ever once in over two hundred years of history has the Supreme Court approved of a suspicionless search designed to produce ordinary evidence of criminal wrongdoing for use by the police."[159]

Given the limitations on search and seizure, it is doubtful that a familial DNA test could be justified on the grounds of genetic similarity alone. Collecting familial DNA for the purpose of assisting a criminal investigation is squarely within the realm of general law enforcement purposes, such that a search will only be constitutional if probable cause is satisfied. Likewise, the scientific thesis underlying familial DNA testing is inherently at odds with the inference of wrongdoing component of probable cause. The practice justifies a search based on the inference that a convict's relatives may be criminally liable simply because they are genetically related to someone who was *previously* convicted of a *different* crime. Familial testing permits police investigating crime A to search the biologi-

152. *Kincade*, 379 F.3d at 862 (Reinhardt, J., dissenting).

153. 462 U.S. 213, 238 (1983).

154. See 379 F.3d at 862 (Reinhardt, J., dissenting).

155. Id. at 834 (plurality opinion).

156. Ferguson v. Charleston, 532 U.S. 67, 81, 84 (2001); Indianapolis v. Edmond, 531 U.S. 32, 44 (2000).

157. 531 U.S. at 44.

158. Id.

159. *Kincade*, 379 F.3d at 854 (Reinhardt, J., dissenting).

cal relatives of a person convicted years ago for crime B. Reduced to its most fundamental level, a concept of "probable cause" for familial DNA testing appears inherently contradictory, as genetic similarity is detached from evidence of wrongdoing. Instead, as a symptom of biology, relatives and future generations risk being stigmatized for their mere genetic similarity to a previously convicted defendant. Assuming possible criminality based on genetic identity replaces the wrong*doing* requirement with what might be described as wrong*being*. Using biological identity as a proxy for wrongdoing is at odds with the Fourth Amendment, even if familial DNA collection were performed in response to an exigent circumstance transcending the general law enforcement interest in locating culpable defendants.

C. *The Stigmatic Consequences of Inferring Criminality from Genetic Identity*

Inferring the possibility of wrongdoing through genetic identity will stigmatize some groups more than others. As a result of the disparate input and output situations within the DNA databank system, it follows that African Americans and Hispanics will face the sting of stigmatization far more often than others. Such a result creates the possibility of entrenching stereotypes that correlate race and ethnicity with criminality. DNA databanks expose the possibility that social and political forces will become increasingly reduced to biological explanations,[160] such that behavior is viewed as prefigured by identity.[161]

A major concern stemming from the disproportionate effect of familial DNA testing on certain racial or ethnic groups is voiced by Elizabeth E. Joh, who worries that DNA testing will be exploited by behavioral genetics, which seeks to explain behavior through genotype.[162] Her fear is that law enforcement personnel will attempt to uncover "markers for criminogenic behaviors," which "could provide justifications for preventive detentions or other means of social control for those identified as genetically predisposed to criminality."[163] A more insidious scenario involves efforts to uncover race or ethnicity-based genetic differences among criminals, which could "permit the criminal law not only to be reactive, but predictive, by identifying would-be offenders on the basis of

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160. Dorothy Nelkin & M. Susan Lindee, The DNA Mystique: The Gene as a Cultural Icon 194 (2004).

161. Already the "near iconic status of DNA in contemporary society" may cause people to look for "racial essences" within DNA. Pilar N. Ossorio, About Face: Forensic Genetic Testing for Race and Visible Traits, 34 J.L. Med. & Ethics 277, 279 (2006).

162. Joh, supra note 56, at 876–77.

163. Id.; see also Tania Simoncelli, Dangerous Excursions: The Case Against Expanding Forensic DNA Databases to Innocent Persons, 34 J.L. Med. & Ethics 390, 392 (2006) ("Repeated claims that human behaviors such as aggression, substance addiction, criminal tendency, and sexual orientation can be explained by genetics render law enforcement databases especially prone to abuse.").

their genetic make-up."[164] If realized, the correlation between genetic identity and race or ethnicity carries startling consequences:

> [There is a] unique potential for behavioral genetics research, when placed in the context of criminal law, to stigmatize racial and ethnic minority groups through the blame-shifting mechanisms of genetic reductionism and genetic determinism. Like the scarlet "A" in Nathaniel Hawthorne's famous novel, DNA associated with criminal or antisocial behavior might become a "scarlet gene" that marks the individual, his family, and his racial or ethnic community as "flawed, compromised, and somehow less than fully human."[165]

Preventing this outcome requires a newfound awareness of the unique risk of stigmatization created by familial DNA testing. Fortunately, traditional Fourth Amendment protections offer a constitutional shield to deflect the most invidious implications of familial testing.

Conclusion

Familial DNA testing poses formidable threats to genetic privacy, and rather than being spread evenly across society, these threats are likely to impact the Hispanic community far more severely than other U.S. residents. Rapid population growth coupled with relatively high arrest and conviction rates will subject disproportionate numbers of the Hispanic community to genetic surveillance and privacy invasions. Over time, this scenario risks constructing stigmatic myths about ethnicity and criminal conduct that can be devastating to those affected. While the Equal Protection Clause provides little reason for optimism, the Fourth Amendment's probable cause limitation on search and seizure may offer a potent tool to short-circuit this new surveillance machinery.

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164. Joh, supra note 56, at 878.

165. Karen Rothenberg & Alice Wang, The Scarlet Gene: Behavioral Genetics, Criminal Law, and Racial and Ethnic Stigma, Law & Contemp. Probs., Winter/Spring 2006, at 343, 344 (footnote omitted).