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DNA: FIVE DISTINGUISHING FEATURES FOR POLICY ANALYSIS

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I. INTRODUCTION

The influx of genetic science into biomedicine and research raises the question of whether predictive or diagnostic information derived from the molecular analysis of DNA merit distinctive legal consideration or policy treatment. The question arises in research, clinical care, and health policy settings. In research settings, investigators and Institutional Review Boards ("IRBs") must consider whether tissue samples containing DNA should be treated differently from other specimens that are not subject to molecular DNA analysis.[1] In clinical care settings, physicians or genetic counselors must consider whether the use of DNA-based information carries wider obligations than the use of ordinary confidential medical information.[2] In health policy settings, insurers, legislators, and other regulators must consider whether information derived directly from the analysis of DNA should be treated differently from other medical information currently used in making decisions about insurance or employment.[3]

We argue that, in these and other contexts, DNA *is* different. We base this judgment on a series of *quantitative* and *qualitative* considerations. In some respects, genetic information derived from the analysis of DNA differs from other medical information only by a matter of degree. Much biomedical research and clinical care threatens subjects' or patients' privacy; but information derived from DNA can do

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1. *See* Joan Stephenson, *Pathologists Enter Debate on Consent for Genetic Research on Stored Tissue*, 275 JAMA 503, 503–04 (1996).

2. *See* Lori B. Andrews, *Legal Aspects of Genetic Information*, 64 YALE J. BIOLOGY & MED. 29, 33–36 (1991).

3. *See* Peter S. Harper, *Genetic Testing and Insurance*, 26 J. ROYAL C. PHYSICIANS LONDON 184 (1992).

so to a significantly greater extent. DNA-derived information also poses novel risks not previously encountered in other biomedical contexts. One example is the possibility of harm to distant persons, some not yet even born, that can result from certain kinds of DNA research.

We recognize that it is hard to sustain a claim of total novelty about the use of genetic information in biomedical settings. Critics of our position may point to existing biomedical areas that have features similar to those exhibited by work with DNA. What we wish to show is that in *both* its quantitative and qualitative respects, DNA *is* different enough from materials or information dealt with in previous biomedical endeavors to warrant special considerations in research, clinical, and health policy settings. We acknowledge that some aspects of genetic singularity have been explored by other scholars; however, our goal is to provide a comprehensive conceptual overview of the genetic terrain and outline the relevant issues for consideration.

II. FIVE DISTINGUISHING FEATURES

Taken together, five aspects of DNA contribute to our belief that predictive or diagnostic information derived from the molecular analysis of DNA is different. Three derive from the intrinsic nature of DNA — DNA's informational nature, longevity, and role as an identifier — and two reflect the wide array of people and interests that can be affected by DNA's utilization in research, clinical care, or insurance and employment contexts — familial risks and community impacts.

A. Informational Risks

The risks associated with the information-rich nature of DNA have long been apparent in the area of genetics. While most of the risks in traditional biomedicine arise from direct physical interventions in people's bodies, whether through invasive surgical procedures or the administration of experimental drugs, this is not usually the case in genetics, where the principal risks are related to the information revealed about subjects' genetic inheritance. Among these risks are anxiety, distress, and other psychological harms to subjects who learn that they carry genes that may predispose them to serious medical problems.[4] These risks are magnified when effective therapeutic interventions are not yet available for the condition and the subject is forced to live with

4. *See* Charles Siebert, *The DNA We've Been Dealt*, N.Y. TIMES MAG., Sept. 17, 1995, at 50.

the prospect of unavoidable illness. Such individuals comprise a growing class that has been called the "asymptomatic ill."[5] Other risks are incidental and include: inadvertent disclosure of painful facts about family relationships (such as non-paternity[6]); stigmatization associated with having a genetic abnormality; and intra-familial discord. Although the likelihood of some of these harms is small, their occurrence can be devastating for individuals.[7] As Francis Collins, Director of the National Human Genome Research Institute of the National Institutes of Health ("NIH") has suggested, powerful new genetic knowledge may prove to be "toxic information."[8]

There are also economic risks of discrimination in employment, medical insurance, and life insurance, at least until prohibited by law.[9] While at least seven states currently have laws prohibiting genetic discrimination in employment[10] or medical insurance,[11] most states leave open the possibility that employers or insurers may request a general medical release and thereby obtain genetic test results that are included in a medical report. Similarly, individuals claiming discrimination have the burden of proving that they have been discriminated against on the basis of genetic information.

Federal guidance on genetic discrimination in employment contexts has primarily come from the U.S. Equal Employment Opportunity Commission ("EEOC"). In its 1995 compliance manual,[12] the EEOC

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5. *See* Dorothy Nelkin, *Diagnosis: The Social Implications of Biological Tests, in* EMERGING ISSUES IN BIOMEDICAL POLICY: AN ANNUAL REVIEW, VOLUME I: SETTING ALLOCATION PRIORITIES; GENETIC AND REPRODUCTIVE TECHNOLOGIES 215 (Robert H. Blank & Andrea L. Bonnicksen eds., 1992).

6. *See* Dorothy C. Wertz, *Ethical and Legal Implications of the New Genetics: Issues for Discussion*, 35 SOC. SCI. & MED. 495, 499 (1992).

7. *See* Nancy E. Kass, *Participation in Pedigree Studies and the Risk of Impeded Access to Health Insurance*, IRB: REV. HUMAN SUBJECTS RES., Sept.-Oct. 1993, at 7, 9.

8. *See* Videotape: The Human Genome Project (National Human Genome Research Institute, National Institutes of Health, 1996) (discussion by Francis Collins).

9. *See* E. Virginia Lapham et al., *Genetic Discrimination: Perspectives of Consumers*, 274 SCIENCE 621 (1996).

10. *See* IOWA CODE ANN. § 729.6 (West 1996); N.H. REV. STAT. ANN. § 141-H:3 (1995); N.J. STAT. ANN. §§ 10:5-5, -12, -43 to -49, 17B:30-12 (West 1996) (comprehensive anti-discrimination statue that includes provisions for employment, housing, banking, privacy, health, life, and disability insurance); N.Y. EXEC. LAW § 296(1), (19) (McKinney 1993); OR. REV. STAT. § 659.036 (1995); R.I. GEN. LAWS § 28-6.7-1 (1995); WIS. STAT. ANN. § 111.372 (West 1996).

11. *See* Kathy L. Hudson et al., *Genetic Discrimination and Health Insurance: An Urgent Need for Reform*, 270 SCIENCE 391 (1995).

12. EEOC, 2 EEOC COMPLIANCE MANUAL § 902, Order 915.002, 902–45 (1995).

suggested that discrimination for dominant genetic disorders would be covered by the American with Disabilities Act. However, there is some concern about whether this ruling would cover carriers of recessive or X-linked disorders.[13]

A wrinkle in federal attempts to regulate genetic discrimination in insurance contexts stems from the fact that self-funded plans account for one-third of the non-elderly insured and are expected to increase significantly.[14] Self-funded plans fall under an exemption of the federal Employee Retirement Income Security Act of 1974[15] ("ERISA") and are immune from state regulation. This problem suggests that national legislative efforts may offer the best opportunity to bypass ERISA exemptions, as well as to provide unified and consistent policy. At least eight U.S. Senators and Representatives have already introduced bills addressing genetic discrimination in insurance and employment.[16]

The most significant step in combating genetic discrimination to date occurred in 1996 with the passage of the Health Insurance Portability and Accountability Act[17] ("HIPAA"). HIPAA bars group insurance plans from using most genetic information as a preexisting condition and bans the use of genetic information as a qualification for entrance into the plan.[18] HIPPA does make an exception for genetic information that is clearly linked to a medical diagnosis;[19] however, a healthy person who tests positive for a genetic mutation would not fall within this category.[20] As significant as HIPAA may become in regulating the discriminatory use of genetic information, it does not provide an absolute bar on discrimination. Insurers can still use test

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13. *See* Karen H. Rothenberg, *Breast Cancer, The Genetic "Quick Fix," and the Jewish Community*, 7 HEALTH MATRIX 97, 112 (1997).

14. *See* Hudson et al., *supra* note 11, at 391.

15. Pub. L. No. 93-406, 88 Stat. 829 (codified as amended in scattered sections of 5, 18, 26, and 29 U.S.C.).

16. *See* Genetic Fairness Act of 1996, S. 1600, 104th Cong. (proposed by Sens. Feinstein and Mack); Genetic Privacy and Nondiscrimination Act of 1996, S. 1898, 104th Cong. (proposed by Sen. Domenici); Genetic Privacy and Nondiscrimination Act of 1996 S. 1416, 104th Cong. (1995) (proposed by Sens. Hatfield and Mack); H.R. 3477, 104th Cong. (1996) (amendment to the Fair Labor Standards Act of 1938 that would restrict employers in obtaining, disclosing, and using genetic information, proposed by Rep. Joseph Kennedy); Genetic Privacy and Nondiscrimination Act of 1995, H.R. 2690, 104th Cong. (proposed by Rep. Stearns).

17. *See* Pub. L. No. 104-191, 110 Stat. 1936 (1996) (codified in scattered sections of 18, 26, 29, and 42 U.S.C.A.).

18. *See* 26 U.S.C.A. §§ 9801–9806 (West. Supp. 1998).

19. *See* §§ 9801(a)(1) & (b)(1)(B).

20. *See* § 9801(a)(1) (permitting exclusion only if "medical advice, diagnosis, care, or treatment was recommended or received" for the genetic condition).

results to increase rates, set lifetime caps, or exclude coverage for particular conditions.[21] Moreover, in seeking to curb genetic discrimination, HIPAA overlooks other potential interests, such as the privacy concerns of insurees. Insurers can demand genetic testing or test results and can divulge test results without authorization.[22]

Those who favor a ban on genetic testing for insurance and employment generally point to the following factors: the need for fairness in risk distribution; the availability of insurance; the danger of discrimination, abuse, and stigmatization of individuals with genetic diseases and their relatives; concern over confidentiality of genetic information; the desire to protect an individual's right not to know his or her genetic profile; the preservation of individual autonomy regarding genetic information; and the absence of absolute reliability, accuracy, and predictability based on genetic testing for sound actuarial risk classification.[23]

By contrast, those who support the use of DNA tests in insurance and employment practices emphasize the need for equitable, not equal, distribution of risk; the precedent set by the current use of family histories in insurance; the need to improve the efficiency of actuarial underwriting vis à vis genetic testing; the fears of adverse selection if individuals with known serious health risks disproportionally take advantage of insurance opportunities, thus bankrupting the industry;[24] the applicant's good faith duty to disclose; and the unlikelihood that underwriting based on genetic tests will deprive people of insurance.[25]

These risks were apparent from the earliest years of genetic science. The gathering of family pedigree data has always had the potential for revealing sensitive, private information about one's lineage. Insurers and employers have already used knowledge that diseases run in families to label, stigmatize, and discriminate.[26] However, the developing capacity for molecular analysis raises these risks to a new level. For one thing, this capacity makes possible unprecedented access to information on the basis of minute amounts of tissue collected from individuals with

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21. *See* Rothenberg, *supra* note 13, at 112.

22. *See id.*

23. *See* Eric Mills Holmes, *Solving the Insurance/Genetic Fair/Unfair Discrimination Dilemma in Light of the Human Genome Project*, 85 KY. L.J. 503 (Spring 1996–97).

24. *See* Robert Pokorski, *Genetic Screening and the Insurance Industry*, 64 YALE J. OF BIOLOGY & MED. 53 (1991); Robert Pokorski, *Insurance Underwriting in the Genetic Era*, 60 AM. J. HUMAN GENETICS 205 (1997).

25. *See* Holmes, *supra* note 23, at 555.

26. *See* Kass, *supra* note 7, at 9.

or without their full, informed consent. As medical geneticist Peter Harper has noted, the fact that DNA samples can be used for analysis, no matter from where in the body they are collected or what the individual's age or clinical state, makes these samples a far more invasive source of information than any kind of previously collected tissue or family history.[27]

The growing ability of molecular analysis to provide predictive and diagnostic assessments about *specific individuals* also places the risks associated with a genetic diagnosis in a qualitatively different realm. The highly specific assessment of individual vulnerability resulting from mutational analysis is distinctive because it singles out the individual's genetic risk based on the sure presence of a genetic lesion. This is quite different from prior risk assessment based on pedigree analysis since the analysis of the DNA from a single individual can uncover existing medical conditions or the risks of future disease *for that person* (as opposed to an average based on members of a family or other demographic group).[28]

It remains true, of course, that we are far more than the sum of our genes. We must be careful not to succumb to "genetic determinism" or "genetic essentialism,"[29] which claims that genetic analyses provide complete knowledge of an individual's life prospects. Genetic research is also making it increasingly clear that environmental conditions can influence the expression of even highly penetrant genes. Nevertheless, genetic information can be relevant to understanding an individual's vulnerabilities and possibilities. As the Human Genome Project moves forward, the informational importance of DNA will greatly increase. Analysis of an individual's DNA will provide unprecedented access to very private information about that person, some of which may be unknown to the DNA donor.

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27. Harper, *supra* note 3, at 184.

28. *See* Charles M. Culver, *The Concept of Genetic Malady*, *in* MORALITY AND THE NEW GENETICS 156 (Bernard Gert et al. eds., 1996).

29. The term "genetic essentialism" has been introduced by Dorothy Nelkin and Susan Lindlee to describe the position that reduces the self to a molecular entity, equating human beings with their genes. *See generally* DOROTHY NELKIN & SUSAN LINDLEE, THE DNA MYSTIQUE: THE GENE AS A CULTURAL ICON 41–49 (1995).

B. The Longevity of DNA

A second relatively distinctive aspect of DNA with important legal implications is its longevity, whether as information or biochemical substance. This longevity creates the possibility of long-term and even transgenerational harms for persons.

Long-term informational risks derive from the creation of libraries of stored DNA, transformed cell lines, or databases of genetic information. In some cases, these preserved remains from past or current genetic studies may outlive the individuals who donated them and prove to be a threat to their descendants. This renders problematic the standard requirement of research that subjects should be free to withdraw at any time. Once a sequence of DNA has been characterized and placed in a computer database open to the public, there is no simple way the donor or donor's descendants can put an end to their exposure to harm.

The problem is amplified by the exponential growth in our genetic knowledge. Unlike most medical data, which reveals results generated at fixed time points, DNA databases have the capacity to generate new information over time as future genetic tests are developed. Soon we may be able to identify the genetic basis for many more disorders, predispositions, and genetic traits. We will also have greater understanding of the genetic factors underlying many complex, polygenic disorders and behavioral conditions or traits not now seen to have genetic causes. The association of the APOE gene allele with increased risk of Alzheimer's disease is an example of genetic factors contributing to, but not directly causing, disease conditions.[30] Recent research into the genetic bases of male sexual orientation illustrates the growing reach of behavioral genetics.[31] As a result, even if we allow for non-transmission of certain genes and for different phenotypical expression of some genes in individuals, the risk remains that DNA donated today may expose the progeny of the donors to new and unimagined forms of stigmatization and discrimination. George Annas has analogized DNA to an individual's "'future diary' written in a code

30. *See* Ann M. Saunders et al., *Association of Apolipoprotein E Allele Epsilon 4 with Late-onset Familial and Sporadic Alzheimer's Disease*, 43 NEUROLOGY 1467 (1993).

31. *See* Stella Hu et al., *Linkage Between Sexual Orientation and Chromosome Xq28 in Males but Not in Females*, 11 NATURE GENETICS 249 (1995).

we have not yet broken."[32] The longevity of DNA information means that to some extent it is also the diary of an individual's descendants.

Over thirty states already authorize the banking of DNA data in DNA "data banks" or "libraries."[33] In favor of DNA libraries, one might argue that DNA samples are a highly efficient means of identification. However, the capacity for DNA to generate personal information about specific individuals, such as disease possibilities, goes beyond identification and suggests a much greater threat to individual autonomy. At least one article has suggested that the banking of genetic materials by government agencies may violate the privacy provisions of the Fourth Amendment.[34] Legal controversy over proposals by the Department of Defense for enduring DNA databases of military personnel exemplifies the growing problem in this area.[35]

We believe that when genetic information becomes irretrievably public, as in computerized databases of large stretches of DNA, efforts should be made to reduce the likelihood that this information can be traced back to identifiable individuals without their consent. As we will see, however, such efforts are complicated by a third feature of DNA that poses a challenge to investigators: the fact that DNA carries so much information that anonymization may be difficult or impossible.

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32. George Annas, *Privacy Rules for DNA Databanks*, 270 JAMA 2346, 2346 (1993).

33. *See* ALA. CODE § 36-18-20 to -31 (Supp. 1991); ARIZ. REV. STAT. ANN. § 31-281 (West Supp. 1997); ARK. CODE ANN. § 12-12-1102 to -1116 (Michie Supp. 1997); CAL. PENAL CODE § 290.2 (West Supp. 1998); COLO. REV. STAT. § 17-2-201(5)(g)(I) (Supp. 1996); CONN. GEN. STAT. ANN. § 54-102g (West Supp. 1998); DEL. CODE ANN. tit. 29, § 4713 (1997); FLA. STAT. ANN. § 943.325 (West 1996 & Supp. 1998); GA. CODE ANN. § 24-4-60 (1995); IDAHO CODE § 19-5501 to -5518 (1997); 730 ILL. COMP. STAT. ANN. 5/5-4-3 (West 1996); IND. CODE § 20-12-34.5-3 (1993); IOWA CODE ANN. § 13.10 (West 1995); KY. REV. STAT. ANN. § 17.175 (Michie 1996); LA. REV. STAT. ANN. § 15:601 to -620 (West Supp. 1998); ME. REV. STAT. ANN. tit. 25, § 1572 (West. Supp. 1997); MASS. GEN. LAWS ANN. ch. 22E, § 2 (West Supp. 1998); MINN. STAT. § 609.3461 (1994); MO. ANN. STAT. § 650.055 (West Supp. 1998); NEB. REV. STAT. § 29-4104 (Supp. 1997); NEV. REV. STAT. ANN. § 179A.075 (Michie 1989); N.H. REV. STAT. ANN. § 632-A:22 (Supp. 1997); N.J. STAT. ANN. § 53:1-20.21 (West Supp. 1998); N.C. GEN. STAT. § 15A-266.6 (Supp. 1997); OHIO REV. CODE ANN. § 109.573 (Banks-Baldwin Supp. 1998); OKLA. STAT. ANN. tit. 74, § 150.27a (West. Supp. 1998); 35 PA. CONS. STAT. ANN. § 7651.303 (West Supp. 1998); S.D. CODIFIED LAWS § 23-5-14 (Michie Supp. 1997); TEX. GOV'T CODE ANN. § 411.142 (West Supp. 1998); VA. CODE ANN. § 19.2-310.2 (Michie Supp. 1997); WASH. REV. CODE ANN. § 43.43.754 (West Supp. 1997); WYO. STAT. ANN. § 7-19-402 (Michie 1997).

34. *See* E. Donald Shapiro & Michelle L. Weinberg, *DNA Databanking: The Dangerous Erosion of Privacy*, 38 CLEV. ST. L. REV. 455 (1990).

35. *See* Bradley Graham, *Two Marines Face Court-Martial Over DNA Test: Case Enters National Debate on the Use of Genetic Data*, WASH. POST, Apr. 12, 1996, at A1.

C. DNA as an Identifier

The information-rich nature of DNA means that even anonymous or anonymized DNA sequences can identify the individuals who contributed them. Stored DNA or genetic information collected in research can be compared with DNA collected from individuals for other purposes, or even with distinctive phenotypical characteristics whose genetic basis is understood, and identifying matches can be made. As our knowledge of genotype-phenotype correlations grows, the preferred form of identification may soon be a numerically expressed DNA pattern of every individual, banked along with that individual's DNA profile in a national DNA computerized data bank.[36]

DNA's potential for identification also has paradoxical implications for genetic research: in some cases, collecting samples from identifiable subjects for new studies may be preferable to using anonymous DNA. Ordinarily, the use of anonymous tissue samples has not involved significant risks for human subjects no matter how sensitive the genetic test. Existing federal regulations permit the routine employment of these samples in research without the consent of the original donors.[37] But DNA is not just tissue. Distribution of anonymous samples to other investigators or publication of the information they contain may at some future time lead back to the donor or the donors' offspring, who never consented to such widespread exposure of intimate facts about themselves. Thus, it is preferable to use DNA from individuals who are apprised of this risk and knowingly consent to it, as opposed to using existing anonymous samples or libraries. New donors are in a position to learn of the risks and decide whether they wish to participate. Donors of anonymous DNA cannot make such a decision but nevertheless remain vulnerable to subsequent exposure and harm.

Once this special aspect of both DNA and genetic research is recognized, other steps can be taken to reduce the risks. In large-scale sequencing studies, for example, efforts can be made to use DNA from multiple donors to form "patchwork" sequences, reducing the likelihood that any one individual's genome is disclosed. Double-blind collection strategies and lottery-like selection of DNA from multiple donors can be used to prevent individuals from accessing their own DNA. This can further protect donors' anonymity by reducing their ability to

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36. *See* Gary T. Marx, *DNA Fingerprints May One Day Be Our National ID Card*, WALL ST. J., Apr. 20, 1989, at A14 (suggesting the possibility of a numerically expressed DNA pattern).

37. *See* 45 C.F.R. § 46.101(b)(4) (1998).

intentionally or unintentionally reveal the location of their DNA once it has been used by research. An advisory issued by the NIH's National Human Genome Research Institute required steps like these in federally funded genomic sequencing research.[38]

The uniqueness of these three risks of DNA — its informational density, longevity, and ability to reveal the identity of the donor — is underscored by the announcement by Scottish researchers that they have been able to clone a sheep using the nucleus from a donor sheep's somatic cell.[39] Although the scenarios here border on science fiction, it is no longer technically inconceivable to imagine someone's preserved somatic cell lines being used to reconstitute a genetic replicate of that individual. The possibility that one's genetic "twin" might be brought into being long after one's death dramatically illustrates the observation that DNA can be used at any time in the future, with or without one's consent, to reveal intimate, identifying facts about an individual.

D. Familial Risks

Legal and policy considerations in medicine have traditionally revolved around the individual subject or patient,[40] ranging from issues of how a study or intervention will affect an individual to whether the individual will have the opportunity to provide voluntary and informed consent. The impact of genetic medicine, however, is complicated by the fact that genes may be shared among members of families, ethnic or racial communities, and other groups with a distinctive genetic inheritance. As one writer observes, "By definition, human genetics pertains to relatedness, rather than separateness."[41] This not only creates special risks for individuals but also widens the circle of people who are exposed to risk and who must be considered as involved in the research or clinical context.

The possibility of risk to other family members is the most familiar expression of this aspect of DNA. Genetic studies on particular individuals routinely implicate other family members and expose

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38. *See* NATIONAL HUMAN GENOME RESEARCH INSTITUTE, NCHGR-DOE GUIDANCE ON HUMAN SUBJECTS ISSUES IN LARGE-SCALE DNA SEQUENCING (1996), *available at* <http://www.nhgri.nih.gov/Grant_info/Funding/Statements/RFA/human_subjects.html>.

39. *See* I. Wilmut et al., *Viable Offspring Derived from Fetal and Adult Mammalian Cells*, 385 NATURE 810 (1997).

40. *See generally* Louis J. Elsas II, *A Clinical Approach to Legal and Ethical Problems in Human Genetics*, 39 EMORY L.J. 811 (1990).

41. Michelle A. Mullen, *The New Human Genetics: Ethical Issues and Implications for Public Policy*, 96 KAN. MED. 55, 56 (1995).

them — sometimes without their consent — to physical, psychological, and social harms. The ability to test for a mutation leading to Huntington's Disease has produced instances where one monozygotic twin wished to be tested for the presence of a mutation while the other did not.[42] Moral theorists suggest that either choice can be rational.[43] Yet testing one twin almost invariably alerts the other to his genetic status. This creates a dilemma for the clinician or researcher who faces such competing claims.

Another facet of this problem appears when the patient or subject refuses to disclose information of vital importance to other family members. One would think that a woman whose child is diagnosed with Fragile X Syndrome, an inherited disorder that can lead to severe mental retardation, especially in male children, would feel an obligation to share this information with her sisters who might wish to use it in their reproductive decision-making. Similarly, a married person would seem to be morally obligated to share relevant genetic information with a spouse whose life may be profoundly affected as a result of a condition that may be passed on to the couple's children.

In both situations, however, fear, family conflicts, or tensions sometimes prevent people from acting on their moral obligation.[44] The President's Commission for the Study of Ethical Problems in Medicine has recommended that disclosure of a patient's confidential medical information to others should be made only if four conditions are met: one, reasonable attempts to elicit voluntary disclosure are unsuccessful; two, there is a high probability of very serious harm; three, there is reason to believe disclosure will prevent the harm; and, four, disclosure is limited to the information necessary for diagnosis or treatment of another person.[45] However, it is not yet clear for legal purposes that

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42. *See* Audrey Heimler & Andrea Zanko, *Huntington Disease: A Case Study Describing the Complexities and Nuances of Predictive Testing of Monozygotic Twins*, 4 J. GENETIC COUNSELING 125; *see also* 5 J. GENETIC COUNSELING 47–50 (letter and replies to Heimler & Zanko, *supra*).

43. *See* Culver, *supra* note 28, at 97–122.

44. *See* ALICE WEXLER, MAPPING FATE: A MEMOIR OF FAMILY, RISK, AND GENETIC RESEARCH 12–13 (1995). The halting and ultimately unsuccessful efforts made by Alice Wexler's grandmother to inform Alice's father of the genetic risks associated with his impending marriage to Alice's mother illustrates the difficulties that many families experience in this area.

45. THE PRESIDENT'S COMMISSION FOR THE STUDY OF ETHICAL PROBLEMS IN MEDICINE AND BIOMEDICAL AND BEHAVIORAL RESEARCH, SCREENING AND COUNSELING FOR GENETIC CONDITIONS 44 (1983).

shared or imposed genetic risks come within this framework of analysis.[46]

In some instances, the problem is not a patient's or subject's limited disclosure of jointly relevant information, but the need for other reluctant family members to participate in research or clinical care. This is especially true in linkage studies, where the cooperation of many individuals is needed to identify genetic loci for disorders. By refusing to cooperate, one or more family members can effectively exercise a veto over work of benefit to their relatives. Conversely, some individuals may experience pressure bordering on coercion from relatives eager to have all family members participate in a study.[47] This problem becomes particularly acute in psychiatric genetics whenever some members of a family suffer from a compromised capacity to consent.[48] Whether coerced or not, participation in linkage studies may also inflict information on some family members for which they are unprepared.[49] Additional harms can result from publishing data from family studies when the family is unique enough to make identification of its members possible.[50]

Another side of this problem appears when parents request testing of their children for adult-onset disorders, such as Huntington's disease, or for asymptomatic carrier status for disorders like cystic fibrosis or X-linked Severe Combined Immune Deficiency. These requests can expose the child to potential psychosocial harms with little corresponding benefit for the child. They can also deprive the child of autonomy as an adult to request or refuse such testing.[51] For those reasons, several medical professional organizations have taken strong positions against acceding to such requests.[52] Those who defend such

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46. *See* Lori B. Andrews, *The Genetic Information Superhighway: Rules of the Road for Contacting Relatives and Recontacting Former Patients*, *in* HUMAN DNA: LAW AND POLICY 133, 133 (Bartha Maria Knoppers et al. eds., 1996); Marshall B. Kapp, *Ethical and Legal Implications of Advances in Genetic Testing Technology*, 1994 LEGAL MED. 305, 311.

47. *See* Lisa S. Parker & Charles W. Lidz, *Familial Coercion to Participate in Genetic Family Studies: Is There Cause for IRB Intervention?*, IRB: REV. HUMAN SUBJECTS RES., Jan.-Apr. 1994, at 6.

48. *See* David Shore et al., *Legal and Ethical Issues in Psychiatric Genetic Research*, 48 AM. J. MED. GENETICS 17 (1993).

49. *See* Peter S. Harper, *Research Samples from Families with Genetic Disease: A Proposed Code of Conduct*, 306 BRIT. MED. J. 1391 (1993).

50. *See* Madison Powers, *Publication-Related Risks to Privacy: Ethical Implications of Pedigree Studies*, IRB: REV. HUMAN SUBJECT RES., Jul.-Aug., 1993, at 7.

51. *See* Dena S. Davis, *Genetic Dilemmas and the Child's Right to an Open Future*, 28 RUTGERS L.J. 549, 549–92 (1997)

52. *See* AMA Council on Ethical and Judicial Affairs, *Testing Children for Genetic*

testing point to parental decision making rights regarding their children as well as tangible parental needs for purposes of future reproductive decision making or financial planning.[53] Here we see a clear and unresolved instance of possible familial conflict over access to genetic information. Parents exert their claims while genetic professionals potentially feel compelled to enter as fiduciaries on the child's behalf.[54]

A special familial problem of DNA-derived information access arises when an individual from whom that information has been gathered has died. Other family members may need access to the deceased's genetic test results for their own medical decision making. Since the deceased are not protected by federal human subjects regulations, no apparent legal obstacles exist for research organizations to share this information. Nevertheless, the deceased may have had strong views about the disposition of her or his genetic information. Distribution of this information to relatives who request it may also inflict harms on other surviving family members.[55]

The potential for familial conflicts and harms involving the collection of DNA calls into question the individual autonomy model that has dominated legal thinking in this area.[56] According to this model, the clinician or researcher has a primary obligation to an individual's welfare. Apart from exceptional circumstances, some stipulated by law,[57] the patient or subject must give consent and retains his or her confidentiality rights, even when disclosing information gathered during treatment or research is needed to prevent harm to innocent third parties.

In the broader context of treatment decisions where families share the economic and emotional (as opposed to medical) impact of decision

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Status, CODE OF MEDICAL ETHICS REPORTS, July 1995, at 47–57; ASHG/ACMG Boards of Directors, *Points To Consider: Ethical, Legal, and Psychosocial Implications of Genetic Testing in Children and Adolescents*, 57 AM. J. HUMAN GENETICS 1233–41 (1995).

53. *See* Mary Z. Pelias, *Duty to Disclose in Medical Genetics: A Legal Perspective*, 39 AM. J. OF HUMAN GENETICS 347, 349 (1991); Mary Z. Pelias and Susan H. Blanton, *Genetic Testing in Children and Adolescents: Parental Authority, the Rights of Children, and Duties of Geneticists*, 3 U. CHI. L. SCH. ROUNDTABLE 525–43 (1996).

54. The requirement of "minimal harm" that generally applies to all non-therapeutic research on children makes this conflict even more pressing and acute for genetic researchers. *See* 45 C.F.R. § 46.404 (1997).

55. *See* Ronald M. Green & A. Mathew Thomas, *Whose Gene Is It: A Case Discussion About Familial Conflict over Genetic Testing for Breast Cancer*, 6 J. GENETIC COUNSELING 245 (1997).

56. *See* Sonia M. Suter, *Whose Genes Are These Anyway? Familial Conflicts over Access to Genetic Information*, 91 MICH. L. REV. 1854 (1993).

57. JAMES C. BECK. CONFIDENTIALITY VERSUS THE DUTY TO PROTECT: FORESEEABLE HARM IN THE PRACTICE OF PSYCHIATRY (1990).

making, some scholars have called for replacing the patient-autonomy model with a family-centered model of decision making.[58] Whenever family members significantly disagree about the appropriate course of care for one of their members, this model resorts to family conferences with decision-making authority.

A similar approach may seem suitable to genetic decision making, where the family, rather than individual members, is often regarded as the "patient." However, we should be wary about such a fundamental change in our social paradigms. The traditional model appropriately privileges the relationship between the individual clinician or researcher and the patient/subject. Among other things, this model sustains trust, the vital element in patients' or subjects' willingness to enter the medical system. Enhanced communication alone resolves many family conflicts. Genetic counselors, in particular, are aware of the fact that conflicts over genetic information often reveal deeper processes of familial tension. Resolving the tension usually requires patience and understanding rather than externally imposed decisions.[59]

E. Community Impacts

A fifth distinctive aspect of DNA-derived information is that it is potentially shared by members of larger ethnic, racial, or other communities beyond the individual or family. Sickle-cell anemia is associated with persons of African descent, Tay-Sachs disease with persons of Ashkenazi Jewish heritage, and Mediterranean Fever with Armenians.[60] The history of eugenic abuses provides a frightening illustration of how easily group stigmatization can result from the misuse of such genetic information.[61] Increases in knowledge from DNA-derived information intensify the potential for these abuses and possibly

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58. *See* Jeffrey Blustein, *The Family in Medical Decision-making*, 23 HASTINGS CENTER REP. 6 (1993); James Hardwig, *What About The Family?* 20 HASTINGS CENTER REP. 5 (1990); Mark G. Kuczewski, *Reconceiving the Family: The Process of Consent in Medical Decisionmaking*, 26 HASTINGS CENTER REP. 30 (1996); James L. Nelson, *Taking Families Seriously*, 22 HASTINGS CENTER REP. 6 (1992).

59. *See* PATRICIA T. KELLY, DEALING WITH DILEMMA: A MANUAL FOR GENETIC COUNSELORS 99 (1977).

60. *See* TROY DUSTER, BACKDOOR TO EUGENICS 160–62 (1990).

61. *See* Daniel J. Kevles, *Out Of Eugenics: The Historical Politics of the Human Genome*, *in* THE CODE OF CODES: SCIENTIFIC AND SOCIAL ISSUES IN THE HUMAN GENOME PROJECT 3 (Daniel J. Kevles & LeRoy Hood eds., 1992); Kenneth L. Garver & Bettylee Garver, *Eugenics: Past, Present, and the Future*, 49 AM. J. HUMAN GENETICS 1109 (1991); Kenneth L. Garver & Bettylee Garver, *The Human Genome Project and Eugenic Concerns*, 54 AM. J. HUMAN GENETICS 148 (1994).

create new forms of stigmatization or discrimination. Serious harms for members of communities occurs if genetic information is utilized to reinforce prejudice against existing classes of people (so-called "demic" discrimination)[62] and/or to create new classes of genetic "untouchables."

Controversy surrounding the Human Genome Diversity Project highlights the fear that genetic medicine may intensify group prejudice.[63] This proposal to collect, preserve, and analyze genetic samples from people world-wide has raised genuine concerns that established genomic markers will become the defining factor in determining who belongs to a particular social group. If this occurs, these markers may serve to exclude individuals who lack defining markers or guarantee pariah status for others who possess them.

A similar concern of external group harm relates to the increasing interest in behavioral genetic disorders. Information regarding the genetic bases of particular conditions may reinforce stigmatizing stereotypes. While the information may be of medical importance, it might be used to support a genetic "determinism" that overlooks environmental contributions. This concern has informed discussions of the research concerning the genetics of alcoholism within the Native American community.[64] The concern has contrasted with the generally positive support for genetic research expressed by members of the National Alliance for the Mentally Ill.[65] Would the identification of genes linked to culturally or socially undesirable traits lead to prenatal "de-selection" if couples are pressured to screen and abort fetuses with these markers? This fear has been raised in the debate surrounding the so-called "gay" gene.[66]

Genetic research may also be used to generate new classes of "untouchables." For example, recent breast cancer research in the Ashkenazic Jewish community suggests that a BRCA mutation potentially predisposing one to breast and ovarian cancer exists in over two percent of this population.[67] Since a majority of carriers have a

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62. *See* Eric T. Juengst, *The Perils of Genetic Genealogy*, 10 CENTERVIEWS 1 (1996).

63. *See id.*

64. *See* INDIAN HEALTH SERVICES, DRAFT IHS GUIDELINES ABOUT THE COLLECTION AND USE OF RESEARCH SPECIMENS 1–8 (1996).

65. *See* Laura L. Hall, Severe Mental Illness, Genetics, and People, Presentation at the Institute of Medicine Discussion on Behavioral Genetics (July 17, 1996).

66. *See* DEAN HAMER & PETER COPELAND, THE SCIENCE OF DESIRE: THE SEARCH FOR THE GAY GENE AND THE BIOLOGY OF BEHAVIOR (1994).

67. *See* C. Oddoux et al., *The Carrier Frequency of the BRCA2 6174delT Mutation Among Ashkenazi Jewish Individuals Is Approximately 1%*, 14 NATURE GENETICS 188 (1996); Jeff P. Struewing et al., *The Carrier Frequency of the BRCA1 185delag Mutation*

mutation detectable by standard molecular techniques, it is possible to identify women with the mutation.[68] While researchers are only beginning to understand the long term benefits of this discovery, the immediate repercussions might be externally or internally imposed discrimination against women of Ashkenazic heritage. External discrimination may result from mandatory screening of Jewish females.[69] Those found to have the mutation, or even untested but suspected members of the group, might be denied employment or insurance because of apprehensions about their health status. Internal group stigmatization might occur from *within* Hasidic Jewish communities towards women found to have the mutation. Current screening initiatives in this population for Tay-Sachs disease and other recessive disorders base their success on voluntary compliance with the effort to prevent marriage between carriers. Since most marital matches in this community are pre-arranged, prevention efforts have been implemented with great success and with relatively little inconvenience for the couples involved.[70] However, in this same community women found to carry the dominant BRCA mutation might be relegated to a class of unsuitable marital partners. Worries about this possibility led U.S. Jewish leaders of the Dor Yeshorim program, which offers screening for recessive disorders to members of the Jewish community, to refuse to test for the BRCA mutations.[71] Concerns have also prompted requests for the National Human Genome Research Institute to develop guidelines for genetic research in this population. These concerns are likely to increase as genetic research is used to stratify levels of risk within populations.

Unfortunately neither federal regulations nor the common law adequately address community concerns. For example, federal guidelines explicitly prohibit consideration of the "possible long-range effects of applying knowledge gained in the research"[72] among the risks of research. Our long-standing legal focus on individual autonomy as

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Is Approximately 1 Percent in Ashkenazi Jewish Individuals, NATURE GENETICS 198 (1995); Jeff P. Struewing et al., *The Risk of Cancer Associated with Specific Mutations of BRCA1 and BRCA2 Among Ashkenazi Jews*, 336 N. ENG. J. MED. 1401 (1997).

68. *See* AMERICAN COLLEGE OF MEDICAL GENETICS, STATEMENT ON POPULATION SCREENING FOR BRCA-1 MUTATION IN ASHKENAZI JEWISH WOMEN (1996).

69. *See* Rothenberg, *supra* note 13, at 103.

70. *See* Etty Broide et al., *Screening for Carriers of Tay-Sachs Disease in the Ultraorthodox Ashkenazi Jewish Community in Israel*, 47 AM. J. MED. GENETICS 213 (1993).

71. *See* Personal Conversation with Rabbi Joseph Ekstein, Director of the Dor Yeshorim Program, in Brooklyn, N.Y. (February 3, 1997).

72. 45 C.F.R. § 46.111 (1997).

the basis of the physician-patient and researcher-subject relationships creates a further obstacle to considering the impact of genetic research on communities. Within such a paradigm, community values such as loyalty, integrity, and solidarity, are often missed or discounted.[73]

Finally, genetic concerns frustrate analogical comparisons to other areas of medical law or policy. The rationale of preventing the spread of disease that underlies policy in AIDS or communicable disease contexts seems unwarranted for predictive genetic testing since issues such as the controllability of the spread of the disease, treatability, or certainty of transmission may differ from the infectious disease context.[74] Thus, while solutions may not involve a full-scale abandonment of individual autonomy, the challenges of community-oriented thinking that genetics introduces into the framework of traditional legal considerations will prove especially challenging.

III. POLICY IMPLICATIONS

The preceding five features, when taken together, justify regarding DNA-derived information as different from other types of medical information. The issue of stored tissue samples provides an illustration of this difference. Pathologists are uncomfortable with new limitations on the use of tissue samples in research or other contexts.[75] They suggest the use of tissues gathered during medical care or surgery has resulted in important medical advances. They point to the problems of securing extensive consent from patients for the future disposition of tissue samples.

These reservations are reasonable where researchers gather tissue not subject to molecular analysis. However, as the DNA analysis of tissue increasingly becomes the norm, no guarantee exists that future studies will not invite significant harms for an expanding circle of people genetically related to the individual donor. As we have indicated, not even the anonymization of information derived from DNA analysis can guarantee full protection from these harms. This does not mean that individuals cannot or should not donate tissue that will be subject to molecular genetic analysis. However, it does place greater weight on the requirement of full and informed consent concerning the risks involved.

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73. *See* Thomas H. Murray, *Individualism and Community: The Contested Terrain of Autonomy*, 24 HASTINGS CENTER REP. 32–33 (1994).

74. *See, e.g.*, Kenneth E. Labowitz, *Beyond Tarasoff: AIDS and the Obligation to Breach Confidentiality*, 9 ST. LOUIS U. PUB. L. REV. 495, 512 (1990).

75. *See, e.g.*, Wayne W. Grody, *Molecular Pathology, Informed Consent, and the Paraffin Block*, 4 DIAGNOSTIC MOLECULAR PATHOLOGY 155 (1995).

It may also require thinking about the legitimate legal and ethical claims of family and community members to involvement in these decisions.

The uniqueness of DNA also has implications for the creation of DNA databases used for identification purposes by government agencies, such as the military. The Pentagon, for example, suggests that it would primarily use DNA samples for identifying the remains of personnel killed in the line of duty. While dental records and fingerprints already allow for some identification, the Pentagon claims that DNA databases provide a superior means of identification. Critics of the policy question the adequacy of privacy safeguards and the potential for abuse of DNA information.

The government's past track record with social security numbers provides genuine cause for concern. The original Social Security Act[76] claimed that social security numbers would be used primarily for the distribution of benefits. Today, computer systems are capable of linking our social security numbers with almost every aspect of our life. From law school admissions to legal infractions, the government has collected a "pedigree" of our life activities.[77] As the private sector becomes involved here, one must wonder what has become of the original Congressional guarantees of confidentiality and privacy.[78]

In light of the five features described above, significant safeguards should be enacted to ensure clear limitations on the use of such DNA registries. The military has made some progress in revising its policy by reducing the time the samples would be held from seventy-five to fifty years, by allowing soldiers to have their samples destroyed upon request after departure, and by requiring consent for military uses other than remains identification. However, the new policy still requires soldiers to submit to DNA sampling and permits DNA material to be turned over without consent when subpoenaed during the investigation or prosecution of a felony. This latter fact is especially troubling given that the Federal Bureau of Investigation has already started a national criminal DNA registry.[79]

Similarly, once samples are collected, it remains an open question whether any legal precedents would bar the military from converting the

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76. Social Security Act, ch. 531, § 205, 49 Stat. 624 (1935) (current version at 42 U.S.C.A. § 405 (West Supp. 1998).

77. *See* OFFICE OF TECHNOLOGICAL ASSESSMENT, 101ST CONG., GENETIC WITNESS: FORENSIC USES OF DNA TESTS 115 (1990).

78. *See* Social Security Act § 205.

79. The FBI already uses a computerized database to chart the frequency of certain genes in the U.S. population. *See* Rick Weiss, *DNA Takes the Stand*, 135 SCI. NEWS 74 (1989).

DNA samples to commercially profitable uses. *Norman-Bloodsaw v. Lawrence Berkeley Laboratory*,[80] in which the Ninth Circuit held that a state- and federally-operated employer can be held liable under both the U.S. and California Constitutions for unauthorized testing of its employees' genetic material (even when provided as part of a general physical examination), provides some support for the argument that the military could not profit from its DNA samples absent authorization. Further, in one of most notable cases on patenting human cell lines, *Moore v. Regents of the University of California*,[81] the California Supreme Court ruled that Moore, the patient plaintiff, stated a cause of action for breach of fiduciary duty and lack of informed consent where his physician failed to disclose his commercial research interest in Moore's cells before conducting a medical procedure. However, the *Moore* court also held that even where there was a lack of informed consent, the plaintiff failed to state a cause of action for conversion because he had no property interests in his cells after doctors removed them from his body.[82] Thus, absent the institution of additional safeguards, it is possible that courts will choose to follow *Moore*'s second holding, allowing the deference traditionally accorded to the military in the area of constitutional rights[83] to trump *Norman-Bloodsaw*'s authorization requirement.

The area of genetic testing for employment or insurance provides a final example of the importance of the policy implications of these five aspects of DNA-derived information. Those seeking to craft legal protections against discrimination in these areas, especially in the area of insurance, have frequently encountered a definitional problem. If we prohibit discrimination on the basis of genetic information, what counts as "genetic"? Many common disorders have a genetic basis. Is the gathering of a standard medical history from an applicant for life insurance therefore to be ruled out of bounds? Should the use of family histories, which also can be broadly construed as conveying genetic information, be banned?

An appreciation of the five features offered above suggests that an *initial* distinction should be made between medical tests that reveal

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80. 135 F.3d 1260 (9th Cir. 1998).

81. 793 P.2d 479, 485–86 (Cal. 1990).

82. *Id.* at 487–97.

83. *See, e.g.*, Goldman v. Weinberger, 475 U.S. 503 (1986) (deferring to military regulation that prevented Orthodox Jew from wearing yarmulke while in uniform); Rostker v. Goldberg, 453 U.S. 57 (1981) (denying Fifth Amendment due process and equal protection challenge to selective service policy requiring only men to register for the draft).

existing health problems, and DNA molecular analysis that only predict disease susceptibility without establishing severity or age of onset.[84] These latter types of genetic testing are not simply "an extension of diagnostic tests that describe people's current condition."[85] DNA-based risk classification schemes overlook environmental factors that affect a person's health.[86] As one commentator notes, "in our excitement we forget that there's still the nurture part of the equation. It hasn't gone away just because we have the opportunity to understand the nature part more quantitatively."[87] Risk classification schemes also neglect to account for the possibility of disease prevention through the early identification and treatment of a genetic disorder. Similarly, though there is little evidence to support such a claim at the present time, one cannot completely dismiss the scientific promise of standard cures for genetic disorders through genetic therapy.

Should legislation against genetic discrimination extend beyond DNA analysis to these other sources of genetic information, such as family histories? Some authors have advocated this position.[88] This question requires careful study in terms of its feasibility in the context of existing underwriting practices. However, we suggest that an appreciation of these five features of DNA explains why, *at a minimum*, information derived directly from molecular analysis of DNA should be singled out for special protection by legislation. Because of the prodigious amount of information that molecular DNA-analysis can provide, not just about the individuals tested, but about their relatives and others with whom they share similar genetic material, there is good reason for placing special emphasis on tests involving direct analysis of DNA. By prohibiting discrimination based on testing of this sort, we can call a halt to an ethically invasive procedure with virtually unlimited risks for many people outside the testing context before this procedure becomes established and made the basis of intense commercial competition.

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84. *See* Susan O'Hara, *Comment, The Use of Genetic Testing in the Health Insurance Industry: The Creation of a "Biologic Underclass,"* 22 SW. U. L. REV. 1211 (1993); Richard Saltus, *Genetic Clairvoyance*, BOSTON GLOBE, Jan. 8, 1995, Magazine at 14, 26.

85. *Genetic Testing; Protecting the Rights of the Insured*, STAR TRIB., Feb. 14, 1995, at 12A.

86. *See id.*

87. Siebert, *supra* note 4, at 94; *see also* Jane E. Brody, *Good Habits Outweigh Genes as Key to a Healthy Old Age*, N.Y. TIMES, Feb. 28, 1996, at C9.

88. *See* Hudson et al., *supra* note 11, at 393.

Admittedly, drawing a line between molecularly-derived DNA and other forms of "genetic" information creates some anomalies.[89] An individual's relatives may be just as imperiled by disclosure of a full family history to an insurance company as by her submitting to a buccal swab for DNA analysis. Nevertheless, the five features we have signaled, taken together, justify drawing one bright line distinction *at least* at the point where molecular DNA analysis begins. No medical examination of a patient and no family history permits the degree of identification of genetic susceptibilities in the individual, kin, and descendants that is made possible by the direct analysis of DNA. Without prejudging the value of a broader definition of genetics in this context, qualitative and quantitative considerations thus combine to recommend placing this kind of testing in a class by itself.

IV. CONCLUSION

Until just a few years ago, genetics was primarily a medical specialty focusing on rare inherited single-gene disorders that affected only a small number of people. Today, as tests for hundreds of genetic markers are identified that indicate inheritance, predisposition, or susceptibility to not only purely genetic diseases, but also to complex disorders suspected of having a genetic component,[90] all of us are potentially involved in genetic medicine.

In the future we can expect that an increasing number of research protocols and clinical procedures will involves genetics. Investigators, IRBs, and patients themselves must all become increasingly sophisticated about the special risks associated with genetic medicine. The beginning of this effort is an understanding of the distinctive informational nature of DNA and the fact that, in some ways, it is a shared possession of families and communities. With this widened perception of risks, we can anticipate and reduce the harms of genetic research and genetic medicine.

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89. *See* Joseph S. Alper & Jonathan R. Beckwith, *Distinguishing Genetic from Nongenetic Medical Tests: Some Implications for Antidiscrimination Legislation*, 4 SCI. & ENGINEERING ETHICS 141 (1998).

90. *See* NEIL A. HOLTZMAN, PROCEED WITH CAUTION: PREDICTING GENETIC RISKS IN THE RECOMBINANT DNA ERA 303 (1989).