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JUDGING GENES: IMPLICATIONS OF THE SECOND GENERATION OF GENETIC TESTS IN THE COURTROOM

DIANE E. HOFFMANN* & KAREN H. ROTHENBERG**

The use of DNA tests for identification has revolutionized court proceedings in criminal and paternity cases. Now, requests by litigants to admit or compel a second generation of genetic tests—tests to confirm or predict genetic diseases and conditions—threaten to affect judicial decisionmaking in many more contexts. Unlike DNA tests for identification, these second generation tests may provide highly personal health and behavioral information about individuals and their relatives and will pose new challenges for trial court judges. This Article reports on an original empirical study of how judges analyze these requests and uses the study's results to inform the construction of a multi-factorial decision matrix to assist judges evaluate the appropriate role of this information in legal proceedings. Through this analytical framework, the Article illuminates doctrinal and theoretical tensions in existing criminal, evidence, constitutional, and tort law that are likely to surface when efforts are made to apply current law in these areas to cases involving the use of health-related genetic tests. In addition, the Article examines the broader implications of the wide-scale use of these tests in court proceedings and argues that appellate judges and policymakers, who establish procedural rules governing litigation, will need to consider the collateral consequences of such use. Moreover, changes in existing doctrines and rules may be necessary to accommodate challenges to underlying legal theories and societal values, such as privacy and responsibility, generated by the use of these tests in the courtroom.

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I. INTRODUCTION

Assume you are a judge presiding over the following two cases:

Case 1. In a non-capital sentencing proceeding of a twenty-eight-year-old man convicted of a violent homicide, the prosecutor requests that you compel the defendant to have a genetic test for a gene mutation that predisposes an individual to exhibit bouts of extreme rage. Between fifty and sixty percent of individuals with this mutation exhibit these behavioral abnormalities before the age at which the defendant committed the crime. With this test result the prosecutor wishes to show that the defendant has a proclivity toward violence (“future dangerousness”). The defendant objects to being compelled to have the test.

Case 2. In the damages phase of a products liability case, the defendant requests that you compel the twenty-one-year-old plaintiff to have a genetic test

for Neurofibromatosis type II (NF-2), as his father died of the disease at the age of forty. NF-2 is a rare, inherited disorder characterized by the development of benign tumors on both auditory nerves and by the development of malignant central nervous system tumors. The disease is unrelated to the injury caused by the defendant's product. Virtually everyone who has the mutation develops the disease; however, the severity of symptoms differs from person to person, and the gene is not predictive of such disparities. An expert testifies that the average age of onset of NF-2 is between eighteen and twenty-four and that the average age of death of those with the disease is thirty-six. At present, the plaintiff has no symptoms of the disease.

Would you compel the test in either case?

Soon, judges across the country may face questions similar to the ones posed by these two hypothetical scenarios. Genetic tests for over 1,000 diseases are currently available in clinical settings, and tests for approximately 300 more diseases are being used in research contexts.¹ The mapping of the human genome, completed in 2003,² has generated a host of new and perplexing questions about the meaning and appropriate use of health-related genetic tests.

At its core, the purpose of the Human Genome Project (HGP) was to improve our understanding of health and genetic disease and to develop diagnostic tests, therapies, and preventive measures to improve the quality of life for individuals who would otherwise be debilitated by such diseases.³ Early on in the genesis of the HGP, however, it was clear that information gleaned from genetic research could also

1. GeneTests, <http://www.genetests.org/> (last visited May 19, 2007). As of May 19, 2007, tests for 1,101 diseases were available for use in clinical settings and an additional 291 tests for research purposes. *Id.*

2. National Human Genome Research Institute, All About The Human Genome Project (HGP), <http://www.genome.gov/10001772> (last visited May 19, 2007).

3. National Human Genome Research Institute, An Overview of the Human Genome Project, <http://www.genome.gov/12011238> (last visited May 19, 2007); *see also* National Human Genome Research Institute, The Human Genome Project Completion: Frequently Asked Questions, <http://www.genome.gov/11006943> (last visited May 19, 2007) (projecting that "genome-based research will eventually enable medical science to develop highly effective diagnostic tools, to better understand the health needs of people based on their individual genetic make-ups, and to design new and highly effective treatments for disease"). The Institute further notes:

Individualized analysis based on each person's genome will lead to a very powerful form of preventive medicine. We'll be able to learn about risks of future illness based on DNA analysis. Physicians, nurses, genetic counselors and other health-care professionals will be able to work with individuals to focus efforts on the things that are most likely to maintain health for a particular individual. That might mean diet or lifestyle changes, or it might mean medical surveillance. But there will be a personalized aspect to what we do to keep ourselves healthy. Then, through our understanding at the molecular level of how things like diabetes or heart disease or schizophrenia come about, we should see a whole new genera-

be employed for non-health-related purposes.⁴ In response to concerns about ethical issues stemming from the Project, in 1990 the National Human Genome Research Institute established its Ethical, Legal and Social Implications (ELSI) Research Program.⁵ One of the goals of the ELSI program was to consider the non-clinical uses of new genetic information.⁶

Policymakers, legal academics, and the ELSI program have focused on the potential use of health-related genetic test results for employment and insurance discrimination and argued for legislation to prevent such improper use.⁷ Utilizing genetic tests to determine the health status or predisposition to disease of courtroom litigants has received relatively less attention. This lack of attention contrasts sharply with the legal system's enthusiastic embrace of DNA tests for purposes of identifying, or excluding from consideration, the perpetrator of a crime or the father of a child.⁸ In just twenty years the use

tion of interventions, many of which will be drugs that are much more effective and precise than those available today.

Id.

4. See Francis S. Collins et al., *A Vision for the Future of Genomics Research*, 422 NATURE 835, 843 (2003) (explaining that "genomic information is not limited to the arenas of biology and of health": the range of additional users could likely include "the life, disability and long-term care insurance industries, the legal system, the military, educational institutions and adoption agencies").

5. National Human Genome Research Institute, *The Planning and Evaluation History of the Ethical, Legal and Social Implications (ELSI) Research Program*, <http://genome.gov/10001754> (last visited May 19, 2007).

6. National Human Genome Research Institute, *The Ethical, Legal and Social Implications (ELSI) Research Program*, <http://www.genome.gov/10001618> (last visited May 19, 2007).

7. See, e.g., Kathy L. Hudson et al., *Genetic Discrimination and Health Insurance: An Urgent Need for Reform*, 270 SCI. 391, 391, 393 (1995) (noting that health insurance providers could use genetic information to discriminate against individuals, and listing recommendations for lawmakers to avoid such discrimination); Karen Rothenberg et al., *Genetic Information and the Workplace: Legislative Approaches and Policy Challenges*, 275 SCI. 1755, 1755-57 (1997) (warning of the societal risks of allowing employers to use genetic information to influence employment decisions and describing federal and state legislative initiatives aimed at addressing genetic discrimination in the workplace); Karen H. Rothenberg & Sharon F. Terry, *Before It's Too Late—Addressing Fear of Genetic Information*, 297 SCI. 196, 197 (2002) (arguing for a comprehensive federal statute to reduce possible abuse of genetic information by employers and standardize the current patchwork of state laws). Numerous state legislatures have made efforts, with varying degrees of success, to pass legislation addressing this issue. Recently, after over a decade of proposals, the U.S. House of Representatives passed the Genetic Information Nondiscrimination Act of 2007 (GINA).

8. See Warren Richey, *DNA Tests Gain Ground as Legal Defense*, CHRISTIAN SCI. MONITOR, Jan. 31, 2006, at 3 (stating that using DNA tests to exonerate wrongly convicted individuals "is part of an evolution taking place across the country in which prosecutors and lawmakers who were once suspicious of the DNA challenges are now increasingly embracing the new technology as a backstop in the criminal justice system"); President's DNA Initiative, *History of Forensic DNA Analysis*, <http://www.dna.gov/basics/analysishistory> (last visited May

of such tests has become widely accepted and has revolutionized court proceedings related to some criminal and most paternity suits.⁹ To some extent, the availability of these tests eliminates the need for “judging” because the tests—if performed accurately—provide virtually conclusive evidence of identity.¹⁰

Coming on the heels of DNA tests for purposes of identification, these health-related tests might be considered a “second generation” of genetic tests, at least in the courtroom setting. This new use of genetic tests, like other scientific advancements, will challenge judges and juries as they struggle to understand the complexities of this new scientific information, which has the potential for both misinterpretation and confusion. The use of technology for this new purpose also raises issues that go beyond legal procedures and scientific methods and poses value-laden policy questions straddling the intersection of law, science, and public policy.¹¹ The increased use of technology also comes at a time when judges are under attack for what some label an “inability” to adequately understand new technologies and scien-

19, 2007) (“The past 15 years have seen tremendous growth in the use of DNA evidence in crime scene investigations as well as paternity testing. Today over 150 public forensic laboratories and several dozen private paternity testing laboratories conduct hundreds of thousands of DNA test[s] annually in the United States.”).

9. See, e.g., The Justice Project, Expanding Post-Conviction DNA Testing, <http://www.thejusticeproject.org/solution/post-conviction-dna.html> (last visited May 19, 2007) (“First introduced in a United States court in 1986, forensic DNA testing has profoundly enhanced the truth-seeking function of the criminal justice system and revolutionized the way we determine guilt or innocence.”); National Human Genome Research Institute, DNA Forensics, <http://www.genome.gov/11510211> (last visited May 19, 2007) (“The advances in DNA testing and technology have revolutionized criminal forensics. Primarily, DNA evidence is used for identification of either the victim or the perpetrator in criminal cases. However, new DNA procedures are being developed to take criminal forensics to another level.”); Victor Walter Weedn & John W. Hicks, *The Unrealized Potential of DNA Testing*, NAT’L INST. JUST., June 1998, at 1, <http://www.ncjrs.gov/pdffiles/170596.pdf> (“Despite early controversies and challenges by defense attorneys, the admissibility of DNA test results in the courtroom has become routine. More than 200 published court opinions support this use, and DNA testing standards have been developed and promulgated.”).

10. See, e.g., Sheila Jasanoff, *Just Evidence: The Limits of Science in the Legal Process*, 34 J.L. MED. & ETHICS 328, 330–31 (2006) (“DNA profiling emerged in the . . . twentieth century as the nearest thing to a failsafe method of identification in the toolkit of the forensic sciences. It came close to realizing the prosecutor’s dream of a method for revealing a party’s guilt or innocence with no possibility of error.”).

11. See SHEILA JASANOFF, *SCIENCE AT THE BAR*, at xv (1995) (describing the questions raised by new technologies in the courtroom as “situated at the intersection of law, science, politics, and public policy”).

tific concepts.¹² Some of these critics have even argued for specialty courts (e.g., science or health courts).¹³

In court proceedings, judges are the final arbiters of whether genetic test results will play a role in any given case: judges decide whether a test should be compelled as well as whether a test result should be admitted into evidence. The potential impact of decisions to admit or compel health- or behavior-related genetic tests are wide ranging. How genetic information is used in the courts in these contexts may determine, among other things, whether individuals will be: (1) compensated for their medical costs and pain and suffering in malpractice, products liability, or toxic tort litigation; (2) hired to perform a job; (3) able to adopt a child or obtain child custody after divorce or separation; or (4) held criminally responsible. In the context of malpractice, decisions regarding genetic tests may also deter-

12. See Stephen Breyer, *Introduction to FEDERAL JUDICIAL CENTER, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 4* (2d ed. 2000), available at [http://www.fjc.gov/public/pdf.nsf/lookup/sciman00.pdf/\\$file/sciman00.pdf](http://www.fjc.gov/public/pdf.nsf/lookup/sciman00.pdf/$file/sciman00.pdf) (“[M]ost judges lack the scientific training that might facilitate the evaluation of scientific claims or the evaluation of expert witnesses who make such claims.”); Sophia I. Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post-Daubert World*, 25 LAW & HUM. BEHAV. 433, 453–55 (2001) (concluding from survey results that “although judges overwhelmingly endorse the active gatekeeping role defined by *Daubert* [*v. Merrell Dow Pharmaceuticals, Inc.*], many may lack the scientific literacy necessitated by *Daubert*”); *Introduction to Symposium, Translating Science into Law: Lessons from Doctors, Judges, and Lawyers About the Use of Medical Evidence in the Courtroom*, 36 NEW ENG. L. REV. 573, 573 (2002) (noting that an “overwhelming majority of the legal community has little knowledge of even basic scientific language or methodology”); Paul S. Miller et al., *Daubert and the Need for Judicial Scientific Literacy*, 77 JUDICATURE 254, 260 (1994) (“[*Daubert*] has not amplified on how judges—often viewed as ‘generalists’ with massive demands placed on their limited time—are to reach the expected level of scientific literacy.”). *But see* David S. Caudill & Lewis H. LaRue, *Why Judges Applying the Daubert Trilogy Need to Know About the Social, Institutional, and Rhetorical—and Not Just the Methodological—Aspects of Science*, 45 B.C. L. REV. 1, 8 (2003) (criticizing the Gatowski survey as an inaccurate representation of judges’ understanding of science).

13. See, e.g., LeRoy L. Kondo, *Untangling the Tangled Web: Federal Court Reform Through Specialization for Internet Law and Other High Technology Cases*, 2002 UCLA J.L. & TECH. 1, 47–53, 62–65 (2002), <http://www.lawtechjournal.com/archives.php> (arguing that specialized courts will increase uniformity and decrease forum shopping); Edward V. Di Lello, Note, *Fighting Fire with Firefighters: A Proposal for Expert Judges at the Trial Level*, 93 COLUM. L. REV. 473, 502–03 (1993) (“Justice Scalia has suggested that adjudication by generalist judges of specialized issues clogs the federal docket and that specialized adjudication might be the solution to this problem.”); COMMON GOOD, AN URGENT CALL FOR SPECIAL HEALTH COURTS (2005), <http://cgood.org/assets/attachments/130.pdf> (setting forth arguments for health courts and highlighting the proposal’s major supporters).

Maryland and Ohio courts recently launched an initiative called the Advanced Science and Technology Adjudication Resource Center (ASTAR). ASTAR is attempting to create a national cadre of judges who will be experts on recent advances in medicine and other scientific fields. Press Release, Maryland Judiciary, Maryland Judiciary Takes Leading Role in Preparing Judges for Science and Technology Issues (Oct. 25, 2005), <http://www.courts.state.md.us/press/2005/pr10-25-05a.html>.

mine whether a health care provider is liable for negligence. In all cases, the use may affect *ex ante* decisions by individuals about whether to obtain genetic tests from their health care providers or participate in genetic research. When a genetic test is compelled, it may have detrimental psychological impacts on the adult or child tested and their potentially affected relatives.

In Part II of this Article, we report on cases in which a party requested a judge to order or admit into evidence a health-related genetic test. These cases include reported judicial opinions, references to such cases in the literature, and cases reported in a database of settlements and jury verdicts. In Part III, we present the results of our survey of state and federal trial court judges who were asked how they would respond to a series of requests to admit or compel a genetic test for health-related purposes in a variety of hypothetical cases. To our knowledge, this is the first empirical study that attempts to discern judicial perspectives on this new use of genetic tests.

In Part IV of the Article, we provide an analytical framework (“decision matrix”) for judicial decisionmaking in these cases, including considerations of the specific context of the case, the purpose of the test (i.e., to determine culpability, causation, damages, or sentencing), and factors unique to these types of genetic tests and the genetic condition at issue. These factors are in part descriptive of what judges said they considered in their responses to the hypothetical cases we posed to them, but they also go beyond these considerations to build a more robust and prescriptive framework for judicial decisionmaking. In addition, the analysis illuminates doctrinal and policy tensions in existing criminal, evidence, constitutional, and tort law—tensions that surface when current doctrine is applied to cases involving the use of health-related genetic tests.

Finally, in Part V, we look beyond the impact of judicial decisionmaking to the broader societal issues at stake. In this Part we explore the competing objectives that factor into decisions to admit or compel health-related genetic tests. These objectives include technical accuracy, fair and just resolution of disputes, the preservation of traditional notions of responsibility, and the protection of privacy. We conclude that the in-court use of these “second generation” genetic tests, in contrast to the first generation tests used for identity, raise unique new challenges for judges who must decide whether to permit the evidence. Furthermore, we believe that appellate judges, legislators, and policymakers who establish evidentiary and procedural rules will need to consider whether the benefits of using second generation

genetic tests in the courtroom are worth the collateral consequences to the legal system and our society.

II. THE SECOND GENERATION OF GENETIC TESTS IN THE COURTROOM—GENETIC TESTS FOR HEALTH AND BEHAVIORAL TRAITS

Over the last decade and a half scientists have made great progress in the development of genetic tests to determine whether individuals have a genetic condition and to assess their risk of developing a genetic disease.¹⁴ Most genetic tests have been developed to assist in diagnosis, treatment, or prevention of physical disease. Some researchers, however, have also suggested more controversial genetic links to aggression, criminality, and addiction and have hinted at the development of genetic tests to assist in identifying individuals who may have a genetic proclivity to these traits and conditions.¹⁵

As the technology has developed, a number of scholars have predicted that courts will admit genetic tests into evidence to determine an individual's health status or predisposition to certain diseases or behavioral traits.¹⁶ It appears, however, that the introduction of these

14. See GeneTests, *supra* note 1. In addition, scientists have identified an ever-increasing number of genetically based diseases. Economic & Social Research Council, Facts and Figures, The Human Genome Project, fig.1, <http://www.esrc.ac.uk/ESRCInfoCentre/facts/index47.aspx?ComponentId=12670&SourcePageId=12641> (last visited May 19, 2007). For a continuously updated database of human genes and genetic disorders, see OMIM (Online Mendelian Inheritance in Man), <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=OMIM> (last visited May 19, 2007).

15. See, e.g., Natalie Angier, *Matter Over Mind? The Curse of Living Within One's Genes*, N.Y. TIMES, Dec. 18, 1994, § 4, at 1 (noting that some researchers have suggested "candidate genes" for aggression and criminality); Human Genome Project Information, http://www.ornl.gov/sci/techresources/Human_Genome/elsi/behavior.shtml#4 (last visited May 19, 2007) (explaining that researchers have asserted claims for a genetic basis of aggression and impulsivity).

16. In 1990, Mark Ellinger predicted that while "so far courts have dealt with only one relatively narrow application of DNA diagnostic technology, 'DNA fingerprinting,' a much broader array of applications inevitably will need to be addressed." Mark S. Ellinger, *DNA Diagnostic Technology: Probing the Problem of Causation in Toxic Torts*, 3 HARV. J.L. & TECH. 31, 32 (1990) (footnote omitted). Ellinger focused on the possible uses of health- and behavior-related DNA testing in toxic tort litigation. *Id.* at 31–32; see also Mark A. Rothstein, *The Impact of Behavioral Genetics on the Law and the Courts*, 83 JUDICATURE 116, 119 (1999) ("Because of the adversary system, it is virtually certain that parties in both criminal and civil cases will assert behavioral genetic arguments . . .").

In 1999, some scholars predicted that "[a]s testing methodologies become more sophisticated, the use of genetic test results is likely to expand, particularly in toxic tort litigation, to provide evidence of causation." Randi B. Weiss et al., *The Use of Genetic Testing in the Courtroom*, 34 WAKE FOREST L. REV. 889, 889 (1999).

Subsequent articles discussed the use of genetic tests in tort cases, in particular in malpractice, toxic tort, and products liability litigation. See, e.g., Gary E. Marchant, *Genetic*

second generation genetic tests in litigation has been relatively slow. There have been few judicial opinions (published or unpublished) regarding the admission or compulsion of genetic tests for the purpose of providing health information about one of the parties. Despite the small number of reported judicial opinions discussing the use of health- and behavior-related genetic tests, databases of settlements and jury verdicts paint a picture of the types of cases in which such tests are being used. Thus far, the majority are torts cases.

A. Tort Cases—*The Tip of the Iceberg*

In the torts context, it appears that health-related genetic tests are most often being used in medical malpractice cases involving birth injury. Typically in these cases, parents sue their obstetrician, asserting that the physician's negligence during labor and delivery caused their newborn's disabilities. The physician argues that the newborn's disabilities are due to a genetic condition, and may seek to compel and admit into evidence the results of genetic tests performed on the newborn.¹⁷

Susceptibility and Biomarkers in Toxic Injury Litigation, 41 JURIMETRICS 67 (2000) (detailing how genetic tests can be employed in toxic injury litigation); Anthony S. Niedwiecki, *Science Fact or Science Fiction? The Implications of Court-Ordered Genetic Testing Under Rule 35*, 34 U.S.F. L. REV. 295, 296 (2000) (discussing the implications of DNA tests in civil cases); Susan R. Poulter, *Genetic Testing in Toxic Injury Litigation: The Path to Scientific Certainty or Blind Alley?*, 41 JURIMETRICS 211 (2001) (noting that genetic testing "could become an important part of the proof of causation in toxic injury cases" and discussing the implicated scientific, ethical, and legal issues).

In addition to the use of genetic tests in tort litigation, some scholars have discussed or suggested the use of such tests in criminal proceedings for the purposes of conviction or sentencing. *E.g.*, Symposium, *The Impact of Behavioral Genetics on the Criminal Law*, 69 LAW & CONTEMP. PROBS. 1 (2006); Paul S. Appelbaum, *Behavioral Genetics and the Punishment of Crime*, 56 PSYCHIATRIC SERVICES 25 (2005); Deborah W. Denno, *Legal Implications of Genetics and Crime Research*, in GENETICS OF CRIMINAL AND ANTISOCIAL BEHAVIOUR 248 (Gregory R. Bock & Jamie A. Goode eds., 1996); Marcia Johnson, *Genetic Technology and Its Impact on Culpability for Criminal Actions*, 46 CLEV. ST. L. REV. 443 (1998); Cecilee Price-Huish, Comment, *Born to Kill? "Aggression Genes" and Their Potential Impact on Sentencing and the Criminal Justice System*, 50 SMU L. REV. 603, 612–25 (1997).

Others have speculated about the use of genetic tests in the employment setting if a plaintiff wishes to claim that he or she has a genetic condition or predisposition that is protected under the Americans with Disabilities Act (ADA). *E.g.*, Mark S. Dichter & Sarah E. Sutor, *The New Genetic Age: Do Our Genes Make Us Disabled Individuals Under the Americans With Disabilities Act?*, 42 VILL. L. REV. 613 (1997); William M. Tarnow, *Genetic and Mental Disorders Under the ADA*, 2 DEPAUL J. HEALTH CARE L. 291, 320–22 (1998).

17. *See, e.g.*, *Bennett v. Fieser*, No. 93-1004-MLB, 1994 WL 542089, at *2 (D. Kan. Feb. 25, 1994) (ordering the plaintiff child to give blood for genetic testing); *Dodd-Anderson v. Stevens*, Nos. 92-1015-MLB, 92-1016-MLB, 1993 WL 273373, at *1 (D. Kan. May 4, 1993) (same); *Harris v. Mercy Hosp.*, 596 N.E.2d 160, 163 (Ill. App. Ct. 1992) (holding that the trial court did not abuse its discretion when it granted the defendant doctor's motion to compel the plaintiff to submit to genetic testing).

Courts have also admitted genetic test results in a small number of toxic torts/product liability cases.¹⁸ In those cases, defendants have argued that the plaintiff's injuries are genetically based and seek to use genetic test results to establish that exposure to a toxic or harmful substance or product was *not* the cause of the plaintiff's injuries. In a few cases, plaintiffs have sought to introduce a negative test result to refute the defendant's claim. While parties are beginning to introduce actual genetic test results in these contexts, it is still more often the case that parties will introduce non-test-based genetic information¹⁹ through expert testimony often attempting to mount a "genetics defense."²⁰

In a small number of toxic tort cases, parties have sought to use biomarkers²¹ to help determine the impact of a toxic exposure on a specific individual's development of a disease or injury.²² Several of

18. See, e.g., *Severson v. Allied Chems. Co.*, No. 1-90-CV-698517 (Cal. Super. Ct. Dec. 18, 1995) (ordering genetic testing to show whether a genetic disorder or the mother's exposure to a chemical solvent at work during pregnancy was the cause of plaintiff-child's mental retardation); *Lawyers Await Written Order on DNA Testing in California Case*, 3 MEALEY'S EMERGING TOXIC TORTS, Apr. 21, 1994, at 6 (reporting on *Severson*).

19. See *Hudson et al.*, *supra* note 7, at 393 (defining genetic information as "information about genes, gene products, or inherited characteristics that may derive from the individual or a family member").

20. See, for example, *Jones v. NL Industries*, No. 4:03CV229-M-B, 2006 U.S. Dist. LEXIS 33744 (D. Miss. Aug. 4, 2006), a case in which five families sued a lead paint manufacturer claiming that lead poisoning caused their children's mental disabilities. The manufacturer argued that the problems were genetically based and won the case. See Shelia Byrd, *Mississippi Families Lose Suit Against Lead Paint Maker*, INS. J., Aug. 7, 2006, <http://www.insurancejournal.com/news/southeast/2006/08/07/71267.htm>. An expert for NL Industries testified that "she conducted a detailed examination of each of the children involved in the case and formed a genetic pedigree from her studies," but did not introduce genetic test results. Mary Margaret Miller, *Lead Paint Trial*, GREENWOOD COMMONWEALTH, Aug. 1, 2006, <http://www.zwire.com/site/news.cfm?brd=1838> (search "Advanced search" using "Lead Paint Trial" for Headline and "2006" for the date). The plaintiffs' attorney in the case noted that "the children were tested for Fragile X, a genetic condition that could cause inherited mental impairment, but the tests revealed normal genetic baselines." Shelia Byrd, *Parents Angered by Defense in Lead Case*, SEATTLE TIMES, July 14, 2006, <http://seattletimes.nwsourc.com> (search "Parents angered by defense in Lead Case"). For a similar case, see *Wintz v. Northrop Corp.*, 110 F.3d 508, 510 (7th Cir. 1997) (upholding summary judgment for defendants where plaintiffs alleged that mother's exposure to bromide during pregnancy caused her child's developmental problems but defendants argued that the child's genetic defect was the sole cause of the child's injury).

21. Biomarkers are "anatomic, physiologic, biochemical, or molecular parameters associated with the presence and severity of specific disease states . . . [and] are detectable and measurable by a variety of methods including physical examination, laboratory assays and medical imaging." Massachusetts General Hospital Center for Biomarkers in Imaging, *Frequently Asked Questions*, <http://www.biomarkers.org/NewFiles/faqs/definition.html> (last visited May 19, 2007).

22. See Bob Van Voris, *Tort Lawyers Discover the Power of Genetics*, NAT'L L.J., Sept. 14, 1998, at A1 (reporting that entrepreneurs have already taken advantage of this opportu-

these cases have involved worker allegations that exposure to benzene led to their cancer. In these cases, plaintiffs have attempted to introduce evidence showing chromosomal damage due to benzene exposure (which, they argued, causes a unique type of chromosomal damage, i.e., leaves a distinct “fingerprint”).²³

Genetic test results might also play a role in the damages portion of a civil case. While courts typically begin their determination of life expectancy with a standard mortality table, courts often consider a variety of other information that plaintiffs or defendants may introduce in an attempt to determine a plaintiff’s life expectancy and lifetime earnings.²⁴ Both evidence of a diagnosed illness and behaviors leading to diminished life expectancy, such as use of drugs, alcohol, or cigarettes, may be admissible.²⁵ Some legal academics have asserted that “[i]f evidence of cigarette smoking is admissible to show that the plaintiff’s life expectancy is lessened . . . , then evidence that the plaintiff was genetically predisposed to such a disorder also would seem to be admissible.”²⁶ Nonetheless, we did not find any judicial opinion discussing the use of genetic tests for the purpose of determining damages.

Although relatively few judicial opinions address a judge’s decision to admit or compel genetic tests for the purpose of determining a party’s health status, a search of the LexisNexis database, *Jury Verdicts*

nity. One company, Benchmark Genetics, established in 1997 and apparently out of business in 2006, collected DNA samples from employees whose jobs exposed them to hazardous chemicals, storing them for the day when they might have to use them as evidence of changes in genetic structure in a personal injury lawsuit.).

23. Courts have responded inconsistently to this argument. In one case, two defense experts disputed plaintiff’s claim that benzene caused his leukemia by offering their opinions that the plaintiff’s chromosomal changes did not match the chromosomal damage connected to benzene exposure, the “benzene fingerprint.” *Leukemia Death Action Involving Benzene Exposure Settles In West Virginia*, 7 MEALEY’S EMERGING TOXIC TORTS, Nov. 6, 1998, at 26 (reporting on *Lavender v. Bayer Corp.*, No. 93-C-226K (W. Va. Cir. Ct. Oct. 12, 1998)). The judge excluded both testimonies on the grounds that the theory lacked a sound scientific basis. *Id.* In another case, however, the court admitted into evidence the defendant’s expert testimony that the chromosomal changes associated with benzene were not apparent in plaintiff’s leukemia cells. See *Shell Oil Wins Defense Verdict In Leukemia Case; Court Allows Testimony On Benzene ‘Fingerprint,’* 7 MEALEY’S EMERGING TOXIC TORTS, Apr. 24, 1998, at 4 (reporting on *Wells v. Shell Oil Co.*, No. 5:96cv282 (E.D. Tex. Mar. 2, 1998)).

24. Mark A. Rothstein, *Preventing the Discovery of Plaintiff Genetic Profiles by Defendants Seeking to Limit Damages in Personal Injury Litigation*, 71 IND. L.J. 877, 885–86 (1996) [hereinafter Rothstein, *Preventing the Discovery*]; Mark A. Rothstein, *Should Genetic Information Be Used to Predict Life Expectancy of Plaintiffs in Torts Cases?*, HOUS. LAW., Sept./Oct. 1996, at 50 [hereinafter Rothstein, *Life Expectancy*].

25. Rothstein, *Life Expectancy*, *supra* note 24, at 50.

26. Rothstein, *Preventing the Discovery*, *supra* note 24, at 886.

and Settlements, Combined,²⁷ between January 1, 1995 and December 31, 2005, yielded 258 cases where genetic tests or conditions were mentioned.²⁸ Of those 258, over half (171) appeared to involve the use of genetic information or genetic tests as a basis for determining liability or damages.²⁹ Ultimately, we were able to confirm whether genetic testing was used in 127 of those cases.³⁰

Of those 127 cases, 70 (55%) were in the context of medical malpractice; 21 (16%) involved child lead poisoning; 26 (21%) involved negligence, and 10 (8%) were miscellaneous cases including domestic relations and product liability/tobacco suits. Of the 70 medical malpractice cases, 47 were related to birth injury. A genetic test was performed in 29 (41%) of the 70 cases. In 26 of these malpractice cases, the defendant requested the test be compelled or the test result be admitted. In each of the lead paint cases, the defendants argued that the plaintiff's injuries (usually developmental or neurological) were not a result of lead paint exposure but, rather, of a genetic condition or other factors. In all of those 21 cases, defendants alleged that a genetic condition caused the plaintiff's condition but no test was actually performed.

A summary of all of the cases and the outcomes of each is provided in Table 1. Based on the reported figures, genetic tests were actually performed in slightly over one quarter of the total cases (27.6%).³¹ While defendants were more likely to raise a genetic argument to bolster their case, they were less likely to support their allegations with a genetic test than plaintiffs who raised such arguments.³²

27. The database contains reports of jury verdicts and settlements from almost all fifty states and the District of Columbia, collected from a variety of sources. In May 2006, the American Lawyers Media portion of the database became available exclusively on Westlaw.

28. We used "genetic!" as the search term.

29. We excluded duplicate versions of cases and cases where the issue was failure to perform genetic testing or counseling or genetic testing for identification (paternity suits).

30. Where the case summaries in the database did not clearly explain the use of genetic testing in the case (for example, a genetic expert witness was listed with no mention of genetic testing in the summary), we attempted to contact the attorneys of both parties for further information.

31. This figure was determined by dividing the number of cases where genetic tests were performed (35) by the total number of cases (127).

32. This result may be due, in part, to the fact that unless a genetic test was already performed on the plaintiff in a medical setting, the defendant would need a court order to compel the test.

TABLE 1: CASES IN WHICH PLAINTIFFS OR DEFENDANTS SOUGHT TO INTRODUCE GENETIC EVIDENCE

Party seeking to introduce genetic evidence	Total cases	Cases in which genetic test performed
Plaintiff	31	15 (48%)
Defendant	111	29 (26%)
Plaintiff & Defendant	15	9 (60%)

B. Criminal Cases—A Matter of Time?

Although the use of DNA tests for purposes of establishing identity in criminal cases has become commonplace, there are almost no reported cases where health- or behavior-related genetic tests have been used in criminal proceedings.³³ Nonetheless, there is clearly potential for such use and several legal commentators have hypothesized the use and implications of admitting into evidence genetic tests in a variety of criminal proceedings.³⁴

33. Despite the fact that these tests have not been introduced as evidence, parties have introduced evidence of genetic predisposition, apparently based on family history, in a handful of criminal cases. *See, e.g., Hill v. Ozmint*, 339 F.3d 187, 201–02 (4th Cir. 2003) (defendant introduced evidence that he “suffered from a genetically based serotonin deficiency, which resulted in aggressive impulses”); *People v. Bobo*, 3 Cal. Rptr. 2d 747, 753 (Cal. Ct. App. 1990) (psychiatrist testified that defendant’s paranoid schizophrenia resulted from “[g]enetic factors, biochemical elements, and developmental experiences”); *Crook v. State*, 813 So. 2d 68, 70–72 (Fla. 2002) (per curiam) (defendant introduced expert testimony that defendant’s violent rages were at least partially caused by genetic factors); *State v. Johnson*, 549 N.E.2d 565, 566 (Ohio Ct. App. 1989) (per curiam) (reversing trial court’s decision to admit expert testimony that defendant committed crimes because of “primary functional disautonomia . . . brought about by bad nutrition acting upon a genetically predisposed person”); *State v. Davis*, No. M1999-02496-CCA-R3-CD, 2001 Tenn. Crim. App. LEXIS 341, *12, *18 (Tenn. Crim. App. May 8, 2001) (defendant used expert’s assertion that he had a “genetic predisposition” for depression and mental illness” to argue that his mental condition prevented him from forming “the requisite intent to commit first-degree murder” and other crimes); *see also* Nita A. Farahany & James E. Coleman, Jr., *Genetics and Responsibility: To Know the Criminal From the Crime*, 69 LAW & CONTEMP. PROBS. 115, 123–30 (2006) (describing the cases listed above as examples of a defendant offering evidence of a behavioral predisposition).

34. *See, e.g., Rothstein, supra* note 16, at 119 (contending that American lawyers will use behavioral genetics arguments before such arguments are generally accepted in the scientific community due to the adversary legal system); Appelbaum, *supra* note 16, at 25–26 (speculating on the effect of introducing data from behavioral genetics research into the criminal justice system); Denno, *supra* note 16, at 254 (suggesting that the legal system will

Most crimes require evidence of purposeful, knowing, or reckless behavior to establish mens rea. Thus, a defendant who suffers from a disease such as mental retardation, schizophrenia, or alcoholism³⁵ may be able to use that disease state to mount an insanity or mens rea defense.³⁶ Either defense requires evidence both that the disease was present at the time of the criminal act (actus reus) and that the disease was affecting the defendant's thought process at that time.³⁷ Genetic tests arguably could be used to support a diagnosis, especially when clinical experts disagree over whether the individual even has the condition or behavioral trait at issue. The state could also employ genetic tests in sentencing proceedings to predict "future dangerousness" if it became evident that certain genetic conditions predispose individuals to violence. Alternatively, such tests could be used by defendants as a mitigating factor if judges were persuaded that one's genetic makeup reduces one's free will.

In the late 1960s, several researchers found evidence that males with an XYY chromosome might be predisposed to violence and crimi-

have to adapt as genetics tests become more sophisticated and scientifically acceptable); Johnson, *supra* note 16, at 465–66 (proposing a new criminal defense called "genetic determinism," which would excuse defendants from criminal liability if they could prove that their genetics controlled their actions); Price-Huish, *supra* note 16, at 625–26 (concluding that "[t]he scientific and legal communities are on the edge of a new frontier with the discovery of genetic explanations" for criminal behavior).

35. Farahany & Coleman, *supra* note 33, at 145–48.

36. The former is an affirmative defense that can negate the requisite mens rea; the latter operates as a complete defense if it negates a specific intent, although it could result in the defendant being found guilty of a lesser general intent crime. 2 WAYNE R. LAFAVE, *SUBSTANTIVE CRIMINAL LAW* § 9.2 (2d ed. 2003). General intent refers to the intent to perform an act. *Id.* § 5.2(e). All crimes, except strict liability crimes, require general intent. *Id.* Some crimes also require specific intent, i.e., "a special mental element which is required above and beyond any mental state required with respect to the *actus reus* of the crime." *Id.* Murder, for example, is a specific intent crime requiring the presence of malice. *Id.* § 14.1(a).

37. The Model Penal Code's insanity defense provision, entitled "Mental Disease or Defect Excluding Responsibility," provides that "[a] person is not responsible for criminal conduct if at the time of such conduct as a result of mental disease or defect he lacks substantial capacity either to appreciate the criminality [wrongfulness] of his conduct or to conform his conduct to the requirements of law." MODEL PENAL CODE § 4.01 (1962). The mens rea defense (also referred to as the "diminished capacity standard") provides that "[e]vidence that the defendant suffered from a mental disease or defect is admissible whenever it is relevant to prove that the defendant did or did not have a state of mind that is an element of the offense." *Id.* § 4.02.

The element of mens rea "remains a critical element of proof in most states, and a potential defense." National Mental Health Association, NMHA Policy Positions: In Support of the Insanity Defense (Mar. 7, 2004), www1.nmha.org/position/ps18.cfm. Indeed, the mens rea element of proof is implied in the MPC's General Principles of Liability. See MODEL PENAL CODE § 2.02(1).

nal behavior.³⁸ Defense attorneys used the studies to put forward an XYY chromosome defense in a handful of criminal cases.³⁹ The defense, however, was later discredited as there was insufficient scientific evidence linking the genetic trait to violent behavior.⁴⁰ Since that time, only a few reported cases have involved a request to the court to consider genetic information in a criminal trial.⁴¹

38. Lee Ellis, *Genetics and Criminal Behavior: Evidence Through the End of the 1970s*, 20 *CRIMINOLOGY* 43, 50 (1982).

39. See Denno, *supra* note 16, at 249 (noting that the XYY chromosome defense was used unsuccessfully in five major American cases).

40. See *id.* at 250 (describing cases in which courts rejected the XYY chromosome defense for lack of sufficient medical evidence causally linking the defect to criminal behavior).

41. See *supra* note 33. Perhaps the most publicized criminal case was that of Stephen Mobley who was tried for the 1991 murder of a Domino's Pizza store manager. Denno, *supra* note 16, at 251. Mobley's attorneys sought to use evidence of Mobley's "genetic make-up," not as a defense, but as a mitigating factor in sentencing. *Id.* Based on a family history of violence, the defense requested both expert and financial assistance to perform neurological testing and subsequent genetic analysis to determine whether Mobley had a genetic mutation associated with inadequate production of MAOA (monoamine oxidase A), a mutation allegedly associated with aggression and violence. *Id.* at 251–52. The trial court denied the defense's request, citing a lack of acceptable scientific connection between the genetic mutation and the behavior in question. *Id.* at 252. After a jury sentenced Mobley to the death penalty, he appealed to the Georgia Supreme Court, in part on the claim that the trial court erred in denying his motion for court-subsidized genetic testing, but the court upheld the lower court ruling. *Mobley v. State*, 455 S.E.2d 61, 65–66 (Ga.), *cert. denied*, 516 U.S. 942 (1995). Mobley filed a habeas corpus petition, claiming his counsel was ineffective at the sentencing phase, in part for "present[ing] an unorthodox mitigating defense that attempted to show a possible genetic basis for Mobley's conduct." *Turpin v. Mobley*, 502 S.E.2d 458, 463 (Ga. 1998). A trial judge vacated his death sentence, but the Georgia Supreme Court reversed on grounds that counsel had made a reasonable strategic decision. *Id.* at 467. The Court of Appeals for the Eleventh Circuit agreed with the Georgia Supreme Court. *Mobley v. Head*, 267 F.3d 1312, 1319 (11th Cir. 2001), *cert. denied*, 536 U.S. 968 (2002). A similar case was recently heard by the Supreme Court of the United States. See *Schriro v. Landrigan*, 127 S. Ct. 1933 (2007). Jeffrey Landrigan filed a petition for federal habeas corpus relief alleging that he was not provided effective counsel because his lawyer, among other things, failed to adequately investigate and present mitigating factors (including a genetic predisposition to violence) at his sentencing hearing for a capital crime. The district court denied Landrigan's request for a hearing, determining that he could not make out "a colorable claim of ineffective assistance of counsel and therefore was not entitled to an evidentiary hearing." *Id.* at 1937. The Ninth Circuit determined that the district court had "abused its discretion in refusing to grant the hearing." The Supreme Court reversed the Ninth Circuit but did not address the issue of the defendant's genetic predisposition. The most interesting commentary on the effect of genetic information on the sentencing decision comes from the dissent in the Court of Appeals's opinion. The dissent argued that in light of the facts that Landrigan had brutally stabbed a fellow inmate and killed a man after escaping from prison, "the potential for future dangerousness—including peril to future fellow inmates—inherent in Landrigan's alleged genetic pre-disposition for violence would have negated its mitigating capacity for evoking compassion in the sentencing judge." *Landrigan v. Schriro*, 441 F.3d 638, 652 (9th Cir. 2006) (en banc) (Bea, J., dissenting).

III. JUDGES AS GATEKEEPERS: SURVEY OF TRIAL COURT JUDGES

Whether courts are capable of making sound decisions to admit or compel health-related genetic test results is an open question.⁴² Judges and jurors, for example, may give these genetic test results more weight than they deserve because the tests appear definitive when, in actuality, they may be only mildly predictive of a genetic condition.

To better understand judicial perspectives about the use of health- and behavior-related genetic tests in court proceedings, we conducted a survey of all state circuit court judges and federal district court judges in Maryland. The judges were asked whether they had experience with requests to admit or compel genetic tests in the courtroom (either for purposes of identity or health/behavioral status); their attitudes toward the use of DNA tests in criminal cases for determining identity; and information about their background, including how long they had been judges, whether they had any educational background in a natural science or engineering, and whether they had attended any judicial education programs on genetics. In addition, the judges were given a series of hypothetical cases and asked whether they would admit or compel a genetic test in the circumstances described and, if not, to indicate the factors that influenced their decisions.⁴³

Several of the hypotheticals were based on actual cases, however, in order to examine the effect of changes in a number of key variables, others were written using genetic tests for diseases or conditions that have not yet been developed or commercialized. Factors that we intentionally varied across the hypotheticals included: the type of request, i.e., to admit *or* compel the test; the context of the request, i.e., civil or criminal case; and the nature of the condition or disease for which the test was requested. The last factor varied based on whether the disorder was physical or mental/behavioral, congenital or late onset, caused by a single gene or mutation or a more complex disorder, and the likelihood that a person who has the gene mutation would

42. Some scholars have suggested that judges do not have “the necessary training, time, or motivation” to make these types of scientific judgments. Niedwiecki, *supra* note 16, at 349 (citing Randolph N. Jonakait, *Forensic Science: The Need for Regulation*, 4 HARV. J.L. & TECH. 109, 170–72 (1991)).

43. The surveys were distributed by mail between January and October 2004. A brief summary of the results of the study were published in the journal, *Science*. Diane E. Hoffmann & Karen H. Rothenberg, *When Should Judges Admit or Compel Genetic Tests?*, 310 SCI. 241 (2005).

develop symptoms of disease or exhibit the behavioral trait related to the mutation, i.e., the gene penetrance.⁴⁴

The hypotheticals included two criminal cases, one involving conviction and the other sentencing, and four tort cases, two focusing on causation and two on damages.⁴⁵ In each case, judges were told that the test met the relevant *Daubert* or *Frye* standard for admission of scientific evidence.⁴⁶ If the judges answered “no” to a question, i.e., they would not admit or compel the test, they were asked how significant a number of listed factors were to their decision.⁴⁷ These factors varied depending on the question but generally included concerns about relevance, stigma, privacy, the failure of the test to indicate the seriousness of the disease or time of onset, whether the test was sufficiently conclusive, and whether the jury would give the test appropriate weight. The exact wording of the hypothetical cases, along with a description and analysis of judicial responses to them, are included in the text below.⁴⁸

After we collected the surveys, we met with small groups of judges in several state circuit courts and at the federal district court to share our results and solicit their reactions to our findings. Along with the survey results, selected comments from these small group meetings are reported below. It was often the insight of one judge that stimulated us to further examine and analyze the issues raised by the survey.

44. Some individuals who have a gene mutation may never develop the disease. Human Genome Project Information, Evaluating Gene Tests: Some Considerations, http://www.ornl.gov/sci/techresources/Human_Genome/resource/testeval.shtml (last visited May 19, 2007). Examples include BRCA1 and BRCA2 genes, which are associated with a rare form of breast cancer, and ApoE, a gene linked to the development of Alzheimer's Disease. *Id.* In other cases, such as with Huntington's disease, the genes are 100% penetrant and those who have the gene will develop the disease if they live to the age of onset. *Id.*

45. Two additional cases, one in the context of employment discrimination where the plaintiff sought to introduce a genetic test providing evidence that he was an alcoholic, and one in the context of a child custody dispute where a father asked the judge to compel the mother to have a genetic test for Huntington's disease, were included in the study but are not discussed in this Article.

46. While the federal courts and most states have adopted the *Daubert* standard for the introduction of scientific evidence, Maryland state courts continue to apply the *Frye* standard. See *Reed v. State*, 391 A.2d 364, 372 (Md. 1978) (adopting standard announced in *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923)); *Clemons v. State*, 896 A.2d 1059, 1065 n.7 (Md. 2006) (reiterating that “Maryland has continued to adhere to the *Frye* test rather than the *Daubert* standard”); see also *infra* note 103 and accompanying text.

47. Possible responses included: “very significant,” “somewhat significant,” “not at all significant,” and “did not consider.”

48. The study protocol was sent to the University of Maryland Baltimore Institutional Review Board (IRB) and was determined to meet the criteria for exemption from IRB oversight.

A. *Response Rate and Background Data*

Of 140 circuit court judges in Maryland, 101, or 72%, responded to the written survey. In addition, 64% of the 25 federal district court judges in the state responded.⁴⁹ In terms of prior experience with requests to admit genetic test results or compel genetic tests, 42% of state judges and 25% of federal judges had had a request to compel a genetic test in a criminal case for the purpose of determining identity; 57% of state judges and 19% of federal judges had had a request to admit such test results. In both cases, the large majority of the judges (93% state; 100% federal) always admitted such requests. Both state and federal court judges had very positive attitudes toward the use of DNA tests for this purpose. In response to the question, "How has the use of DNA tests affected the fairness of the outcomes in those cases?," 81% of state judges and 62% of federal judges responded either "largely positively" or "somewhat positively." A significant majority (76%) of state judges had ordered a DNA test in a paternity case for the purpose of determining identity.⁵⁰

Seven state court judges reported that they had received requests to compel genetic tests for the purpose of determining health status (i.e., the presence of a genetic disease or predisposition), and only two state judges had received requests to admit such tests. Of these respondents, two had received a request to admit or compel in the context of a criminal proceeding. When asked for the circumstances of each request, for the civil proceedings the types of cases included paternity, adoption, child custody, malpractice, personal injury, and lead paint poisoning. No federal judge had received a request either to compel or admit genetic tests to determine health status.

B. *Results—Criminal Cases*

Hypothetical #1: Criminal Case for Homicide: In a criminal homicide case, at issue is the admission into evidence of a genetic test to show that the

49. Of those state court judges who responded, the average number of years served on the bench was 9.4 (range: 1–27). For federal judges, the comparable number was 11.3 (range: 0.5–37.5). Out of the 101 state judges, five had an undergraduate degree in a natural science or in engineering, and only one had a graduate degree in either of these areas. Of the federal judges, one had an undergraduate degree in a natural science or in engineering, and none had a graduate degree in either area. In addition, over half of the state court judges (58%) had attended an educational program for Maryland and Delaware judges held in October 1998 on "Genetics in the Courtroom," and 16% had attended other educational programs on genetics. By contrast, only 25% of federal judges had attended a judicial educational program focusing on genetics.

50. Federal judges were not asked to respond to the paternity question because they do not hear paternity cases.

defendant could not satisfy the mens rea requirement necessary to establish criminal intent. The defendant (age 28) requests to have admitted the results of a genetic test showing that he has schizophrenia.

Schizophrenia is a serious psychiatric behavioral disorder. Someone with schizophrenia may have difficulty distinguishing between what is real and what is imaginary, may be unresponsive or withdrawn, and may have difficulty expressing normal emotions in social situations.

Symptoms may develop slowly over months or years, or may appear very abruptly. The disease may come and go in cycles of relapse and remission.

A person who tests positive for a gene mutation that predisposes him/her to schizophrenia has a 50–60% probability of manifesting symptoms of the disease by the age of 25.

The prosecution objects to the admission of the test.

Would you admit the test results?

In response to this question, respondents were fairly evenly divided, with a small majority of state court judges (54%) saying they would admit and a somewhat larger majority of federal judges (62%) saying they would not. Of those who would not admit, a large majority believed the results were not sufficiently conclusive, presumably because only 50–60% of individuals with the gene would manifest symptoms by the time they reached the age of the defendant when he committed the crime. Other reasons given for not admitting the test results in this scenario were that the jury would weigh the results inappropriately; the results would not be relevant to a determination of guilt or innocence; and the test did not indicate how seriously the disease would manifest.

In discussion with judges about the results, an initial hurdle for many was whether, even if it were clear that the defendant had schizophrenia at the time of the crime, the diagnosis would be sufficiently probative to the determination of mens rea.⁵¹ Assuming that it would

51. When extreme symptoms of schizophrenia are present, “persons are said to exhibit impaired reality testing and to be actively psychotic . . . [indicating] that some aspect of the person’s experience would not be consensually validated by most or all of his peers.” DAVID L. FAIGMAN ET AL., *SCIENCE IN THE LAW* 22 (2002) (emphasis omitted). To negate some or all of the mens rea required for committing the charged offense, a defendant may offer clinical testimony to show that he did not have the capacity to form the necessary intent required by the law. *Id.* at 16–17. Some states, however, “do not permit the introduction of psychiatric testimony as to any issue other than insanity, finding its use to prove diminished capacity too speculative and unreliable.” *Id.* at 17 (citing GARY B. MELTON ET AL., *PSYCHOLOGICAL EVALUATIONS FOR THE COURTS: A HANDBOOK FOR MENTAL HEALTH PROFESSIONALS AND LAWYERS* 128–29 (1987)). Maryland has not adopted the defense of diminished capacity; however, Maryland courts have permitted a defendant to present evidence

be probative, the judges remained divided about whether to admit the test. A few judges commented that the test indicates a predisposition for development of the disease, not whether someone has the disease. As a result, it would not be informative on the question of whether the defendant had symptoms at the time of the crime and, therefore, would not be relevant. One judge noted that the issue was not so much one of admissibility, but rather one of how much weight to give the test results (or how much weight to instruct the jury to give them).

Several respondents described this as a “gray area” where the ultimate question would be whether the information would be more prejudicial than probative. A number of judges expressed the view that they would probably admit the test results if an expert testified regarding their scientific foundation. Some said they would be more likely to admit the test results if there were experts on each side—one expert asserting that the defendant had schizophrenia and the other expert disputing that contention. One judge said he would be more likely to admit the test results if there was clinical evidence supporting a diagnosis of schizophrenia, but would feel differently about admitting the test results standing alone. Even if an expert laid the foundation, others were still unsure of the test results’ reliability, or were concerned that a jury might find the information too confusing. Respondents had opposing views as to how a jury would interpret the test results—some thought a jury would give them more weight than they deserve given their questionable probative value; others thought that juries often hear evidence of a similar nature and an expert could help them interpret the test results.

Hypothetical #2: Criminal Case—Sentencing: Assume Case 1 has moved on to a non-capital sentencing proceeding. At issue is the admission of a genetic test to show the future dangerousness of the defendant. The prosecutor requests that the defendant be compelled to have a genetic test for a gene mutation that predisposes an individual to exhibit bouts of extreme rage. (The con-

of impaired mental condition for the purpose of showing the absence of mens rea in a specific intent crime. *See* *Hoey v. State*, 536 A.2d 622, 633 (Md. 1988) (“[W]here a particular mental element of a crime must be proved to establish the commission of a crime, evidence that it did not exist, whether due to mental impairment or some other reason relevant to that issue, is admissible.”). The Fourth Circuit has held that in federal criminal trials psychiatric evidence may still be introduced to rebut specific intent, despite the Insanity Defense Reform Act (IDRA) of 1984, 18 U.S.C. § 17 (2000), which seemingly narrowed the admissibility of psychiatric testimony. *See* *United States v. Worrell*, 313 F.3d 867, 872–74 (4th Cir. 2002) (noting that “the IDRA does not prohibit psychiatric evidence of a mental condition short of insanity when such evidence is offered purely to rebut the government’s evidence of specific intent”).

dition is referred to as *Hyde's Syndrome*.)⁵² As in Case 1, between 50% and 60% of individuals with this mutation exhibit these behavioral abnormalities before the age of 25. With this test result the prosecutor wishes to show that the defendant has a proclivity toward violence ("future dangerousness"). The defendant objects to being compelled to have the test.

Would you compel the test?

In contrast to their responses to the first hypothetical, the large majority of respondents (82% of state court judges and 85% of federal court judges), said they would *not compel* a genetic test in a criminal sentencing proceeding for the purpose of establishing proclivity toward "future dangerousness." As in Hypothetical #1, respondents believed that the test was not sufficiently conclusive but, in follow-up discussions, were also concerned about the stigma that would be created by such a test result. The judges thought that compelling the test would be using an "inexact" instrument to condemn someone for life. Using such a test, they asserted, would be tantamount to concluding that the defendant could never "be good." Others believed that because such a test was being used as an indicator of mental, not physical, health, it would be especially offensive and stigmatizing.

Several judges were of the view that individuals should not be compelled to know the future against their will. They reasoned that such information is an invasion of one's privacy and could have a negative psychological impact on the recipient. One judge said he thought judges were likely to reflect societal reluctance to "cubby hole" people based on genetics, giving insurance as an example of this hesitancy. Another judge expressed concern about how the information would be used in the future, stating that because this was in the context of a criminal case it could become a matter of public record.

52. "Hyde's Syndrome" is a fictitious disease. However, researchers continue to investigate the relationship between various types of real psychoses (schizophrenia, delusional disorders, major depressive disorder, and bipolar disorder) and violence. According to one source,

[t]he literature is quite diverse, ranging from anecdotal reports, to investigations of the incidence of mental illness among offender populations, to studies of the incidence of criminal activity among persons diagnosed with psychiatric disorders. Many studies have design flaws, such as biased sample selection, questionable diagnostic validity, a limited range of predictors, or inadequate measures of violence (criminality), all of which may contribute to inconsistent results across studies or limit the generalizability of their findings.

FAIGMAN ET AL., *supra* note 51, at 30 (citing Alexander D. Brooks, *The Constitutionality and Morality of Civilly Committing Violent Sexual Predators*, 15 U. PUGET SOUND L. REV. 709, 740-50 (1992)).

If the result could be put under seal, however, he indicated that he might feel differently.

While most of the judges seemed reluctant to use a genetic test in the context of sentencing, a few argued that in cases where the defendant has no criminal history, this type of test might help them predict future dangerousness. These judges reasoned that because the defendant had already been convicted, his privacy interest would be lower than in the pre-conviction stage. Judges, they asserted, are in the “risk assessment” business and, as such, “need all the information they can get in attempting to predict future behavior.”

Additionally, some judges raised the point that in the future, all those convicted of a crime in Maryland and many other states will have their DNA taken and stored.⁵³ Several were troubled by this broad-based testing because it raises the specter of studies of prison inmates for a “violence gene.” They realized, however, that if the test had already been performed, there would be no need to compel it. The issue would be whether to use it for sentencing purposes. Several judges expressed concern that relying on a genetic test in these circumstances would “take the judgment out of judging.”

In comparing and contrasting the results in these two hypotheticals, significant variables for the judges’ decisions appeared to be whether the request was to admit or compel, who requested the test, and for what purpose it would be used (conviction or sentencing). Judges were more likely to grant the request of the defendant to admit a test for schizophrenia to show lack of intent than to grant a request by the prosecutor to compel a test to increase a sentence. We are uncertain whether differences in judicial responses to the two cases would have been as great if both were requests to *admit* a test result.

53. As of December 2004, all fifty states required that convicted sex offenders provide a DNA sample, and thirty-nine states required that all convicted felons provide such a sample. See National Conference of State Legislatures, *State Laws on DNA Data Banks: Qualifying Offenses, Others Who Must Provide Sample* (Nov. 2003), <http://www.ncsl.org/programs/health/genetics/DNAoffenses.htm> (listing states requiring DNA sampling of convicted offenders); see also ROSEMARY WALSH, *PRIVACY INTERNATIONAL, THE UNITED STATES AND THE DEVELOPMENT OF DNA DATA BANKS* (Feb. 2, 2006), <http://www.privacyinternational.org/article.shtml?cmd%5B347%5D=x-347-528471> (discussing the development of state and federal DNA databases). These state DNA databases are linked by the Combined DNA Index System (CODIS) operated by the Federal Bureau of Investigation. See *How Effectively Are State and Federal Agencies Working Together to Implement the Use of New DNA Technologies? Before the Subcomm. on Gov't Effic., Fin. Mgmt. and Intergov't Rel. of the H. Comm. on Gov't Reform*, 107th Cong. 49 (2001) (statement of Dwight E. Adams, Deputy Ass't Dir., Laboratory Div., FBI). Most of the information in CODIS consists of DNA profiles that only include specific segments of DNA that “do not reveal information relating to a medical condition or disease.” *Id.* at 51.

The prosecution's request to compel the test raised concerns about the psychosocial impact of the genetic information on the plaintiff that would not be relevant for a request to admit a test that had already been performed in a medical setting.

C. *Results—Civil Cases*

Hypothetical #3: Medical Malpractice: In a malpractice case, you are asked to compel a genetic test of a minor. The mother of a minor brought suit alleging that her doctor was negligent in his care of her during her labor and delivery and, as a result, her son suffered permanent brain damage. The physician, an Ob-Gyn, argued that the child's condition was due to a genetic condition rather than any negligence on his part, and requested that you compel a genetic test. During a motion hearing on this request, a geneticist testified that the child may suffer from Fragile X Syndrome, a genetic condition characterized by moderate mental retardation in affected males. The child's mother objects to the test.

Would you compel the test?

Hypothetical #4: Toxic Tort: Assume facts similar to Hypothetical #3; however, rather than a malpractice suit, this is a toxic tort suit against a manufacturer of solvents. The child's mother sues a solvent manufacturer for damages to her son resulting from her exposure to solvents at her workplace while she was pregnant. Her son shows some of the traits of Fragile Y Syndrome.⁵⁴ Fragile Y Syndrome manifests similarly to Fragile X, however, symptoms only develop as a result of a combination of genetic and environmental factors, i.e., only individuals with the genetic condition develop the disease but only as a result of exposure, pre or post birth, to certain solvents. (These individuals have a heightened sensitivity to the solvents.) The defendant requests that you compel the child to have a genetic test for the Syndrome. The child's mother objects to the test.

Would you compel the test?

In the context of the civil tort hypotheticals where the defendant was asking the judge to compel a test to establish that the defendant's negligence was not the cause of the plaintiff's injury, the large majority of judges said they would compel the test (85% of state judges and 75% of federal judges in the malpractice case; 71% of state judges and 77% of federal judges in the context of the toxic tort). In these two hypotheticals, the judges were comfortable compelling the test because, they reasoned, the plaintiff had put the health of her child at issue and the defendant had a right to this information. They distin-

54. "Fragile Y Syndrome" is a fictitious disease.

guished this scenario, where the test was being used to confirm a diagnosis, from others where the test was being used for prediction, and commented that compelling a test for purposes of diagnosis is a well-established practice. Others distinguished these cases from the prior criminal scenarios, commenting that these cases were “only” about money and did not implicate a liberty interest. Several judges also commented that although these cases did not involve a question about the plaintiff’s mental state, when a plaintiff puts his or her mental state at issue, but declines to consent to testing, he or she faces sanctions and possible dismissal of the case, thus compelling the testing is usually unnecessary. One judge said that he might not admit the test result, but he would compel it because it might promote a settlement.

Despite the large majority who said they would compel the test in Hypothetical #3, a few raised the point that the test would not rule out negligence as the cause of the plaintiff’s disability; the child’s disabilities could be attributed both to a genetic disorder and to negligence. In such a case, the finding would be relevant to a determination of damages. The genetic condition, e.g., Fragile X, would be treated as a preexisting condition resulting in mitigation of damages for the physician.⁵⁵ The challenge in such a case would be whether a medical expert could, with any certainty, determine how much of the child’s disability was due to negligence and how much to the genetic condition.

In response to Hypothetical #4, in which the judge was asked to compel a test for a complex genetic condition that manifested only as a result of having a specific gene mutation and being exposed to a certain solvent, judges’ reasons for compelling the test were similar to those given for the prior hypothetical. The distinguishing factor in this fact pattern was that a negative test would rule out Fragile Y as the child’s disorder and potentially any liability on the part of the defendant, assuming the solvent otherwise posed no threat to the fetus. A positive test, however, would mean the defendant’s actions were, in part, a cause of the child’s disorder. In this latter scenario, most judges seemed to agree that damages would be allocated based on the rule that “you take your victim as you find him.” One judge, however,

55. See, e.g., *Ostrowski v. Azzara*, 545 A.2d 148, 152 (N.J. 1988) (“Courts recognize that a defendant whose acts aggravate a plaintiff’s preexisting condition is liable only for the amount of harm actually caused by the negligence.”); see also *Fosgate v. Corona*, 330 A.2d 355, 357–58 (N.J. 1974) (concluding that the jury instruction that allowed damages in this malpractice action “only to the extent of [the] aggravation or acceleration” correctly stated the general legal principle).

commented that juries might reduce damages, despite a jury instruction consistent with the aforementioned rule, if they believed that the condition was not exclusively a result of the defendant's negligence; another person could have been exposed to the solvent and not developed the syndrome.

Hypothetical # 5: Damages—Life Expectancy: In the damage phase of a products liability case, at issue is the compelling of a genetic test to show shortened life expectancy of the 21-year-old plaintiff. The defendant requests that the plaintiff be compelled to have a genetic test for Neurofibromatosis type II (NF-2), as his father died of the disease at the age of 40. NF-2 is a rare inherited disorder characterized by the development of benign tumors on both auditory nerves and by the development of malignant central nervous system tumors. The disease is unrelated to the injury caused by the defendant's product. Virtually everyone who has the mutation develops the disease; however, the severity of symptoms differs from person to person, and the gene is not predictive of such disparities. An expert witness testifies that the average age of onset of NF-2 is between 18 and 24 and that the average age of death of those with the disease is 36. At present, the plaintiff has no symptoms of the disease.

Would you compel the test?

Respondents were significantly divided in their response to this request. The majority of both state and federal judges, however, said they would not compel the test (56% of state judges and 62% of federal judges). The primary reason judges gave for a "no" response was that there was not "good cause" for the test.

In discussion with judges about these results, some indicated that the information was "too problematic" and that a jury would have a difficult time understanding it; others believed that life tables could be used with an instruction about the meaning of the test. Those troubled by compelling the test asked, "where does this stop?," raising concerns about the use of such tests to predict other diseases such as breast cancer or heart disease for which the genetic component is a relatively minor cause of the disease. One judge said he would draw the line based on whether or not one of the party's parents suffered from the disease and, as a result, there was a high background probability that the child would have the disease. Some asked, rhetorically, "how far do we go now with trying to predict life expectancy? Do we allow defendants to ask questions about family history such as when the plaintiff's parents died and what they died of?"

Others who said they would not compel the test expressed concerns about the psychological impact on the plaintiff. One said a plaintiff given this information might commit suicide. In response to this sentiment, another judge said the plaintiff might be better off

knowing that he had the gene. Others who were uncomfortable compelling the test said they saw a difference between using the information in this hypothetical and in the prior tort cases because in this hypothetical the information would be used to predict the future rather than looking back to determine causation. However, a number of judges indicated that they would admit evidence that the plaintiff was a smoker for the purpose of establishing that she would, more likely than not, have a reduced life expectancy due to lung cancer and other diseases. One judge made the distinction that smoking is a voluntary activity whereas a genetic predisposition is something that a plaintiff cannot control.

A few judges suggested compromise solutions to this case. One offered that the defendant could introduce the possibility of the gene based on family history (50%), and the jury could determine damages based on this likelihood. As a result, damages would be less than what they would have been if the plaintiff did not have the gene and more than if the plaintiff had the gene. The burden would then be on the plaintiff to have the test if he wanted to rebut the implication that he had the gene and argue that his damages should be higher. Another judge suggested that the possibility that the plaintiff had the gene could be presented to the jury along with the fact that the plaintiff was offered the test but declined to have it. The plaintiff, in that case, would then have to explain to the jury why he did not want the test. One judge analogized this situation to cases where the plaintiff is offered surgery that might reduce damages but nevertheless declines to have it because of associated risks or concerns that it might not be effective.

Hypothetical # 6: Damages—Pain & Suffering: Instead of the defendant asking that a genetic test be compelled, in the damage phase of the case, the plaintiff asks to admit genetic test results showing that he has a condition that makes him extremely sensitive to pain. He would like to use this information to argue that his damages for pain and suffering should be increased. Individuals with the genotype of the plaintiff have a 70% probability of manifesting the heightened sensitivity. The age of onset of the condition is typically early adulthood (18–24). Individuals who manifest the condition experience extreme sensitivity to pain and often must take heavy doses of pain medication throughout their lives, which may only partially relieve their pain.

Would you allow the introduction of this genetic test result into evidence?

In contrast to Hypothetical #5, most judges (82% of state court judges and 62% of federal judges) responded “yes” to the plaintiff’s request to admit a genetic test to show increased sensitivity to pain. A few judges thought it would be very helpful to have a test for pain—to

be able to turn something so subjective into something more objective. Those who responded “no” provided the following reasons as “very significant” to their decision: (1) the “test was not sufficiently predictive”⁵⁶ and (2) the jury would weigh the test result inappropriately.⁵⁷ One judge said that he would not let it in because there is no indication that the plaintiff currently has the condition and the test cannot tell with certainty whether he will develop it.

D. *Limitations of the Data*

Vignettes, by nature, lack the complexity and context surrounding a real case, and responding to them does not require the usual interaction and dialogue that is part of an actual social encounter or courtroom proceeding.⁵⁸ This may have been particularly true in our survey, which likely presented a number of judges with their first exposure to some of these complex genetics issues. This counsels caution in using the survey data to predict what judges would decide in actual cases. The fact that some of the judges appeared to change their opinions after discussion in a small group setting may reflect this dynamic. Judges may decide differently in the courtroom where they generally hear testimony from experts with opposing views who provide the necessary background information for more informed decisions. These judicial respondents did not have the opportunity to hear oral argument, read briefs, converse with other colleagues, or hear from experts before opining on the survey hypotheticals. As a result, their responses to the survey vignettes may not be valid predictions of their ultimate judgments about these unique cases and may represent only their initial reactions to these types of fact patterns.

Regarding generalizability, while the survey yielded a sufficient response rate to generalize results to judges in Maryland, the results may not be applicable to judges from other states. The judiciary in

56. Eighty-seven percent of state court judges who responded “no” said that this was “very significant” in their decision not to admit the test.

57. Fifty-three percent of state court judges who responded “no” said that this was “very significant” in their decision not to admit the test.

58. See generally Dinah Gould, *Using Vignettes to Collect Data for Nursing Research Studies: How Valid Are the Findings?*, 5 J. CLINICAL NURSING 207 (1996) (exploring the validity of data derived from vignettes); Rhidian Hughes, *Considering the Vignette Technique and Its Application to a Study of Drug Injecting and HIV Risk and Safer Behaviour*, 20 SOC. HEALTH & ILLNESS 381 (1998) (addressing the benefits and difficulties of vignette research, including the criticism that vignette data ignores the necessary interaction and feedback of social life); John W. Peabody et al., *Measuring the Quality of Physician Practice by Using Clinical Vignettes: A Prospective Validation Study*, 141 ANNALS INTERNAL MED. 771 (2004) (discussing vignettes as a tool for measuring the quality of clinical practice while also pointing out their shortcomings).

Maryland has been especially sensitive to the use of genetic information in court proceedings. In 1998, the Maryland Judicial Institute held a two-day educational program for judges on genetics and genetic testing, with a significant number (60%) of state court survey respondents in attendance.⁵⁹ In addition, a number of judges have attended workshops outside the state that have included sessions on genetic information and genetic tests.

IV. FRAMEWORK FOR JUDICIAL DECISIONMAKING

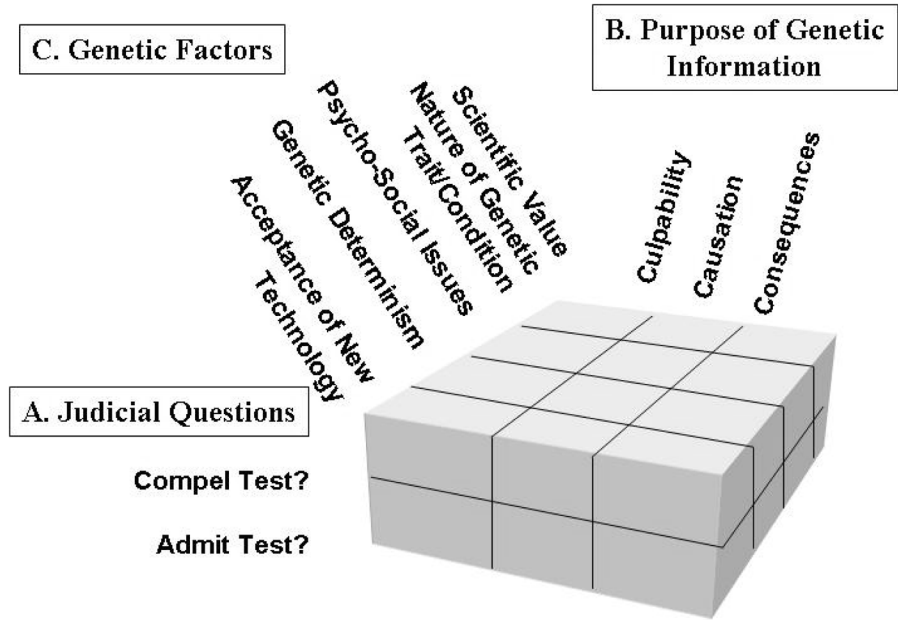
Our survey results indicate that context is crucial for judges deciding these cases. In evaluating the hypotheticals, judges appeared to weigh multiple factors simultaneously in an attempt to reach a fair decision. Conceptually, they seemed to apply a framework that initially distinguished between *criminal* and *civil* settings. In each of the two contexts they considered a number of issues. We used the judicial survey responses to inform the construction of a decision matrix that might be used by judges to evaluate these complex cases. In the three-dimensional matrix depicted in Figure 1, each axis indicates a separate set of factors that we argue are essential to the judicial decision-making process.

The vertical (y) axis (labeled “Judicial Questions”) indicates whether the initial request made by one of the litigants is to compel a genetic test or to admit a pre-existing test result into evidence. The horizontal (x) axis (labeled “Purpose of Genetic Information”) contains factors relating to how the genetic information will be used, i.e., determining culpability or liability, causation, or consequences (i.e., damages in a civil case or sentence in a criminal case). On the diagonal (z) axis (labeled “Genetic Factors”) are considerations relevant to genetic tests and conditions, i.e., the scientific value of the test and the nature of the genetic trait or condition, psychosocial issues, including privacy and stigma, concerns about genetic determinism, and the acceptance of a new technology or new use of an existing technology.⁶⁰

59. See *supra* note 49.

60. An alternative configuration illustrating the complexity of the decisionmaking process would be based on a four-dimensional matrix with the first dimension being the judicial question and the second dimension being the purpose of the test. The third dimension, however, would focus solely on the scientific value of the test and nature of the genetic trait or condition, including whether the disease or condition is monogenic or multifactorial, the gene penetrance, and the disease latency. The fourth dimension would capture the ethical/social issues relating to utilizing the tests in the courtroom, including privacy, stigma, psychological issues, effects on family members, and economic implications of the genetic test result.

ANALYTICAL FRAMEWORK



Below, we elaborate on each of these factors and attempt to describe how they might be applied in or affect judicial decisions to compel or admit health-related genetic tests. In the analysis, we also highlight weaknesses in existing doctrinal law that appear exacerbated when confronted with the challenge of incorporating these genetic tests and suggest that, in some cases, these doctrines be re-examined.

A. Judicial Question: Admit or Compel?

Compelling a test, in contrast to admitting an existing test result, was more troubling to judges in the criminal context than in the civil context. Although we only asked judges about compelling a test in the sentencing phase of a criminal proceeding, where privacy rights may be somewhat attenuated, discussions with judges revealed that many thought that compelling a health- or behavior-related genetic test in the conviction phase of a criminal proceeding may raise Fourth Amendment⁶¹ privacy and other constitutional concerns. Thus far,

61. The Fourth Amendment provides:

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

no reported opinions appear to discuss the constitutionality of compelling a health- or behavior-related genetic test in criminal proceedings. The jurisprudence to date has been limited to compelling a genetic test solely for purposes of determining the identity of an individual.

For Fourth Amendment protections to apply, the action at issue must be considered a search.⁶² If deemed a search, it must be “reasonable.”⁶³ Compelling a physical specimen like blood from beneath a person’s skin by law enforcement agents during arrest, prosecution, or conviction, has long been considered a search for Fourth Amendment purposes.⁶⁴ More recent jurisprudence has expanded the criteria for what constitutes a search from samples collected “beyond the body’s surface”⁶⁵ to include the collection and analysis of urine and “deep lung” breath from a breathalyzer test.⁶⁶ In making these determinations, courts have considered not only the extent of bodily invasion and intrusiveness of the collection process, but also the nature of the information obtained from the sample. In the context of urine testing, the Supreme Court in *Skinner v. Railway Labor Executives’ Ass’n*⁶⁷ recognized, for example, that the chemical analysis of urine “can reveal a host of private medical facts about an employee, including whether he or she is epileptic, pregnant, or diabetic.”⁶⁸

U.S. CONST. amend. IV.

62. *Id.*

63. *Winston v. Lee*, 470 U.S. 753, 767 (1985).

64. *See Schmerber v. California*, 384 U.S. 757 (1966) (holding that a police-ordered extraction of a blood sample from an arrestee suspected of drunk driving constituted a Fourth Amendment search). For a government intrusion to be recognized as a search, an individual must have “an actual (subjective) expectation of privacy” in the information obtained, and that expectation must be “one that society is prepared to recognize as ‘reasonable.’” *Katz v. United States*, 389 U.S. 347, 361 (1967) (Harlan, J., concurring).

65. *Schmerber*, 384 U.S. at 769.

66. *Skinner v. Ry. Labor Executives’ Ass’n*, 489 U.S. 602, 616–17 (1989). In *Skinner*, the Railway Labor Executives’ Association and other labor organizations brought suit to enjoin regulations promulgated by the Federal Railroad Administration (FRA) that mandated blood sampling and urine testing of railroad employees involved in certain train accidents. *Id.* at 606, 612. While the Court held that the regulations did not violate the Fourth Amendment, *id.* at 634, it found that “[s]ubjecting a person to a breathalyzer test, which generally requires the production of . . . ‘deep lung’ breath . . . implicates . . . concerns about bodily integrity and . . . should . . . be deemed a search.” *Id.* at 634, 616–17.

67. 489 U.S. 602 (1989).

68. *Id.* at 617. In concluding that the urine collection and testing contemplated by the FRA regulations were “intrusions [that] must be deemed searches under the Fourth Amendment,” the Court reasoned that “chemical analysis of urine,” while not “a surgical intrusion into the body[,] . . . can reveal a host of private medical facts[,] . . . [and] the process of collecting the sample . . . itself implicates privacy interests.” *Id.*

While a blood test may be used for obtaining a genetic sample, more recently the less intrusive method of taking a saliva sample or cheek (buccal) swab is often used. Although not technically beneath the skin, several federal and state courts have determined that a collection of epithelial cells by use of a cheek swab is a search within the meaning of the Fourth Amendment.⁶⁹ One federal district court distinguished a sample taken by cheek swab from one obtained by expectoration and concluded that swabbing the inside of the cheek was “clearly a search within the skin, if not literally beneath it.”⁷⁰ In contrast, the court determined that production of a saliva sample via expectoration is “not accompanied with the personal and private character of voiding a urine sample”⁷¹ and does not involve any intrusion into the subject’s body. Nevertheless, because of the sensitive information obtained in a saliva sample, the court concluded that it constituted a search under the Fourth Amendment.⁷²

To satisfy the “reasonableness” requirement under the Fourth Amendment, courts have generally required that law enforcement agents obtain a judicial warrant⁷³ supported by probable cause.⁷⁴

69. See *United States v. Nicolosi*, 885 F. Supp. 50, 55–56 (E.D.N.Y. 1995) (determining that while a cheek swab to obtain genetic information was not as intrusive as a blood test, it implicates “dignitary interests” and therefore requires Fourth Amendment constitutional protection). The court in *Nicolosi* determined that collection of a saliva sample fell “squarely in the middle” of a continuum of physical evidence based on the invasion of privacy and dignitary interests at stake. *Id.* at 55. On one end of the spectrum, the court assigned items within the public domain, such as voice, hair, or handwriting samples, that do not require a “full Fourth Amendment procedure.” *Id.* On the other end, the court placed blood and other internal bodily fluids that have to be extracted from the body and that clearly constitute a search. *Id.*; see also *In re Shabazz*, 200 F. Supp. 2d 578 (D.S.C. 2002) (holding that a subpoena requiring submission of a saliva sample for DNA testing was a Fourth Amendment search); *State v. Ostroski*, 518 A.2d 915, 920 (Conn. 1986) (“[B]ecause the acquisition of . . . the saliva is a search, the [F]ourth [A]mendment requires that the state establish probable cause.” (citations omitted)).

70. *Nicolosi*, 885 F. Supp. at 55–56.

71. *Id.* at 56.

72. *Id.* The court considered the “significant amount of genetic identity information” a saliva sample provides. *Id.* at 55.

73. See *Schmerber v. California*, 384 U.S. 757, 770 (1966) (“[W]arrants are ordinarily required for searches of dwellings, and, absent an emergency, no less [is] required [for] intrusions into the human body The importance of informed, detached and deliberate determinations of the issue whether . . . to invade another’s body in search of evidence of guilt is indisputable and great.”).

74. See U.S. CONST. amend. IV (“[N]o Warrants shall issue, but upon probable cause”). At least one federal court and several state courts have required probable cause to obtain a cheek swab in the context of arrest. See, e.g., *Nicolosi*, 885 F. Supp. at 55–56 (“[T]his is a case where the determination whether the right of privacy must reasonably yield to the right of search is . . . to be decided by a judicial officer upon a proper showing of probable cause.” (internal quotation marks omitted)); *State v. Ostroski*, 518 A.2d 915, 920 (Conn. 1986) (noting that the acquisition of a saliva sample is a Fourth

However, courts have also found searches of the body to be reasonable when conducted without a warrant if the intrusion into the body was minor and there was probable cause for the search.⁷⁵ On occasion, courts have determined that a warrant alone is insufficient. For example, in *Winston v. Lee*,⁷⁶ the Supreme Court held that, despite obtaining a court order compelling the defendant to undergo surgery to remove a bullet lodged under his collarbone, the proposed

Amendment search, thereby requiring the state to establish probable cause); *Pyle v. State*, 645 P.2d 1390 (Okla. Crim. App. 1982) (holding a saliva sampling to be a reasonable search where the state's search warrant was based on probable cause). While this is the general rule, in response to a grand jury subpoena or non-testimonial identification order, courts have held that individualized suspicion and/or reasonableness is sufficient without probable cause. *See, e.g., In re Shabazz*, 200 F. Supp. 2d 578 (holding that a grand jury subpoena ordering a saliva sample was a reasonable search because it was based on "reasonable individualized suspicion" and reasonable procedures were to be used to obtain the sample); *In re Grand Jury Proceedings Involving Vickers*, 38 F. Supp. 2d 159, 167-68 (D.N.H. 1998) (finding a grand jury subpoena requesting saliva samples reasonable and therefore enforceable); *Henry v. Ryan*, 775 F. Supp. 247 (N.D. Ill. 1991) (holding that individualized suspicion, not probable cause, was the appropriate requirement where a detainee was compelled by grand jury subpoena to produce blood and saliva samples); *Bousman v. Iowa Dist. Court*, 630 N.W.2d 789, 798 (Iowa 2001) (finding a nontestimonial identification order for a saliva sampling constitutionally based on a finding of "reasonable grounds to suspect" rather than upon a showing of probable cause); *In re Nontestimonial Identification Order Directed to R.H.*, 762 A.2d 1239 (Vt. 2000) (holding that federal and Vermont constitutional search and seizure provisions do not require a demonstration of probable cause to obtain a nontestimonial order for saliva). Moreover, in the context of evidence in administrative or regulatory proceedings, courts have held that individualized suspicion is not necessarily required. For the most part, these cases have been analyzed using a "special needs" test, i.e., a suspicionless search may be allowed where the search is designed to serve the government's "special needs" beyond the normal need for law enforcement. *See, e.g., Skinner v. Ry. Labor Executives' Ass'n*, 489 U.S. 602, 620 (1989) (noting that the government agency's interest in regulating the conduct of railroad employees to ensure safety presents "special needs" that may justify deviations from the customary warrant and probable cause requirements).

75. While a warrant is generally required, courts have also established a number of exceptions to the requirement, such as exigent circumstances in which evanescent evidence might otherwise deteriorate or disappear, like alcohol in the blood stream. *See, e.g., Schmerber*, 384 U.S. at 770-71 (finding that a compulsory, reasonably conducted blood test performed without a warrant but incident to arrest was reasonable because there was probable cause to suspect defendant was under the influence of alcohol and a reasonable belief that an emergency existed that threatened to destroy the evidence); *United States v. Berry*, 866 F.2d 887, 891 (6th Cir. 1989) ("Because evidence of intoxication begins to dissipate promptly, it is evident in this case that there were exigent circumstances indicating the need to take [the blood sample]."); *United States v. Snyder*, 852 F.2d 471, 473-74 (9th Cir. 1988) (noting that exigent circumstances existed at the time blood was extracted from the defendant driver). Moreover, minor bodily intrusions in which the procedure is routine, harmless, and performed by medical personnel do not violate the Fourth Amendment. *See, e.g., Cupp v. Murphy*, 412 U.S. 291 (1973) (holding that a warrantless search of defendant's fingernails was constitutionally justified because the search was supported by probable cause, very limited in nature, and necessary to preserve potentially fleeting evidence).

76. 470 U.S. 753 (1985).

“search” was unreasonable because the state failed to justify its intrusion “upon an area in which our society recognizes a significantly heightened privacy interest.”⁷⁷ In arriving at its conclusion, the Court declared that “[t]he reasonableness of surgical intrusions beneath the skin depends on a case-by-case approach, in which the individual’s interests in privacy and security are weighed against society’s interests in conducting the procedure.”⁷⁸ The *Winston* Court placed less emphasis on the risk of the surgery than on the intrusion of the defendant’s privacy interests from forced anesthesia and the surgical procedure, and on the failure of the state to demonstrate a compelling need for the information.

In most cases, once a DNA sample is obtained, law enforcement personnel may have sufficient evidence to arrest and prosecute a suspect without needing to know anything about the person’s health status or predisposition to disease or behavioral traits. While it is difficult to imagine a case where the prosecution would seek an order compelling a health- or behavior-related genetic test in the arrest and investigatory phase of a criminal proceeding, one might envision a case where there is no DNA evidence tying the suspect to the crime but the prosecution theorizes, based on evidence at the crime scene or eyewitness accounts, that it is highly likely that the person who committed the crime had a relatively rare genetically based condition that could assist in identifying that individual.⁷⁹

In such a case, prosecutors would face the hurdle of satisfying the probable cause requirement. If probable cause could be established, courts might struggle with the application of the existing Fourth Amendment “reasonableness” test to compelling a health-related genetic test. In fact, in a relatively recent case, the Supreme Court was challenged to rethink its Fourth Amendment jurisprudence in light of new technology allowing increased surveillance of individual behavior.⁸⁰ As a result of the unique privacy issues raised by health- or be-

77. *Id.* at 766–67.

78. *Id.* at 760. The Court considered several factors used to analyze reasonableness in the context of bodily searches including “the extent to which the procedure may threaten the safety or health of the individual” and “the extent of intrusion upon the individual’s dignitary interests in personal privacy and bodily integrity,” and weighed those factors against “the community’s interest in fairly and accurately determining guilt or innocence.” *Id.* at 761–62.

79. For example, an individual might have a rare, genetically based allergic reaction to a chemical or food, or could have a genetic predisposition to a rare behavioral disorder with certain signature characteristics.

80. See *Kyllo v. United States*, 533 U.S. 27, 29, 34 (2001) (characterizing its charge as determining the limits upon the power of a new technology (thermal imaging) to “shrink the realm of guaranteed privacy”).

havior-related genetic information, the appellate courts may need to re-examine the reach of the Fourth Amendment and the contours of personal privacy.⁸¹ Little consideration has been given to personal and family privacy interests in information obtained from the sample in the context of determining reasonableness. Health- and behavior-related genetic tests arguably reveal more private facts about an individual than DNA tests used for purposes of identification.⁸² Moreover, they can be distinguished from the blood and urine tests that seek to provide evidence of substances such as alcohol or drugs that are only temporarily in the body. Genetic tests reveal evidence of immutable characteristics as well as information about third parties who do not have a voice in whether or not this information is disclosed.

At some point in the future, courts may also confront the question of whether the Fourth Amendment applies to the taking of a pre-existing tissue sample from a tissue bank rather than compelling the sample from an individual. In such a scenario, if the sensitive nature of the information is the basis for the determination of a “search,” then conducting health- or behavior-related genetic tests on the sam-

81. Other authors have also recommended a need for a revised interpretation of the Fourth Amendment in light of numerous new technologies. See, e.g., Stephen E. Henderson, *Nothing New Under the Sun? A Technologically Rational Doctrine of Fourth Amendment Search*, 56 MERCER L. REV. 507 (2005) (discussing the “reasonable expectation of privacy” requirement and arguing that the “third party doctrine” must be narrowly construed if the Fourth Amendment is to meaningfully limit government intrusions). Because a state’s constitution may impose more stringent standards on searches and seizures than those required by the United States Constitution, state judges and lawmakers may also want to examine this issue. See, e.g., *Graves v. State*, 708 So. 2d 858, 861 (Miss. 1997) (“[T]he Mississippi Constitution extends greater protections of an individual’s reasonable expectation of privacy than those enounced under Federal law.”); *Commonwealth v. Waltson*, 724 A.2d 289, 292 (Pa. 1998) (noting “enhanced privacy rights” in the Pennsylvania Constitution).

82. See Justin A. Alfano, Note, *Look What Katz Leaves Out: Why DNA Collection Challenges the Scope of the Fourth Amendment*, 33 HOFSTRA L. REV. 1017, 1032 (2005). Alfano notes:

[T]he DNA used by law enforcement is used exclusively for identification purposes. The thirteen core STR loci used in criminal offender databases are each found on non-genic stretches of DNA known as “junk DNA” not linked to any genes that would permit an onlooker to discern any socially stigmatizing conditions or private medical facts.

Id. (citing *United States v. Kincade*, 379 F.3d 813, 818 (9th Cir. 2004)); see also David H. Kaye, *Bioethics, Bench, and Bar: Selected Arguments in Landry v. Attorney General*, 40 JURIMETRICS 193, 203–04 (2000) (explaining that a Massachusetts DNA databanking law would not likely have infringed on genetic privacy); D.H. Kaye, *The Constitutionality of DNA Sampling on Arrest*, 10 CORNELL J.L. & PUB. POL’Y 455, 461–62 (2001) [hereinafter Kaye, *Constitutionality*] (stating that the analysis of DNA sequences collected for law enforcement purposes “disclose[s] nothing about the individual’s susceptibility to diseases, bodily structure, or mental functioning”). Kaye notes that “[s]ome states expressly prohibit use of more informative loci.” *Id.* at 462 n.22 (citing VT. STAT. ANN. tit. 20, § 1937(b) (1998)).

ple would appear to constitute a search subject to Fourth Amendment protections.

Compelling genetic tests that reveal behavioral traits or predisposition to mental illness may also raise legal and normative questions about the use of self-incriminating evidence and due process concerns. While the Supreme Court has determined that bodily invasions implicate the Fourth Amendment,⁸³ the Court held in *Schmerber v. California* that such procedures do not implicate the Fifth Amendment self-incrimination protections.⁸⁴ Relying on the testimonial versus noncommunicative evidence dichotomy, the Court concluded that the privilege against self-incrimination applies only to testimonial evidence, i.e., compelled communications that convey factual assertions or disclose information.⁸⁵ While the framework applied in *Schmerber* would appear to rule out a Fifth Amendment defense by an individual who was compelled to provide a bodily sample for a health-related genetic test, one might argue that cases like *Schmerber*, in which the government was attempting to extract the defendant's blood to determine if it contained alcohol, are distinct from cases involving genetic

83. See, e.g., *Winston v. Lee*, 470 U.S. 753 (1985) (holding that a government-ordered intrusion to force defendant to undergo surgery to remove evidence of a crime would not be a reasonable search permitted by the Fourth Amendment); *Schmerber v. California*, 384 U.S. 757, 772 (1966) (applying Fourth Amendment scrutiny to a minor bodily invasion by law enforcement agent but ultimately finding no Fourth Amendment violation).

84. *Schmerber*, 384 U.S. at 760–61. The Self Incrimination Clause of the Fifth Amendment states that “No person . . . shall be compelled in any criminal case to be a witness against himself . . .” U.S. CONST. amend. V, cl. 3. The Court in *Schmerber* held:

[T]he [Fifth Amendment] privilege protects an accused only from being compelled to testify against himself, or otherwise provide the State with evidence of a testimonial or communicative nature, and that the withdrawal of blood and use of the analysis in question in this case did not involve compulsion to these ends.

384 U.S. at 760–61 (footnote omitted).

85. *Schmerber*, 384 U.S. at 761 & n.5; see also, e.g., *Gilbert v. California*, 388 U.S. 263, 266–67 (1967) (rejecting defendant's claim that a sample of his handwriting was privileged under the Fifth Amendment because “[a] mere handwriting exemplar, in contrast to the content of what is written, like the voice or body itself, is an identifying physical characteristic outside its protection”). In addition, the refusal to submit to a blood-alcohol test has been adjudicated to be outside the protection of the Fifth Amendment. See, e.g., *South Dakota v. Neville*, 459 U.S. 553, 563–64 (1983) (“Given, then, that the offer of taking a blood-alcohol test is clearly legitimate, the action becomes no less legitimate when the State offers a second option of refusing the test, with the attendant penalties for making that choice.”); *Deering v. Brown*, 839 F.2d 539, 543–44 (9th Cir. 1988) (extending the *Neville* holding to situations where the refusal to submit to a breathalyzer test is made a criminal offense with attendant penalties). *Contra* *Commonwealth v. McGrail*, 647 N.E.2d 712, 714 (Mass. 1995) (“Because the refusal [evidence], in essence, constitutes testimony concerning the defendant's belief on a central issue to the case, we conclude that the evidence of the defendant's refusal to submit to a field sobriety test constitutes testimonial or communicative evidence.”), *overruled on other grounds* by *Commonwealth v. Blais*, 701 N.E.2d 314, 318 n.3 (Mass. 1998).

testing. In the latter, the government would be compelling a test not to offer evidence of a foreign substance contained in the defendant's blood or other bodily fluids or tissues, but rather to show that one's genetic makeup causes some people to be more apt to engage in certain unlawful (dangerous) conduct. Cases where law enforcement personnel are searching for foreign substances also differ from searches for a person's genes. The former involves the product of a voluntary act, while the latter is something individuals cannot control. Information obtained from genetic tests is also distinct from information obtained from fingerprints,⁸⁶ as the former may include highly personal-relational and health matters that are unrelated to identification.⁸⁷ Thus, although the Court has not yet determined whether such genetic information constitutes "self-incriminating" evidence protected under the Fifth Amendment, this type of information is distinguishable from the evidence involved in prior Supreme Court rulings.

Compelled health-related genetic testing may also implicate the due process protections of the Fifth and Fourteenth Amendments, in particular, an individual's liberty interests. Such interests may include protection from certain types of bodily invasions as well as the collection, for public purposes, of private and highly personal information. While minor bodily intrusions are unlikely to trigger due process protections,⁸⁸ there is a possibility that the Due Process Clause could be interpreted to protect private, potentially stigmatizing, genetic information.⁸⁹ Here, as above, the new use of this technology pushes the

86. Obtaining fingerprints from individuals suspected of a crime has long been permissible under the Fifth Amendment. *See, e.g., Schmerber*, 384 U.S. at 764 ("[B]oth federal and state courts have usually held that [the Self Incrimination Clause] offers no protection against compulsion to submit to fingerprinting . . ."); *United States v. Thomann*, 609 F.2d 560, 562 (1st Cir. 1979) ("Fingerprint evidence does not fall within the [F]ifth [A]mendment's privilege against self-incrimination. Compelling a criminal suspect to exhibit his identifying physical characteristics, such as a blood sample or fingerprints, is not the forced extraction of testimonial or communicative evidence contemplated by the [F]ifth [A]mendment.").

87. Such information, which may at some future time include proclivity to aggression, mental illness, or alcoholism, could cause grave injury to a person's reputation. *See, e.g., Collins et al., supra* note 4, at 844 (noting the "history of misunderstanding and stigmatization" in "research into the genetic contributions to traits and behaviours"); Lawrence O. Gostin, *Health Information Privacy*, 80 CORNELL L. REV. 451, 490 (1995) ("Disclosure of some conditions can be stigmatizing, and can cause embarrassment, social isolation, and a loss of self-esteem."); *see also infra* note 144 and accompanying text.

88. *See, e.g., Breithaupt v. Abram*, 352 U.S. 432, 439–40 (1957) (finding that the Due Process Clause does not invalidate defendant's conviction based upon evidence of an involuntary blood test because applying a blood test is "so slight a [] [bodily] intrusion").

89. *See Kaye, Constitutionality, supra* note 82, at 470–71 (analyzing the application of the Due Process Clause to state efforts to disclose highly personal information).

envelope of existing constitutional jurisprudence and may give judges pause when deciding whether to grant a motion to compel such tests.

The difference between compelling testing and admitting an existing genetic test result is also important in the civil context. The ability of courts in civil cases to compel genetic testing is based on Rule 35 of the Federal Rules of Civil Procedure⁹⁰ or an equivalent state law. Under Rule 35, a court may order a party to submit to a physical or mental examination.⁹¹ Most often, defendants employ Rule 35 to rebut plaintiffs' allegations of physical or psychological injuries.⁹² A possible sanction for failure to comply with an order for a medical exam is dismissal of the case.⁹³ In addition to its use to compel genetic testing, Rule 35 has been used in other troublesome ways such as compelling psychological exams related to sexual trauma and HIV tests.⁹⁴

In deciding whether to compel an examination under Rule 35, courts must determine whether the party subject to the examination has placed her mental or physical condition "in controversy" and whether "good cause" exists for the exam.⁹⁵ "Good cause" requires a factual showing that there is a need for the examination and that there is no less intrusive means available for obtaining the information.⁹⁶ In considering the intrusiveness of the examination, courts generally only consider the physical health risks to the examinee, although a few courts have considered the psychological and emotional trauma that may accompany a physical or mental exam.⁹⁷ Courts

90. FED. R. CIV. P. 35.

91. *Id.*

92. *See* Niedwiecki, *supra* note 16, at 295.

93. *See, e.g.,* Bodnar v. Bodnar, 441 F.2d 1103, 1103-04 (5th Cir. 1971) (per curiam) (affirming the district court's dismissal where appellant refused to submit to a court-ordered mental examination).

94. *See* Niedwiecki, *supra* note 16, at 299.

95. FED. R. CIV. P. 35 (requiring condition to be "in controversy" and court order to be made "only on motion for good cause shown and upon notice to the person to be examined").

96. *See* Schlagenhauf v. Holder, 379 U.S. 104, 118 (1964) ("[W]hat may be good cause for one type of examination may not be so for another. The ability of the movant to obtain the desired information by other means is also relevant."); *see also* 8A CHARLES ALAN WRIGHT ET AL., FEDERAL PRACTICE AND PROCEDURE § 2234.1 (1994) (quoting *Schlagenhauf* in articulating the "good cause" standard).

97. *See, e.g.,* Doe v. Roe, 526 N.Y.S.2d 718, 722 (N.Y. Sup. Ct. 1988). In *Doe*, the court stated:

While there is no consensus under what circumstances the extraordinary remedy [of] involuntary testing should take place, it is clear that the medical, psychosocial, and legal ramifications of such testing place it on an entirely different plane than other, non-invasive or minimally invasive procedures. This infor-

often “justify their rulings by stating that the ordered testing is necessary to promote a fair and judicious conclusion to the dispute.”⁹⁸

In *Harris v. Mercy Hospital*,⁹⁹ one of the few reported cases where a genetic test was compelled, the court focused primarily on the physical intrusiveness of the procedure, commenting that blood tests are routine procedures in everyday life.¹⁰⁰ The court appeared to ignore the plaintiff’s arguments that the test would subject the minor to “trauma, serious complications from contamination or infection, and [the] risk of [AIDS].”¹⁰¹ Nor did it consider the fact that the blood test had only a 50% likelihood of indicating that the child had the genetic defect as a reason not to compel the test.¹⁰²

In cases where an individual was already tested in the context of medical treatment, diagnosis, or research, a judge may be asked to determine whether the results should be admitted. To be admissible, evidence must meet the relevant Daubert or Frye standard of the jurisdiction,¹⁰³ must not be protected by a privilege, and must be relevant. In the case of medical tests, in some jurisdictions a genetic test performed by a physician for the purpose of diagnosis or treatment may

mation must be taken into account whenever an involuntary AIDS test is sought, and must be part of the balancing process in which a court engages.

Id.

98. Niedwiecki, *supra* note 16, at 306.

99. 596 N.E.2d 160 (Ill. App. Ct. 1992).

100. *Id.* at 163. In *Harris*, the mother of a minor brought suit against physicians and a hospital alleging that their negligent care and treatment during her labor and delivery caused permanent brain damage to her daughter. *Id.* at 161. During discovery, a geneticist who previously examined the child as part of her medical care testified that she may suffer from Angelman Syndrome, a disorder believed to involve a chromosomal abnormality. *Id.* Based upon the geneticist’s testimony, a defendant physician sought to establish that the child’s condition was caused by a genetic disorder, rather than the physician’s negligence, and filed a motion to order the plaintiff to submit to a chromosomal blood test. *Id.* After finding “good cause” for the blood test, the trial court granted the physician’s motion. *Id.* at 162. The plaintiff refused to comply with the order. As a result, the court held plaintiff’s counsel in civil contempt and imposed a ten-dollar fine. *Id.* The trial court’s decision to compel the order was upheld on appeal. *Id.* at 163.

101. *Id.* at 162.

102. *Id.* at 163; *see also* *Bennett v. Fieser*, No. 93-1004-MLB, 1994 WL 542089, at *2 (D. Kan. Feb. 25, 1994) (imposing a Rule 35 order for withdrawal of 5 cubic centimeters of blood from a minor child for genetic testing because the amount of blood was small, the pain would be relatively minor, and the result was relevant to the outcome of the case).

103. Under the *Frye* standard, judges are generally deferential to scientists. Once a fact achieves “general acceptance” in the field, it can be admitted into evidence and relied upon by expert witnesses. *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923). However, in 1993, the Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* expressly rejected the *Frye* test for federal court litigation and created a greater role for judges as “gatekeepers.” 509 U.S. 579, 587–89 (1993). Under the *Daubert* standard, judges are required to evaluate the reliability and scientific validity of scientific information before deciding whether to admit it as evidence. *Id.* at 594–95.

be inadmissible as a result of a physician-patient privilege.¹⁰⁴ Although the majority of states have such a privilege, in some states it applies only to information revealed to a psychiatrist or other mental health professional.¹⁰⁵ In addition, some states recognize an exception where the patient is a litigant and puts her physical or mental health at issue.¹⁰⁶

The test result would be relevant if it would make some fact that is of consequence to the outcome of the case (guilt, innocence, or liability) more or less probable. The probative value of a genetic test result may depend on a variety of factors including the accuracy and reliability of the test, the penetrance of the gene, the impact of environmental causes on the expression of the gene, and the severity of the disease.¹⁰⁷

Judges generally admit such evidence if they determine it to be relevant. Even if relevant, however, judges may exclude the evidence if they determine that it would be unfairly prejudicial because of its tendency to inflame or confuse the jury.¹⁰⁸ Thus, a judge will exclude

104. McCormick's treatise on evidence explains the application of the physician-patient privilege as follows:

Statutes conferring a physician-patient privilege vary extensively, though probably a majority follow the pioneer New York and California statutes in extending the privilege to "any information acquired in attending the patient." Understandably, these provisions have been held to protect not only information explicitly conveyed to the physician by the patient, but also data acquired by examination and testing. Other statutes appear facially to be more restrictive and to limit the privilege to communications by the patient. This appearance, however, may frequently be misleading, for statutes of this sort have been construed to provide a privilege fully as broad as that available elsewhere.

1 McCormick ON EVIDENCE § 100, at 455-56 (6th ed. 2006) (footnotes omitted).

105. *Id.*; see MD. CODE ANN., CTS. & JUD. PROC. § 9-109(b), 9-109.1(b) (LexisNexis 2006); see also *Butler-Tulio v. Scroggins*, 774 A.2d 1209, 1216 (Md. Ct. Spec. App. 2001) (noting that "there is no physician-patient privilege in Maryland").

106. See BARRY R. FURROW ET AL., HEALTH LAW 154 (2d ed. 2000).

107. See John C. Childs, *Toxicogenomics: New Chapter in Causation and Exposure in Toxic Tort Litigation*, 69 DEF. COUNS. J. 441, 444 (2002) (discussing some of the "confounding factors, such as the potential synergistic or additive effects of other genetic, toxic or environmental influences on the body" involved in assessing genetic test results); Niedwiecki, *supra* note 16, at 351-52 (discussing the "uncertainties" for courts weighing the probative value of genetic test results).

108. FED. R. EVID. 403 ("Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence."); see also *Hines v. Joy Mfg. Co.*, 850 F.2d 1146, 1154 (6th Cir. 1988) (clarifying that exclusion of evidence at a court's discretion still requires a showing that the evidence is "more than damaging to the adverse party; it must be unfairly prejudicial"); *Jackson v. Firestone Tire & Rubber Co.*, 788 F.2d 1070, 1075 (5th Cir. 1986) ("Determinations of whether to exclude even relevant evidence because of its potential for

evidence if she distrusts the jury's ability to evaluate it properly.¹⁰⁹ In the case of a genetic test, a judge might exclude evidence if he decides that a jury would find it too confusing or give it too much weight (e.g., decide that someone with a genetic condition or predisposition is more likely to commit a crime, simply by virtue of that fact alone).

Other rules of evidence may also prevent the introduction of genetic tests linked to certain kinds of information. For example, the Federal Rules of Evidence prohibit the introduction of character evidence, i.e., evidence probative of a certain behavioral trait, to show propensity to behave in a certain way.¹¹⁰ This may be of particular significance for efforts in criminal cases to admit genetic tests indicating a predisposition to a behavioral trait such as aggression, impulsiveness, or addiction.¹¹¹

Judges in civil cases may also be less likely to compel a genetic test than to admit a test result. However, other factors may be more signif-

prejudicial or inflammatory effects upon the jury are made by balancing inflammatory potential against the likely probative value of the evidence.”).

109. *See Empire Gas Corp. v. Am. Bakeries Co.*, 646 F. Supp. 269, 276 (N.D. Ill. 1986) (“‘[U]nfair prejudice,’ within the context of Rule 403, means undue tendency to suggest decision on an improper basis, commonly, though not necessarily, an emotional one. Generally, . . . the danger of unfair prejudice . . . always exists where [evidence] is used for something other than its logical probative force.” (citation omitted)). A judge, however, will often admit, with limitations, complex statistical evidence if a qualified expert can explain the evidence to the jury using precise, understandable language. FED. R. EVID. 702; *see also Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 151–52 (1999) (instructing that the *Daubert* gatekeeping standard applies beyond purely scientific testimony to skill- or experience-based testimony because its purpose “is to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field”).

110. Rule 404(a) generally does not allow the introduction of “[e]vidence of a person’s character or a trait of character . . . for the purpose of proving action in conformity therewith on a particular occasion.” FED. R. EVID. 404(a). There are, however, exceptions to this rule in the criminal context. Under Rule 404(a)(1) the prosecution is allowed to introduce character evidence of the accused when the accused attacks a pertinent trait of character of the alleged victim. FED. R. EVID. 404(a)(1). Also, in a homicide case, under Rule 404(a)(2) the prosecution is allowed to introduce evidence of the “character trait of peacefulness of the alleged victim” in order to “rebut evidence that the alleged victim was the first aggressor.” FED. R. EVID. 404(a)(2). Notably, Rule 404 only allows proof of character by way of reputation or opinion. FED. R. EVID. 405(a).

111. *See Appelbaum, supra* note 16, at 26 (“Genetic data may even run afoul of standards for admissibility of evidence, because guidelines such as the Federal Rules of Evidence exclude testimony aimed solely at demonstrating that the defendant has a propensity to behave in a particular way.”). *But see* Steven I. Friedland, *The Criminal Law Implications of the Human Genome Project: Reimagining a Genetically Oriented Criminal Justice System*, 86 Ky. L.J. 303, 334, 336–37 (1997) (asserting that an individual’s genetically determined behavioral traits may play a major role in questions of character evidence at trial and that genetic “character evidence” would differ from traditional character evidence by virtue of its permanency).

icant in the civil context. In comparing the two damage hypotheticals (Hypotheticals #5 and #6), the judges were much more hesitant to *compel* a test at the request of the defendant for purposes of mitigating damages than to *admit* a test result at the request of a plaintiff to expand damages. We speculate that this was more likely due to concerns about the psychological trauma of an unwanted predictive test revealing a gene for a terminal, incurable disease than concerns about compelling a test for purposes of determining damages per se. In Hypotheticals #3 and #4, the large majority of judges had no trouble compelling a test to prove or refute negligence as the *cause* of the plaintiff's injury, presumably because the plaintiff could terminate the case. The same would be true in the context of damages, i.e., the plaintiff could *withdraw from* the case. The posture of the case, however, may also be important to judicial evaluation. If the hypothetical we posed in the causation context involved testing for a condition that was lethal and could lead to childhood death, it is not clear whether the judges would have been less willing to compel the test as the information was potentially relevant to the defendant's liability. However, if in that same case, the defendant wished to compel a genetic test in the damages portion of the case, judges may have been more reluctant to compel the test both because of the psychological consequences and because it could be considered unfair to shortchange a plaintiff who happens to have a genetic condition that will lead to his early death. Moreover, judges may believe it would be worse to "force" withdrawal in the damages phase by a plaintiff who has already established liability than to force one to withdraw before he has established any wrong.

If both Hypotheticals #5 and #6 had been requests to *admit* a genetic test result, we predict that the difference in judicial responses between the two hypotheticals would not have been as great, but that the judges still would have been less likely to admit the NF-2 test result. Even if the plaintiff in Hypothetical #5 had already had a genetic test indicating that he had the gene mutation for NF-2 and was aware of the result, judges might have been more reluctant to admit the test for the reasons stated above, i.e., it seems unjust to reduce the plaintiff's damages because he got an unlucky number in the genetic lottery of life.¹¹² Some might consider this reduction of damages a

112. Courts in prior cases have split on whether to compel and/or admit HIV tests for the purpose of determining life expectancy in civil cases. *Compare* *Sacramona v. Bridgestone/Firestone Inc.*, 152 F.R.D. 428, 431 (D. Mass. 1993) (refusing to compel a personal injury plaintiff to undergo HIV testing because the plaintiff did not place his life expectancy "in controversy" under the Federal Rules of Civil Procedure by seeking future dam-

“windfall” for a negligent defendant, especially if the damages would have been larger if the plaintiff did not have the genetic condition.

This latter argument is supported by the principle of retributive justice—the belief that defendants should be sanctioned for their wrongdoing. Moreover, it assumes that defendants who are equally at fault should be liable for similar amounts of damages and that those tortfeasors who are “lucky enough” to encounter a plaintiff with a shorter life expectancy should not benefit from their victim’s misfortune. The argument is further bolstered by economic/instrumental claims that deterrence is a legitimate goal of tort law that should not be undermined by schemes focusing solely on compensation.¹¹³ According to this perspective, damages should be sufficient to encourage potential wrongdoers to minimize risks, i.e., take “cost-justified precautions.”¹¹⁴

B. *Legal Purpose of the Test*

A second factor that must be considered in analyzing a request to admit or compel a genetic test is the purpose for which the test infor-

ages), *and Doe v. Roe*, 526 N.Y.S.2d 718, 726–27 (N.Y. Sup. Ct. 1988) (stating, in the context of a custody battle, that a father’s potentially shortened life span does not rise to the level of a “compelling need” sufficient to order involuntary HIV testing), *with Agosto v. Trusswal Sys.*, 142 F.R.D. 118, 120 (E.D. Pa. 1992) (admitting plaintiff’s positive HIV status, upon finding that he waived his privilege to confidentiality when he sought compensation for future pain and suffering and lost wages in a products liability suit), *and Pettyjohn v. Goodyear Tire & Rubber Co.*, Civ. A. No. 91-CV-2681, 1992 WL 105162, *1 (E.D. Pa. Apr. 29, 1992) (granting defendant’s motion to compel plaintiff to submit to HIV testing in a personal injury case, where defendant’s purpose for the discovery request was to establish plaintiff’s reduced life expectancy); *see also* Niedwiecki, *supra* note 16, at 320–26 (discussing cases of court-ordered HIV testing); Ugo Colella, *HIV-Related Information and the Tension Between Confidentiality and Liberal Discovery: The Need for a Uniform Approach*, 16 J. LEGAL MED. 33, 35 (1995) (discussing civil discovery disputes involving HIV-related information). Courts may distinguish situations where the disease or condition is immutable from those where the condition is due to lifestyle or behavior, e.g., smoking or drug use. *See, e.g.*, *Wehmeier v. UNR Indus. Inc.*, 572 N.E.2d 320, 340 (Ill. App. Ct. 1991) (“We conclude the smoking evidence was relevant to the issues of causation and damages and should have been admitted on these issues without restriction.”); *Rawlings v. Andersen*, 240 N.W.2d 568, 573 (Neb. 1976) (“In an action where permanent, personal injury is claimed, the defendant may show as affecting damages that the plaintiff was a person of intemperate habits.”).

113. *See* JULES L. COLEMAN, *RISKS AND WRONGS* 237–39 (1992) (discussing the economic theory of deterrence); Michael L. Rustad & Thomas H. Koenig, *Taming the Tort Monster: The American Civil Justice System as a Battleground of Social Theory*, 68 BROOK. L. REV. 1, 56 (2002) (analyzing the underlying policy reasons for civil damage awards); Benjamin C. Zipursky, Symposium, *Civil Recourse, Not Corrective Justice*, 91 GEO. L.J. 695 (2003) (discussing and critiquing the corrective justice theory).

114. *See* COLEMAN, *supra* note 113, at 238–39 (suggesting that liability rules should encourage “cost-justified precautions”).

mation will be used. Whether the information will be used to determine guilt or innocence, liability, causation, damages, or sentencing will have different implications for judicial decisionmaking.

Thus far, the most frequent use of health-related genetic tests in the courtroom has been in the context of establishing or refuting causation. While in the medical malpractice context the use of genetic test results may be appropriate to show that a defendant's negligence was not the cause or sole cause of a plaintiff's injuries, the use of genetic test results in toxic tort litigation to establish or exclude a genetic cause for the plaintiff's condition can be problematic due to the uncertainties of proof of causation in toxic injury claims.

Defendants have attempted to use genetic tests to show either that the plaintiff has a genetic condition that accounts for her disease/disability or that the plaintiff had a genetic susceptibility to a disease/disability that made it more likely than not that the disease would have occurred without the toxic exposure.¹¹⁵ Plaintiffs have tried to refute these arguments by showing that they either do not have a genetic condition or predisposition to a genetic disease *or* that exposure to a toxic substance caused their disease/disability because of their genetic susceptibility or sensitivity to the substance.¹¹⁶

Genetic tests may be valuable to defendants who wish to show that the plaintiff's condition is due to a genetic anomaly or susceptibility, and not toxic exposure, e.g., Fragile X syndrome versus lead paint. In such cases, the gene may explain all of the plaintiff's disabilities. However, it is also possible that both the genetic condition and the lead exposure could contribute to the plaintiff's symptoms.

In cases where the defendant wishes to show that the plaintiff had a "disease susceptibility gene," the use of a genetic test is more troublesome, especially if the test is being used in an attempt to rule out the toxic exposure as a cause of the plaintiff's infirmities. This is because of the different ways in which genetic variations may increase disease susceptibility. They may "facilitate toxic injury by making an affected cell more or less susceptible to toxic insult," or alternatively, "they may

115. Poulter, *supra* note 16, at 212–13 (discussing the impact of genetic testing on a plaintiff's proof of causation in toxic tort cases).

116. In *In re Hanford Nuclear Reservation Litig.*, No. CY-91-3015-AAM, 1998 WL 775340, at *64–65 (E.D. Wash. Aug. 21, 1998), *rev'd on other grounds*, 292 F.3d 1124, 1139 (9th Cir. 2002), plaintiffs argued that they developed thyroid cancer from radiation exposure because they had a genetic sensitivity to such exposure. The argument was unsuccessful as they were unable to find reasonable scientific support for individual susceptibility. *Id.* at *67.

be involved in independent disease etiologies that do not involve the toxic insult at issue.”¹¹⁷ According to Poulter:

The “alternative cause” model posited by many commentators is valid only if the second mode of action applies, [i.e., the plaintiff had a genetic predisposition to the disease at issue and likely would have developed the disease independently of the exposure to the toxic substance] yet the first mode is more consistent with current understandings of many diseases with genetic components. When it is not known whether the genetic variation facilitates toxic injury or is involved in an independent disease pathway, genetic testing will not assist causal analysis.¹¹⁸

Where the first mode of action applies, the disease is a result of both the genetic susceptibility and the toxic exposure. Attempting to determine whether the toxic exposure legally caused the plaintiff’s disease or condition where the disease is a result of multiple causes is fraught with difficulties. We avoided these complexities in Hypothetical #4 by making it clear that the condition at issue only resulted when both the genetic susceptibility *and* the toxic exposure existed. In most cases, however, the mechanism of causation will not be known. More specifically, we will not know whether: (1) the disease was a result of the genetic susceptibility alone or the toxic exposure alone; (2) the toxic exposure triggered the genetic susceptibility; or (3) the toxic exposure accelerated the disease manifestation so that it occurred earlier than it might have otherwise. If the disease is a result of both a genetic susceptibility and a toxic insult, we will not know whether the interaction between the two causes is additive, synergistic, or antagonistic.¹¹⁹ Poulter argues that in cases where we do not yet understand the actual disease mechanism, courts should not permit the introduction of genetic test results in toxic tort cases.¹²⁰

Despite the mechanistic complexities,¹²¹ some authors have speculated as to how genetic test results indicating genetic susceptibility to

117. Poulter, *supra* note 16, at 213.

118. *Id.* at 213. Even if the second mode of action applies, this does not rule out the possibility that the toxic exposure had a harmful effect on the plaintiff. *Id.* at 219–20.

119. *See id.* at 222, 230.

120. *Id.* at 236 (“Where information about the relationship between genetic susceptibility and toxic insult is not understood, genetic testing will not be probative.”).

121. In addition to the complexities identified by Poulter, Marchant explains:

Even when a susceptibility genetic marker has been unambiguously identified, its effects can vary across individuals for a variety of reasons. Some increases in susceptibility are dose-dependent, in that they primarily increase an individual’s susceptibility to a toxic agent relative to the general population only at low or high doses. Certain associations appear to be ethnic-dependent, in that the susceptibil-

a toxic substance may affect causation determinations in litigation. Such cases are subject to the same difficulties as are present in other toxic tort cases.¹²² Plaintiffs, as an initial matter, will need to show that the toxic exposure was “more likely than not” the cause of the plaintiff’s disease or condition.¹²³ Often, under current tort doctrine, in order to satisfy the “more likely than not standard” courts require that plaintiffs show that the relative risk of the disease at issue as a result of exposure to the toxic substance is greater than two. This is often a difficult hurdle for plaintiffs;¹²⁴ however, plaintiffs who can show that they have a genetic susceptibility to disease based on exposure to the toxic substance may be able to surmount the causation hurdle.¹²⁵

If causation can be established, the fact that someone has a genetic predisposition to disease based on toxic exposure would generally not reduce damages in a case alleging that exposure to a toxic

ity associated with a particular gene appears to be limited to particular ethnic groups and is not seen in other groups even when the same gene is present. . . . Finally, individual susceptibility to potentially toxic agents is rarely determined by a single genetic locus, but rather is the combined influence of many different genes (as well as non-genetic factors).

Gary E. Marchant, *Genetics and Toxic Torts*, 31 SETON HALL L. REV. 949, 952–53 (2001).

122. See generally Ellinger, *supra* note 16 (discussing the legal implications of using DNA diagnostic technology in toxic tort litigation); Susan R. Poulter, *Science and Toxic Torts: Is There a Rational Solution to the Problem of Causation?*, 7 HIGH TECH. L.J. 189 (1992) (discussing the challenges of proving causation in cases of toxic torts); see also Marchant, *supra* note 16, at 89 (“One of the most formidable obstacles that injured plaintiffs face in toxic injury litigation is to demonstrate that the defendant’s product or action caused the plaintiff’s injuries.”); Mark Parascandola, *What Is Wrong with the Probability of Causation?*, 39 JURIMETRICS 29, 29–30 (1998) (arguing that causation is difficult to prove in toxic tort cases because “the injury in question is typically a chronic disease that may develop years later following long-term exposure to low doses of a carcinogen or other toxin . . . [and] the mechanism by which the toxin causes the disease may be poorly understood”).

123. See Poulter, *supra* note 16, at 217.

124. A number of statistical experts have argued that this standard is flawed and unfairly disadvantages plaintiffs. *E.g.*, Sander Greenland & James M. Robins, *Epidemiology, Justice, and the Probability of Causation*, 40 JURIMETRICS 321, 331–33 (2000); Mark Parascandola, *supra* note 122, at 37–39. Some have argued that in cases where plaintiffs cannot meet the “more likely than not” rule, plaintiffs should receive partial compensation based on the cause that is attributable to the defendant’s actions. This has been referred to as “proportional recovery.” See Poulter, *supra* note 16, at 224 & n.63 (citing *In re Agent Orange Product Liab. Litig.*, 597 F. Supp. 740 (E.D.N.Y. 1984), *aff’d*, 818 F.2d 145 (2d Cir. 1987), *cert. denied*, *Pinckney v. Dow Chem. Co.*, 484 U.S. 1004 (1988)).

125. See Marchant, *supra* note 16, at 67–68 (noting that a plaintiff could satisfy the more probable than not standard if she has a genetic susceptibility to cancer from exposure to defendant’s product); see also Marchant, *supra* note 121, at 954–56 (discussing cases in which plaintiffs made a genetic susceptibility argument). While in some circumstances such tests may assist plaintiffs, in others, defendants may use genetic tests to show that plaintiffs have a gene that makes them more resilient or resistant to toxic exposures than the average person, therefore reducing the likelihood that the toxic exposure in question caused the plaintiff’s harm. *Id.* at 956.

chemical caused the harm. As indicated by a number of judges who participated in our survey, in these cases the court would likely adopt the well-known tort doctrine that a tortfeasor takes her victim as she finds him—the fact that an individual is highly sensitive to a chemical exposure is not particularly helpful to the defendant. Where the plaintiff had a pre-existing physical condition, the defendant is liable for the full extent of the plaintiff's harms even if the defendant could not have foreseen such harms.¹²⁶

While the majority of courts may apply this rule, in the context of product liability cases, some courts have accepted a defendant's argument that its product was not "defective or unreasonably dangerous" if the plaintiff had a rare, idiosyncratic and unforeseeable reaction to the product.¹²⁷ Conceivably, some courts might apply this "idiosyncratic response defense" in cases of a rare genetic condition.¹²⁸ While the rule may be appropriate in cases where the causal link between the product and the genetic condition had not been established, once evidence of such a relationship exists, manufacturers should be required to warn individuals with the genetic sensitivity of the risk.¹²⁹

126. *See, e.g.*, *Dahlen v. Gulf Crews, Inc.*, 281 F.3d 487, 495 (5th Cir. 2002) (citing in support of this rule RESTATEMENT (SECOND) OF TORTS § 461 (1965)); *Tuite v. Stop & Shop Cos.*, 696 A.2d 363, 367 (Conn. App. Ct. 1997) (same); *Cavens v. Zaberdac*, 849 N.E.2d 526, 530 (Ind. 2006) (same); *Benn v. Thomas*, 512 N.W.2d 537, 539–40 (Iowa 1994) (same); *Wilkinson v. Lee*, 617 N.W.2d 305, 309 (Mich. 2000) (same); *see also* RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL HARM § 31 (Proposed Final Draft No. 1, 2005); W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS § 43, at 290–93 (W. Page Keeton ed., 5th ed. 1984) (commenting on liability beyond the risk a defendant reasonably anticipated).

127. *Marchant, supra* note 16, at 79–81; *see also* RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2 cmt. k (1998) (noting that products do not have to contain warnings of risks of allergic reactions that are not reasonably foreseeable at the time of sale); *Daley v. McNeil Consumer Prods. Co.*, 164 F. Supp. 2d 367, 373 (S.D.N.Y. 2001) ("The supplier owes no special duty of warning to the unknown few who constitute a mere microscopic fraction of potential users who may suffer some allergic reaction not common to the ordinary or normal person." (internal quotation marks omitted)). Evidence of linkages between genes and allergic reaction has surfaced in a variety of cases. *See, e.g.*, *Roberto Littera et al., HLA-Dependent Hypersensitivity to Nevirapine in Sardinian HIV Patients*, 20 AIDS 1621, 1621 (2006) (documenting a link between allergic reactions to an AIDS medication and a gene more prevalent in Sardinians than other Italians).

128. *Marchant, supra* note 16, at 80–81 & n.73. *Marchant* notes that the idiosyncratic response defense "applies when the product would not be expected to cause similar health effects in a 'normal' or 'average' person. The formal justification for this defense is that the hyper-susceptibility of the plaintiff, rather than the product, is the proximate cause of the plaintiff's injury." *Id.* at 80 (footnotes omitted).

129. In fact, where courts have applied an idiosyncratic response defense, some have based the defense on "the unforeseeability of the rare susceptibility in the exposed population." *Marchant, supra* note 16, at 81. In general, these courts have held that "a 'normally safe' product that injures only a small number of susceptible individuals is not defective, but must be accompanied by a warning when the manufacturer knew or should have

The question of whether this latter doctrine will apply to cases where a product harms an individual with a genetic susceptibility has yet to be resolved. However, it raises the question as to where, in these cases, the burden should fall—on the innocent victim or the product manufacturer. Beyond this broader policy question, the application of the doctrine will require some articulation as to how rare the genetic condition would have to be before it would attach.¹³⁰

An additional use of genetic tests in the context of determining causation has been proposed where a plaintiff has a unique physiological or cellular abnormality that is attributable to exposure to a specific toxin, i.e., a biomarker. As has been seen in some benzene exposure cases, defendants may attempt to disprove causation by arguing that the plaintiff's blood or tissue sample did not display the "correct" type of cellular damage.¹³¹ Judges should be wary of these types of arguments, however, because it is often difficult for laypersons to distinguish between valid scientific bases for the claims and more tenuous ones.¹³² For example, the theory of a chromosome-specific

known of the potential for an idiosyncratic response, no matter how unusual." *Id.* Other courts, however, have emphasized "the undue burdens that liability would impose for a product that is safe for most people" and have held that there is "no defect or duty to warn, even when the defendant knows or should know that there are likely to be a small number of unidentifiable susceptible individuals." *Id.* at 81–82.

130. See RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2 cmt. k (stating a general rule, followed by the majority of courts, for required warnings on products in cases involving allergic or idiosyncratic reactions to products). Generally, "a warning is required when the harm-causing ingredient is one to which a substantial number of persons are allergic" and "[t]he ingredient that causes the allergic reaction must be one whose danger or whose presence in the product is not generally known to customers." *Id.* In most cases, a plaintiff must show that "the allergic predisposition is not unique to the plaintiff"; however, the court may also consider "the severity of the plaintiff's harm." *Id.* In addition, warnings need not be provided for risks of allergic reactions that are not reasonably foreseeable at the time of sale. *Id.*; see also *Mountain v. Procter & Gamble Co.*, 312 F. Supp. 534 (E.D. Wis. 1970) (holding that manufacturers of a shampoo owed no duty to warn of possible allergic reactions to the product when only a slight percentage of total sales resulted in injury); *Morris v. Pathmark Corp.*, 592 A.2d 331 (Pa. Super. Ct. 1991) (holding that the manufacturer was not liable and a warning was not required on a product that caused the plaintiff to manifest an unusual or rare idiosyncratic sensitivity because there was "no evidence that the product had contained an ingredient to which a significant number of persons were allergic"). But see *Gober v. Revlon, Inc.*, 317 F.2d 47 (4th Cir. 1963) (holding that whether manufacturers of nail polish owed a duty to warn even though the number of users injured by the polish was small was a proper question for the jury).

131. See *supra* note 23 and accompanying text.

132. See, e.g., Samuel H. Wilson & William A. Suk, *Overview and Future of Molecular Biomarkers of Exposure and Early Disease in Environmental Health*, in BIOMARKERS OF ENVIRONMENTALLY ASSOCIATED DISEASE 3, 9 (Samuel H. Wilson & William A. Suk eds., 2002) ("[I]n a broad sense, it is fair to say that the promise of biomarkers has not yet moved from the lab to the clinic or from development to application."). According to Suk and Wilson, "propos[als] to develop biomarkers using assays that detect DNA strand breaks, chromosomal

“benzene fingerprint” is not widely accepted, whereas a number of protein biomarkers for benzene exposure have been validated.¹³³

In the criminal context, whether the genetic test information will be used for a determination of guilt or in sentencing does, and arguably should, make a difference in how judges evaluate whether to admit or compel the test. As discussed above, genetic tests for use in the guilt or innocence phase of a criminal proceeding raise both Fourth and Fifth Amendment issues.¹³⁴ The overlay of Fourth Amendment protections, however, may be of less concern in the sentencing process than in the conviction phase of a criminal proceeding because courts have fairly consistently referred to the felon’s lower expectation of privacy, especially as it pertains to issues of incarceration.¹³⁵ In the sentencing phase, judicial evaluation of requests to admit or compel a genetic test may depend on who is making the request. Conceivably either side could make the request, but for opposite reasons—the defendant may argue that he should have a reduced sentence, as his genetic trait prevented him from exercising free will; in contrast, the prosecution may seek a harsher sentence, claiming the defendant is dangerous and incurable.¹³⁶

aberrations, micronuclei, or the endogenous rate of DNA repair or mutation . . . are suboptimal for biomarker development, largely because of unresolved issues in their reproducibility, accuracy, validation and interpretation.” *Id.* at 10.

133. See, e.g., Matthew S. Forrest et al., *Discovery of Novel Biomarkers by Microarray Analysis of Peripheral Blood Mononuclear Cell Gene Expression in Benzene-Exposed Workers*, 113 ENVTL. HEALTH PERSP. 801, 804–05 (2005), available at <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1257610> (identifying four genes that show altered expressions after high occupational exposure to benzene); Roel Vermeulen et al., *Decreased Levels of CXC-Chemokines in Serum of Benzene-Exposed Workers Identified by Array-Based Proteomics*, 102 PNAS 17041, 17046 (2005), available at <http://www.pnas.org/cgi/content/full/102/47/17041> (finding decreased levels of a circulating protein could be a potential biomarker of the early stage biological effects of benzene).

134. See *supra* notes 64–89 and accompanying text.

135. See, e.g., *Hudson v. Palmer*, 468 U.S. 517, 527–28 (1984) (“A [Fourth Amendment] right of privacy . . . is fundamentally incompatible with the close and continual surveillance of inmates and their cells required to ensure institutional security and internal order . . . [, and] the prisoner’s expectation of privacy always yield[s] to what must be considered the paramount interest in institutional security.” (footnotes omitted)); see also *Groccman v. U.S. Dep’t of Justice*, 354 F.3d 411, 413–14 (5th Cir. 2004) (per curiam) (pointing out that an incarcerated individual has a lower expectation of privacy); *United States v. Kincade*, 379 F.3d 813 (9th Cir. 2004) (holding that application of “a totality of the circumstances analysis to uphold compulsory DNA profiling of convicted offenders” comports with the Fourth Amendment and Supreme Court precedent); *Vore v. U.S. Dep’t of Justice*, 281 F. Supp. 2d 1129, 1133, 1137 (D. Ariz. 2003) (upholding the constitutionality of a DNA collection statute and remarking on the Ninth Circuit’s statement that the Supreme Court in *Hudson* “may have intended to strip the inmates of all Fourth Amendment privacy rights” (quoting *Somers v. Thurman*, 109 F.3d 614, 617 (9th Cir. 1997))).

136. See *Denno*, *supra* note 16, at 254 (describing the potential use of genetic evidence as a “double-edged sword”).

C. *Concerns about Genetic Tests Related to Health and Behavior*

Judges will need to consider a third set of factors when evaluating requests to admit genetic test results or compel genetic tests. These factors, which relate to the unique features of health- and behavior-related genetic tests and conditions, include: the scientific value or utility of the test; the nature of the genetic trait or condition; the psychological impact of the tests, their impact on personal privacy, and on the privacy of relatives of the person tested; concerns about genetic determinism; and the use of a pre-existing technology for a new purpose.

1. *Test's Scientific Value and Nature of Genetic Trait or Condition*

The multiple factors that form the decision matrix in Figure 1 go beyond the challenging *Daubert* and *Frye* questions that will be raised by these tests. These factors provoke additional questions about admissibility, i.e., is a test result admissible if it indicates that an individual has a gene that only has a 40-60% probability of expression? What is the test's utility? While both genetic and non-genetic tests can be used for diagnostic and predictive purposes, genetic tests for certain diseases provide more definitive diagnoses than other non-genetic, medical tests and can "identify predispositions that are exclusively transmitted . . . from parent to child."¹³⁷ However, the predictive ability of the tests varies greatly, depending on the gene being analyzed and the data linking that gene to a future disease risk.¹³⁸

In the courtroom, genetic tests could be used to support a diagnosis, especially when clinical experts disagree over whether the individual has the condition. Yet, not all genetic tests would be equally valuable for this purpose. A genetic test will only reveal whether someone has the gene or mutation for a genetic condition; it does not indicate whether the individual has the condition unless the gene is 100% penetrant, i.e., there is a 100% correlation between having the gene mutation and having the disease or condition and the condition has an early onset. Thus, the value of the test depends on its predictive ability (which is dependent on gene penetrance) and the age of onset of the genetic condition. A third factor that must also be considered is the variability of expression of the symptoms of the genetic

137. Michael J. Green & Jeffrey R. Botkin, "Genetic Exceptionalism" in *Medicine: Clarifying the Differences Between Genetic and Nongenetic Tests*, 138 ANNALS INTERNAL MED. 571, 572 (2003), available at <http://www.annals.org/cgi/content/abstract/138/7/571>.

138. See generally DOROTHY NELKIN & LAURENCE TANCREDI, DANGEROUS DIAGNOSTICS (2d ed. 1994) (discussing the potential uses and abuses of genetic tests, as well as problems of reliability associated with the tests).

disease or illness, i.e., whether it is a mild or severe case. Different expression levels can arise as a result of environmental factors that alter cellular processes or because other genes and their protein products often exert a modifying effect on gene expression.¹³⁹

Penetrance may, in part, relate to whether the genetic condition at issue is monogenic (i.e., the result of a single gene mutation)¹⁴⁰ or multifactorial (i.e., the result of a combination of multiple genes or both genetic and environmental factors).¹⁴¹ A monogenic disease may be present at birth or be “late onset.” In the latter situation, it is highly likely that the genetic condition will manifest as long as the individual lives long enough, notwithstanding environmental factors. Genetic tests for monogenic disorders are generally more reliable than those for complex, multifactorial diseases because tests for complex disorders currently do not include information on the probability that an individual with a mutation associated with a disease actually will develop that disease.¹⁴²

In response to the hypotheticals that we included in our survey, judges were much more willing to admit a test result or compel a test when it was for a gene that was highly penetrant. For example, in the medical malpractice case (Hypothetical #3) where the genetic test was being requested to confirm a diagnosis of Fragile X, a condition for

139. See Leena Peltonen & Victor A. McKusick, *Genomics and Medicine: Dissecting Human Disease in the Postgenomic Era*, 291 *Sci.* 1224 (2001), available at <http://www.sciencemag.org/cgi/content/full/291/5507/1224> (discussing individual variations in genetic diseases resulting from the modifying effects of other genes, the environment, or an individual's lifestyle choices).

140. Monogenic disorders include Huntington's disease, cystic fibrosis, Tay-Sachs disease, sickle cell anemia, hemophilia, Fragile X syndrome, thalassemia, and hereditary hemochromatosis, among others.

141. The influence of “nature v. nurture” has long been debated in relation to many illnesses. See, e.g., Norman Poythress et al., *Scientific Status*, in *SCIENCE IN THE LAW* 22, 29 (David L. Faigman et al. eds., 2002) (“Although there is general consensus that genetics is a significant etiological factor in the major psychoses, debate remains concerning the role of the environment. . . . [P]eople vary widely in their responses to adverse life events, and the interaction of stress with underlying psychological (subjective) or biological factors is poorly understood.”).

142. See, e.g., Lori Andrews & Erin Shaughnessy Zuiker, *Ethical, Legal, and Social Issues in Genetic Testing for Complex Genetic Diseases*, 37 *Val. U. L. Rev.* 793, 803–05 (2003) (explaining the reduced predictive value of genetic tests for complex diseases). Providing good reason for why genetic tests for complex disorders are less reliable, David Bentley explains that “we fall short at present . . . in our understanding of physiological function or how sets of molecules work together, and in our ability to infer this from the accumulated information linked to the genome.” David R. Bentley, *Genomes for Medicine*, 429 *Nature* 440, 441 (2004). Bentley points out that geneticists currently do not understand “the functional sequences outside genes, . . . when and where genes are expressed, and in response to what signals” or “the biochemical functions of most proteins, and . . . most of the interactions between cellular components.” *Id.*

which virtually 100% of individuals with the genetic mutation have the condition at birth, the large majority of judges were willing to compel the test. In contrast, in the first criminal hypothetical (Hypothetical #1) where the plaintiff wished to admit a genetic test to support a diagnosis of schizophrenia, arguably, the judges were less comfortable admitting the test because the gene penetrance was only 50–60%.

Where the purpose of the test was to aid the judges in prognostication, as in the hypotheticals involving criminal sentencing (Hypothetical #2) and determination of life expectancy (Hypothetical #5), the judges were much less willing to compel the test. Such hesitancy appeared due to concerns about gene penetrance as well as gene expression. In the criminal case (Hypothetical #2), the penetrance of the gene again was only 50–60%. In the civil damages case (Hypothetical #5), while the penetrance of the gene was very high, there was significant variability in the severity of symptoms an individual with the gene would manifest. Such variability also may have accounted for judicial reluctance to admit the test result in that scenario.

2. *Psychosocial Issues (Privacy, Stigma, Psychological Harms)*

Judicial reluctance to compel or admit genetic tests was also tied to concerns about stigma, privacy, and the psychological impact of receiving unwanted information about a lethal and incurable genetic condition. Judges were sensitive to situations where news of a genetic condition could be psychologically devastating, as when there is no cure or treatment for it. Academics who have written on this issue have also expressed concerns about this element of health-related genetic testing. As one author put it, “[m]any DNA tests have the potential to reveal not only information of direct relevance to the litigation, but additional information of profoundly disturbing personal significance, information that may be only peripherally related or even unrelated to the physical harm that has been placed at issue in litigation.”¹⁴³

In addition to psychological harms, the disclosure of such information may also carry “relational harms.” Studies have demonstrated that potential spouses may be discouraged from entering a marriage

143. Ellinger, *supra* note 16, at 33. Ellinger provides the example of Huntington’s Disease (HD), for which “[a] DNA diagnostic test . . . can inform presymptomatic at-risk individuals whether they will almost certainly develop HD,” and cites one study finding that “over two-thirds of at-risk persons expected they would become depressed if DNA tests were positive, and another study [showing] that twenty-one percent of at-risk individuals might commit suicide if the tests were positive.” *Id.* at 68 (footnote omitted).

with a person carrying a “disease gene,” while current spousal relationships may also be negatively affected by such revelations.¹⁴⁴

The hypotheticals included in our survey highlight issues that may arise when the genetic test relates to mental and behavioral traits as well as physical health. The former may have given judges significantly greater pause. Such hesitation is warranted in light of the stigma associated with behavioral traits like aggression and impulsiveness as well as the role of genetics in such behaviors. Rothenberg and Wang confirm these reasons for caution, asserting that “[a]s one moves toward the behavioral end of the spectrum, the genetic influence on a trait becomes more uncertain and difficult to isolate, while the stigma associated with such influence becomes more significant.”¹⁴⁵ These concerns are clearly more weighty in the context of compelling a test than admitting an existing test result, since a litigant who seeks to admit a test has (presumably) decided that the value of the knowledge one gains from the test outweighs the potential harm (to oneself, at least), while a request to compel seeks to deny the individual who is to be tested the opportunity to strike that balance.

Moreover, genetic information can have a devastating impact on blood relatives who may be at risk for developing a genetic disease, but do not wish to know that they are at risk for such a condition.¹⁴⁶ These third parties, who likely have no role in the legal proceeding, by

144. See Andrews & Zuiker, *supra* note 142, at 811–12 (citing primary research that found 5% of female and 31% of male carriers of the Tay-Sachs recessive mutation were likely to change marriage plans if their intended spouse was also a carrier, as well as results indicating nearly one-third of couples divorced following positive testing of one spouse for the dominant Huntington’s mutation).

145. Karen Rothenberg & Alice Wang, *The Scarlet Gene: Behavioral Genetics, Criminal Law, and Racial and Ethnic Stigma*, 69 LAW & CONTEMP. PROBS. 343, 353 (2006). Rothenberg and Wang further assert that while behavioral traits are the most “indeterminate and controversial subjects of genetics research,” they also “may be the most relevant to criminal law” where conditions that contribute to violence, such as alcoholism, mental illness and antisocial behavioral traits, may assist prosecutors and judges in conviction and sentencing. *Id.* at 354; see also generally TED PETERS, PLAYING GOD?: GENETIC DETERMINISM AND HUMAN FREEDOM (1997) (discussing ethical challenges to moral responsibility when genes predispose individuals to criminal behavior).

146. See, e.g., Green & Botkin, *supra* note 137, at 572 (“Another feature of predictive genetic testing is that results can affect a patient’s family.”); C. Christopher Hook et al., *Primer on Medical Genomics Part XIII: Ethical and Regulatory Issues*, 79 MAYO CLINIC PROC. 645, 646 (2004) (raising the issue of whether patients should have the right not to know about the presence of genetic diseases, particularly about late-onset disorders); Samuel C. Seiden & Karine Morin, *The Physician as Gatekeeper to the Use of Genetic Information in the Criminal Justice System*, 30 J.L. MED. & ETHICS 88, 89 (2002) (maintaining that genetic test results deserve a higher standard of confidentiality because they might reveal information about a patient’s family members and their risks for developing a genetic disease, and that such information may be unknown to those family members).

virtue of their genetic relationship, may be “victims” harmed psychologically and in other ways by the revelation of this “unwanted” information.¹⁴⁷

A few authors have discussed the value of protective orders to preserve individual privacy in civil cases where genetic tests are compelled or admitted. Rothstein asserts that such orders should be issued when defendants are seeking to discover plaintiffs’ genetic profiles in an attempt to limit their financial liability.¹⁴⁸ Others have argued that issuing protective orders is not an adequate remedy for the invasion of privacy imposed by court-ordered genetic testing because individuals would be unable to keep the information private when, for example, applying for health insurance or employment.¹⁴⁹

3. Genetic Determinism

Concerns about genetic determinism, i.e., “the impulse to treat DNA as destiny, discounting the possibility of deviating from one’s genetic predisposition,”¹⁵⁰ appeared more important in the criminal than in the civil context where “branding” has the potential to deprive an individual of liberty. This was evident in the hypothetical use of a genetic test to determine “future dangerousness” in a sentencing proceeding (Hypothetical #2). Judges may have been concerned about such use because it may overemphasize the influence of genes on human behavior. Rothenberg has termed this overemphasis “genetic myopia”;¹⁵¹ others have referred to it as “genetic essentialism.”¹⁵²

The problem with over reliance on genetics is that it shifts the blame for the undesirable behavior from individual free will and the influence of family and environment to a person’s hardwiring. Use of genetic test results to show that the defendant lacked the requisite

147. For example, if a sister of a woman who discovers that she has a genetic predisposition to ovarian cancer finds out this information, she would know that she is also at an increased risk of having a similar genetic predisposition. The sister may not wish to know this information. Or, a child of a man who discovers that he has the gene for Huntington’s Disease may not want to know this fact given that the child will then have a fifty percent probability of having the disease.

148. Rothstein, *Preventing the Discovery*, *supra* note 24, at 879, 901–02. Rothstein proposes this judicial approach as one of “three alternatives designed to promote the plaintiff’s interests in privacy and confidentiality, the defendant’s interest in avoiding overcompensation, the judiciary’s interest in avoiding complexity in litigation, and the public’s interest in the public health and the conservation of health resources.” *Id.* at 879.

149. Niedwiecki, *supra* note 16, at 345.

150. Rothenberg & Wang, *supra* note 145, at 356.

151. Karen H. Rothenberg, *Breast Cancer, the Genetic “Quick Fix,” and the Jewish Community: Ethical, Legal, and Social Challenges*, 7 HEALTH MATRIX 97, 102 (1997).

152. *E.g.*, Rochelle Cooper Dreyfuss & Dorothy Nelkin, *The Jurisprudence of Genetics*, 45 VAND. L. REV. 313, 320–21 (1992).

mens rea or to predict future dangerousness invokes concerns about genetic determinism and illuminates the tension underlying ongoing debates about free will and theories of punishment. The instrumentalist goals of deterrence and incapacity could be used to argue that because the defendant has a genetic predisposition to violence, he cannot be “cured” or deterred and thus he requires a longer period of incarceration. The goal of retribution for voluntary immorality would lead to an argument that the defendant does not deserve the full extent of punishment because he is not fully culpable for the crime.¹⁵³

The concern about genetic determinism is consistent with a larger uneasiness in the relationship between law and the sciences and is at the crux, for example, of disagreements about the insanity defense and the legal doctrine of diminished capacity. Michael Perlin articulates the tension as it plays out in the insanity defense, stating:

The insanity defense symbolizes the gap between the aspirations of a theoretically positivist, objective, common law legal system (in which behavior is allegedly animated by free will and is judged and assessed on a conscious level), and the reality of an indeterminate, subjective, psychosocial universe (in which behavior is determined by a host of biological, psychological, physiological, environmental and sociological factors, and is frequently driven by unconscious forces).¹⁵⁴

Genetic determinism emphasizes the biological component of this admixture of forces, potentially ignoring the array of other factors Perlin cites as influencing behavior.

While genetics is simply one factor among many affecting behaviors, an overemphasis on genetic causes can have unintended consequences. An individual who learns that she is genetically predisposed to alcoholism, for example, may try harder to avoid drinking or may decide that she cannot “fight nature” and succumb to the temptations of alcohol drinking more than she otherwise would. As Rothenberg and Wang point out, by going the latter route she shifts “blame to her

153. Rothenberg & Wang, *supra* note 145, at 357. For an expanded discussion of the theories underlying punishment and criminal responsibility and their interplay with information about genetically based behavior traits, see Rebecca Dresser, *Criminal Responsibility and the “Genetics Defense,”* in GENETICS AND CRIMINALITY 163 (Jeffrey R. Botkin et al. eds., 1999), and Matthew Jones, Note, *Overcoming the Myth of Free Will in Criminal Law: The True Impact of the Genetic Revolution*, 52 DUKE L.J. 1031 (2003).

154. MICHAEL L. PERLIN, THE JURISPRUDENCE OF THE INSANITY DEFENSE 32 (1994); *see also* Richard C. Boldt, *The Construction of Responsibility in the Criminal Law*, 140 U. PA. L. REV. 2245, 2246–47 (1992) (examining the divergence between causal factors that influence choice and free will).

genes and away from her individual autonomy,” thus fulfilling the “prophecy of genetic determinism.”¹⁵⁵

4. *New Technology*

The fourth factor that emerged as pertinent to judicial decision-making in this area was the comfort level of the individual judge with this technology and its more recent application to health- and behavior-related tests in court proceedings. A number of authors have predicted that judges are likely to embrace health-related genetic tests. This view touts the seductiveness of such tests, pointing out that “relative to other kinds of evidence, . . . genetic . . . evidence appears more precise, constricts the need for interpretation by various experts, and therefore more quickly and definitively resolves otherwise complicated disputes. It ‘offers seemingly definitive answers at a time of frustration with the vagueness of other disciplines.’”¹⁵⁶ For example, Halwani and Krupp argue:

Unlike the types of psychological evidence that are routinely raised in court, reliable genetic evidence poses less evidentiary problems than ‘rotten social background’ evidence or evidence of mental illness with no recognised biological basis. Genes create more certainty: genes don’t lie and may back up the claims of an accused with solid scientific evidence.¹⁵⁷

Despite the fact that judges in our survey were largely very positive about the use of DNA testing for identification purposes in criminal and paternity cases, they did not wholeheartedly embrace this second generation of genetic tests. Rather, they were much more discriminating in determining whether the tests should be introduced into court proceedings. Where, for example, the tests were to be used for predictive purposes, the judges seemed skeptical and concerned about their potential power and persuasiveness.¹⁵⁸ In final comments

155. Rothenberg & Wang, *supra* note 145, at 357.

156. Denno, *supra* note 16, at 253 (quoting Dorothy Nelkin, *After Daubert: The Relevance and Reliability of Genetic Information*, 15 CARDOZO L. REV. 2119, 2127 (1994)).

157. Sana Halwani & Daniel Brian Krupp, *The Genetic Defence: The Impact of Genetics on the Concept of Criminal Responsibility*, 12 HEALTH L.J. 35, 41 (2004) (footnote omitted); *see also* Denno, *supra* note 16, at 253 (“Because such evidence can give an ‘aura of truth,’ it consequently provides more power to technical experts and those who can pay for the new scientific techniques.” (citing NELKIN & TANCREDI, *supra* note 138)).

158. But, the potential persuasiveness of the tests may not be the judges’ only concerns. They may have moral or ethical reasons for caution in applying the technology to predict behavior or disease. These reasons may include:

(1) [genetic evidence’s] historical association with past abuses by the Nazis during the Holocaust; (2) its potential chilling of our notions of free will; (3) its

about the survey and about genetic testing generally, one judge said: “we’re scared of it because it’s a new technology.” Judges, like members of the broader society, may not trust new technologies, at least initially, and fear unknown consequences of their use outside of the contexts for which they were developed.

V. THE VALUE OF HEALTH-RELATED GENETIC TESTS IN THE COURTROOM VS. THE “COLLATERAL CONSEQUENCES” OF THEIR WIDESPREAD USE

While trial court judges rightly must evaluate the benefit of genetic tests in the cases before them, appellate judges, legislators, and policymakers who promulgate evidentiary and procedural rules and polices governing litigation should also be concerned about the broader judicial and public policy implications of using these tests routinely in court. Ideally, these rule makers will consider whether the use of health-related genetic tests will, on the whole, lead to “better” or “fairer” and more accurate judicial outcomes and, if they do, whether such incremental improvements are worth some of the “collateral consequences,” i.e., the social ramifications of a general movement to accept the use of these tests in non-clinical settings.

A. *Better Outcomes?*

To determine whether the admission of genetic test results in litigation will lead to “fairer” or “more accurate” results, each case must be evaluated on its own specific facts. In our hypotheticals, whether better outcomes would result if the genetic test at issue were admitted into evidence is not consistently clear. In the criminal case where the defendant wanted to admit the results of a genetic test for schizophrenia (Hypothetical #1), the test would show only that the defendant had a 50–60% chance of manifesting the disease at the time of the crime. Without the test, the defendant would likely need to rely completely on the testimony of psychiatrists with expertise in schizophrenia diagnosis or upon the testimony of witnesses who observed the defendant’s behavior or interacted with the defendant at the time of the crime. If there were opposing experts, the test results might provide some valuable additional information to a jury or judge trying to determine whether the defendant had the disease (and ultimately, the

stigmatizing effect . . . ; and, more recently (4) its potential absolution of societal responsibility for the social and economic factors that could lead to crime if society finds a genetic-defect defence acceptable.

Denno, *supra* note 16, at 254 (citations omitted).

necessary mens rea) at the time, but the information would be probabilistic in nature and could confuse a jury. If the jury gives the evidence greater or lesser weight than it is due, it could make the process less accurate.

In the medical malpractice case (Hypothetical #3), the genetic test result would arguably lead to a fairer resolution. Without the test result, the defendant might be ordered to pay for damages he did not cause. The toxic tort case (Hypothetical #4), however, is less clear. Given the complexity of the interaction between genetic susceptibility and toxic exposure, judges and juries could be confused by the information and inaccurately impute greater significance to the test results than is warranted. Similarly, we question whether the use of genetic tests in damage cases (Hypotheticals #5 and #6) will result in “better” outcomes.¹⁵⁹ For the most part, in the context of damage calculations, these tests will be used for purposes of prognostication. Their accuracy for determining life expectancy will depend on the penetrance of the gene and the variability of its expression.

B. Implications for Existing Law

The introduction of health-related genetic tests in the courtroom also has implications for existing law which, when initially conceived, did not contemplate the likes of this type of technology. The issues raised by the introduction of these tests in litigation, highlighted by a number of hypotheticals in our survey, may lead trial attorneys to push law and policymakers to reconsider some of our existing legal doctrines and their underlying policies. In some cases such reconsideration may be appropriate. In others, the current legal framework may adequately accommodate the policy and theoretical tensions underlying the doctrine. For example, in the criminal context, defense attorneys may want to use genetic test results as a mitigating factor in sentencing. This may challenge the notions of free will undergirding our common law legal system.¹⁶⁰ The use of the tests in criminal cases

159. *But see* Garrison, *supra* note 25, at 460 (“Once courts confront the fears of using genetic evidence in civil cases, the parties will benefit from more accurate claim adjudication, whether in calculating lifetime expectancy damages or proving legal causation.”).

160. Whether the criminal justice system will need to change in response to genetic information that predisposes individuals to behave in certain ways has been the basis of increasing scholarly discourse and debate. *See, e.g.*, Dresser, *supra* note 153, at 163 (concluding that “courts will need guidance on the proper response to claims of a genetics defense”); Farahany & Coleman, *supra* note 33, at 116 (“[I]rrespective of the scientific progress in the field of behavioral genetics . . . such evidence has little utility in assessing criminal responsibility.”); Friedland, *supra* note 111, at 308–09 (warning that a shift from “free will to . . . [genetic] determinism . . . would create pressure to reinvent the current

also, arguably, stretches our Fourth, Fifth, and Fourteenth Amendment jurisprudence to consider the limits of the government's ability to intrude into new dimensions of privacy and may force courts to re-examine the contours of that elusive principle.

In the torts arena, the tests may provoke a rethinking of our traditional rules governing causation, an area already plagued by difficulties in addressing complex, multifactorial diseases such as cancer. While genetic tests may initially be perceived as providing more certainty about the role of genetics in the ultimate disease process when an injury or medical condition has multiple causes, our ability to disaggregate causes of complex disorders will continue to be based on epidemiological data, much of which is not available. As a result, introducing genetic tests into causation decisions may muddy the analysis.

The use of genetic tests in the damages phase of a trial may also prod judges to reconsider how much weight we give to life expectancy in determining damages. While genetic tests will not allow us to know exactly how long someone will live, they may allow us to improve our accuracy in such estimations. However, even if a genetic test would allow us to predict with 100% accuracy when someone would die and to "custom tailor" damage awards based on individual genetic makeup, we may not be comfortable using someone's intrinsic and immutable characteristics against her. Courts already allow juries to consider whether a plaintiff has a pre-existing illness, such as cancer or heart disease, in arriving at a damage award.¹⁶¹ This new technology has the ability to accelerate judicial movement along this path: it pushes the envelope of current tort doctrine as it pertains to damage calculations highlighting tensions between longstanding goals of accurate compensation, deterrence, and retributive justice.¹⁶²

Finally, the availability of behavior-related genetic tests for traits such as aggression or addiction may provoke prosecutors to call for a reexamination of our rules of evidence and may tempt policymakers to consider changes in these rules. Under the current framework established by the Federal Rules of Evidence, character evidence is generally inadmissible to show that a person acted consistently with her

understanding of criminal responsibility"); Johnson, *supra* note 16, at 470 (suggesting that the criminal justice system and the nature of criminal responsibility will change as genetic technologies advance); Jones, *supra* note 153, at 1050 (arguing that the current criminal law framework can accommodate this new information and need not drastically change).

161. Rothstein, *Preventing the Discovery*, *supra* note 24, at 885.

162. See *supra* notes 113–114 and accompanying text.

character,¹⁶³ as it may so “overpersuade” juries “about a person’s bad character that they deny the person a fair hearing.”¹⁶⁴ This rule arguably makes sense in the context of the introduction of genetic tests for behavioral traits. However, there are a number of exceptions to the rule.¹⁶⁵ Some of these exceptions may be used to the advantage of the defendant;¹⁶⁶ others benefit the prosecution.¹⁶⁷ In addition, there are exceptions that may affect other individuals involved in litigation, e.g., the alleged victim¹⁶⁸ or a witness for either side.¹⁶⁹

Changing the rules to allow for a more liberal admission of character evidence would seem, at least in criminal cases, to fly in the face of the underlying premise of our criminal justice system “that a defendant must be tried for what he did, not who he is.”¹⁷⁰ Providing for more flexibility in the admission of character evidence also animates consideration of psychological theories of behavior. These theories have evolved over the last fifty years from the “trait or generality theory,” popular in the 1950s,¹⁷¹ to the “theory of situationism,” popular

163. See *supra* note 110.

164. ROBERT E. JONES ET AL., RUTTER GROUP PRACTICE GUIDE: FEDERAL CIVIL TRIALS & EVIDENCE ¶ 8:1127 (2006); see also BENNETT L. GERSHMAN, PROSECUTORIAL MISCONDUCT § 10:2 (2d ed. 1999) (“The deep tendency of human nature to punish, not because our victim is guilty this time, but because he is a bad man and may as well be condemned now that he is caught, is a tendency which cannot fail to operate with any jury, in or out of court.” (quoting JOHN HENRY WIGMORE, EVIDENCE IN TRIALS AT COMMON LAW § 57 (3d ed. 1940))).

165. For example, character evidence is admissible where character itself is an element of a crime or claim, e.g., defamation. FED. R. EVID. 405(b). Such evidence may also be admissible to rebut the assertion of a character trait by the accused or to establish the character of an alleged victim or witness. FED. R. EVID. 404(a)(2)–(3) & 607–609.

166. The defendant in a criminal case may offer evidence of his own good character. FED. R. EVID. 404(a)(1).

167. If the defendant has “opened the door” by bringing in evidence of his own character, the prosecution may rebut with character evidence. FED. R. EVID. 404(a)(1).

168. The defendant in a criminal case may attack pertinent traits of the character of the alleged victim. FED. R. EVID. 404(a)(2).

[I]n a homicide case in which the defendant claims that the alleged victim was the first aggressor, the defendant would be allowed to call witnesses to testify that the victim had a violent character. When the defendant makes this attack, the prosecution can rebut by supporting the victim’s character or by attacking the defendant’s character for the same trait.

ROGER C. PARK, TRIAL OBJECTIONS HANDBOOK § 2:7 (2d ed. 2001).

169. Evidence of the character of the witness may be admitted to show or rebut the witness’s credibility. FED. R. EVID. 404(a)(3). This includes exploring the mental capacity of the witness, FED. R. EVID. 607, as well as the witness’s character “for truthfulness or untruthfulness.” FED. R. EVID. 608.

170. GERSHMAN, *supra* note 164, § 10:2 (citing *United States v. Vizcarra-Martinez*, 66 F.3d 1006, 1014 (9th Cir. 1995)).

171. Edward J. Imwinkelried, *Some Comments About Mr. David Karp’s Remarks on Propensity Evidence*, 70 CHI.-KENT L. REV. 37, 44 (1994). Imwinkelried writes: “According to this theory, even when there is only a ‘miniscule sample [] of [the person’s] prior behavior,’ it is

in the '60s and '70s,¹⁷² to the more recent "interactionist theory."¹⁷³ In the recent past, some have argued that this evolution "cuts in favor of liberalizing the character evidence prohibition."¹⁷⁴ We would urge caution in any movement toward liberalization of evidence rules based on new genetically based evidence.

C. *Broader Implications*

In ruling on questions to admit or compel genetic tests for health conditions and behavioral traits, judges will be making decisions that are at the intersection of several larger societal, political, and legal controversies. Those decisions will have implications that are much more significant than those resulting from the resolution of the case at hand. These controversies include, among other issues, the role of science in judicial decisionmaking.

In *Science at the Bar*, Sheila Jasanoff describes the interplay between law and science as one in which the boundaries, which we often take for granted as hard and fast, are often negotiated.¹⁷⁵ In this negotiation process, "legal disputes around scientific 'facts' often appear as sites where society is busily constructing its ideas about what constitutes legitimate knowledge . . . and how much deference science should command in relation to other modes of knowing."¹⁷⁶ Furthermore, she asserts that "science and technology in the legal system invariably redraw the lines of power and authority, as when the law opens up new areas of technical decisionmaking to review or control by non-expert publics."¹⁷⁷

To a large extent the trend in the legal system, and society more broadly, has been to honor science in all its "objective" glory, shroud-

possible to draw a trustworthy inference as to character and then to use that inference as the basis for a further, reliable inference as to the person's conduct on a particular occasion." *Id.* (alterations in original) (citing Susan M. Davies, *Evidence of Character to Prove Conduct: A Reassessment of Relevancy*, 27 CRIM. L. BULL. 504, 513 (1991)).

172. *Id.* at 44-45 ("Situationist theorists denied that persons possess relatively permanent character traits which are predictive of conduct even in highly similar situations."). In reaction to situationism, "some legal commentators urged that character evidence has absolutely 'no probative value' on the question of a person's conduct on a specific occasion." *Id.* at 45 (citing Robert G. Spector, *Commentary: Rule 609—A Last Plea for Its Withdrawal*, 32 OKLA. L. REV. 334, 351 (1979)).

173. *Id.* at 45. According to the interactionist theory, "if there is a sufficient sample of the person's behavior in similar situations, the person's conduct in an analogous situation can be accurately forecast on the average." *Id.* (citing Davies, *supra* note 171, at 517-20).

174. *Id.* at 45 (citing Davies, *supra* note 171, at 519).

175. JASANOFF, *supra* note 11, at xiv-xv.

176. *Id.* at xv.

177. *Id.* at xvi.

ing it with a protective cloak and giving it heightened deference.¹⁷⁸ This has been accomplished in the courtroom by either “delegating scientific issues to scientists or making legal actors more technically literate.”¹⁷⁹ The latter has included proposals to carve out specialty science courts in which a cadre of judges, trained in science, would be the arbiters of science-based disputes.¹⁸⁰ Yet, these proposals, as Jasanoff argues, “chronically overestimate the power of experts to rationalize moral and political choices about science and technology.”¹⁸¹ The more difficult decisions that ultimately must be made in these disputes are not necessarily the technical ones, but rather are decisions that involve tradeoffs between conflicting values that must be weighed and titrated. In the case of genetic tests for health and behavioral conditions, those values include scientific accuracy, the need for a just resolution of a real dispute, the importance of individual and family privacy, and the protection of family relationships. In some cases, the legal system has determined that justice and other societal values outweigh scientific accuracy.¹⁸²

Courts have come under attack for their elevation of science and technology, informed, some argue, by an “unexamined technological determinism.”¹⁸³ The criticism, however, has not been one-sided. Other voices charge that courts have been too cautious in their thinking about technology, exaggerating its risks and squelching innovation.¹⁸⁴ Consistent with the view of Jasanoff and others, we would

178. *Id.* at 6 (calling the phenomenon “a manifestation of our society’s deep commitment to a rational, and hence reliably objective, policy process”). See generally, e.g., Edward P. Richards, *The Jurisprudence of Prevention: The Right of Societal Self-Defense Against Dangerous Individuals*, 16 HASTINGS CONST. L.Q. 329, 340 (1989) (“Public health jurisprudence is based on a deference to scientific decision making.”); Jones, *supra* note 153, at 1047–48 (“[T]he criminal justice system may be more likely to integrate genetics because—unlike social science—genetics is ‘hard’ science.”); Gary E. Marchant, *Pollution, Science and Regulatory Decision Making*, <http://www.law.asu.edu/?id=8300> (last visited May 21, 2007) (“[G]reater deference [is given] to agency decisions allegedly based on ‘objective’ science rather than policy, political or economic considerations. This tendency to cloak policy judgments under the guise of science is referred to in the legal literature as the ‘science charade.’”); Austin Dacey, *Science and the Public*, The Center for Inquiry, <http://www.scienceandthepublic.org/description.htm#> (last visited May 21, 2007) (discussing the center’s research in the area and explaining how “[t]he implicit social contract between science and other institutions in society makes the issue of the public’s participation in science policy especially controversial”).

179. JASANOFF, *supra* note 11, at 6.

180. *Id.* at 7.

181. *Id.*

182. See *id.* at 10–11 (“[T]he legal system’s allegiance to values other than those of science may open the way to decisions that look like sheer irrationality.”).

183. *Id.* at 12.

184. *Id.*

argue that in determining whether to admit or compel health- and behavior-related genetic tests, judges should base their decisions on a careful assessment of the multiple factors and values at stake, not a blind allegiance to the “technological imperative.”

A second controversy highlighted by the introduction of health-related genetic tests in court proceedings is the role of courts in protecting personal and family privacy. These issues are at the heart of concerns about broad based judicial acceptance of genetic tests that reveal information about an individual’s current health condition, or predisposition to certain diseases or behavioral traits. What may be most unique about these second generation genetic tests (setting them apart from DNA tests for identity), however, is that they not only reveal personal health and behavioral information about a party to a legal action but they also reveal private and potentially unwanted health information to the family members of those individuals. These “innocent bystanders” may be significantly harmed by this new knowledge. Its revelation may also have significant ramifications for familial relationships and may lead to a breakdown in family ties, thus undermining a societal and judicial goal of preserving harmonious family relationships.¹⁸⁵

Privacy is a dominant value in our culture, public policy, and jurisprudence. Yet, privacy is not unassailable or incapable of being trumped by higher values. In our current political climate, despite laudable governmental goals to establish protections for personal health information through extensive government regulations, those regulations have many exceptions that allow access to such information for “higher” public policy reasons, among them law enforcement.¹⁸⁶ Moreover, outside the realm of health information, the

185. See Rothenberg, *supra* note 149, at 118–23 (discussing the concern that genetic testing will threaten family privacy); see, e.g., Tamar Lewin, *In Genetic Testing for Paternity, Law Often Lags Behind Science*, N.Y. TIMES, Mar. 11, 2001, § 1, at 1 (describing a paternity case in which DNA testing revealed that an alleged father did not carry the cystic fibrosis mutation and thus could not be the father of three of four children he assumed were his).

186. For example, Congress passed The Health Insurance Portability and Accountability Act of 1996, Pub. L. No. 104-191, 110 Stat. 1936, and authorized the Department of Health and Human Services to promulgate regulations governing identifiable health information. See 45 C.F.R. § 164 (2006) (discussing the disclosure of health information). Section 164.512 lists specific exceptions to allow disclosure of protected health information to government entities, including information about victims of domestic violence or abuse; information needed for health oversight agencies to complete their mission; information needed for judicial or administrative proceedings; and information necessary for law enforcement purposes, which has explicitly defined parameters. See generally Daniel J. Solove, *The Origins and Growth of Information Privacy Law*, in 1 6TH ANNUAL INSTITUTE ON PRIVACY LAW: DATA PROTECTION—THE CONVERGENCE OF PRIVACY & SECURITY 23 (2005) (reviewing the historical and legal precedents for current privacy law).

broader right to privacy seems under siege, with intrusions from unregulated cyberspace and from government efforts to combat terrorism.¹⁸⁷

Despite the societal value of privacy, claims for accountability, a social good, may outweigh claims to personal privacy.¹⁸⁸ Allen argues that “[a]ccountability imperatives drive the law of tort and crime” and, absent some type of protective privilege, one cannot simply respond “[n]one of your business” to demands to explain one’s behavior when accused of a crime or a negligent act.¹⁸⁹ Such reasoning accounts for breaches of privacy in the courtroom when justice is at stake. Yet, one cannot paint with a broad brush and determine that in all cases accountability trumps privacy in the courtroom or, more precisely, that requests to invade a party’s privacy are in furtherance of a goal of accountability. For example, in tort cases where there is likely to be a request to compel or admit genetic tests, it seems reasonable to distinguish between those requests that are in the context of causation and those that are in the context of a damage calculation. In cases involving causation, the use of the information is likely to be consistent with the goal of accountability, i.e., of determining whether the defendant caused the plaintiff’s harm and thus should be accountable for his negligent conduct. In the context of damages, using private personal health information against a plaintiff to reduce his award may lead to a more accurate determination of a plaintiff’s life expectancy. How-

187. See, e.g., L.A. Chung, *Privacy Rights Erode Under Patriot Act*, SAN JOSE MERCURY NEWS, Feb. 22, 2006, available at <http://www.keepmedia.com/pubs/MercuryNews/2006/02/22/1239543> (noting that the PATRIOT Act allows the government to obtain citizens’ personal information very easily); John Podesta, *USA Patriot Act: The Good, the Bad, and the Sunset*, HUM. RTS.: J. OF THE SEC. OF INDIVIDUAL RTS. & RESPS. MAG., 2002, at 3 (“The potential for abuse, for invasion of privacy, and for profiling citizens is high.”); *Another Cave-In on the Patriot Act*, N.Y. TIMES, Feb. 11, 2006, at A14. Moreover, during the last decade and a half, the courts have chipped away at the Fourth Amendment requirement of probable cause. This has occurred both in the context of individualized criminal procedures, e.g., the use of nontestimonial identification orders used to extract physical evidence from suspects prior to arrest without a search warrant and outside the criminal process. See *supra* note 74 (describing “special needs” cases). Notably, rather than resulting in greater protections, the availability of DNA tests and the collection of DNA evidence for purposes of identity seem to have been at the heart of these cases. Much of this jurisprudence has been specifically in response to DNA testing for the purpose of establishing state and federal DNA data banks. These data banks in large part exist to assist in solving future crimes as well as crimes that have already been committed but were not specifically under investigation when the sample was obtained. *Miller v. U.S. Parole Comm’n*, 259 F. Supp. 2d, 1166, 1176 (D. Kan. 2003).

188. See Anita L. Allen, *2003 Daniel J. Meador Lecture: Privacy Isn’t Everything: Accountability as a Personal and Social Good*, 54 ALA. L. REV. 1375, 1376 (2003) (“[A]lthough privacy is important, it is not everything.”).

189. *Id.* at 1376–77.

ever, it not only undervalues privacy, it also arguably undervalues the goals of deterrence and fairness across defendants and reduces the goal of accountability by divorcing damages from proportionality to fault.

In weighing various factors that are at stake in decisions to admit or compel genetic tests in the courtroom, judges will be acting in a current climate that is inhospitable to privacy claims. This may make decisions to overlook privacy claims more palatable but will perhaps make judges more wary about further infringements on an already weakened societal value.

Wide-scale acceptance of these tests in the courtroom may also impact how genetic tests are used outside the courtroom. For example, they may hinder the use of genetic tests in the clinical setting or in medical research, creating a chilling effect on patients' willingness to have a genetic test for diagnostic or therapeutic purposes because of fear of that information coming out in a court proceeding, perhaps a child custody case. The infringement on personal privacy when known medical information is revealed without consent is also a factor that deserves weight in the decisionmaking matrix. Currently, when individuals are told the risks of a genetic test in the clinical setting as part of an informed consent process, they are not told that the test result could be used against them in a legal proceeding. If this risk were to be disclosed, it could impact individual willingness to obtain such tests, even for therapeutic purposes.¹⁹⁰

There may be other implications as well, depending on the specific genetic test at issue. If courts use the test to indicate sensitivity to pain, for example, it could change our view of pain and suffering such

190. See Seiden & Morin, *supra* note 146, at 91 (“[I]f patients fear that a blood or tissue sample might be used against them in a court of law, they might be reluctant to allow a physician to perform certain tests or procedures.”). When genetic tests for medical purposes were first becoming available, use of the information by insurers and employers fueled the fears of patients and potential subjects in genetic research. See, e.g., Diane E. Hoffmann, *The Biotechnology Revolution and its Regulatory Evolution*, 38 DRAKE L. REV. 471, 482 (1989) (discussing the concerns about genetic discrimination and invasion of privacy at the start of the Human Genome Project); Robert Wachbroit, *Making the Grade: Testing for Human Genetic Disorders*, 16 HOFSTRA L. REV. 583, 590–91 (1988) (raising privacy and employment-related issues, among others); Society for Women’s Health Research: Health Policy: Issues: Genetic Nondiscrimination: Policy Statement, http://www.womenshealthresearch.org/site/PageServer?pagename=policy_issues_nondisc_ps (last visited May 21, 2007) (Policy statement on Genetic Nondiscrimination states: “The Society is particularly concerned about the impact of genetic discrimination on the participation of women in clinical trials. . . . [W]omen will be reluctant to enroll in clinical trials if they fear that their medical information will be used against them by health insurers and employers”); see also Rothenberg & Terry, *supra* note 7, at 196 (noting the fear that genetic testing may lead to discrimination by insurance companies and employers).

that we do not rely on patient subjective reporting. In family law cases involving adoption or child custody, use of such tests may change our notions of what it means to be a “good parent,” i.e., is it one who will not develop a genetic condition with a short life expectancy? Widespread acceptance of the tests in the courtroom could also change our expectations of when it is appropriate to be tested. For example, we may come to expect that everyone have a genetic test before marriage or prior to conceiving a child.

VI. CONCLUSION

The value of genetic test results for purposes of providing information about the health status of one of the parties in a court proceeding will depend, in large part, on its admission into evidence. In our adversary system, judges are assigned the role of gatekeepers in admitting or keeping out information for consideration by the trier of fact. In the case of health- and behavior-related genetic tests, judges will initially be required to determine whether the test in question meets the relevant *Daubert* or *Frye* test in that jurisdiction. However, once that threshold test is met, judges will still have discretion to determine the probative value of the information and whether that value is outweighed by “risks” of the information, including its potential to mislead or confuse the jury.

While compelling or admitting genetic tests in some court proceedings may be beneficial, judges will need to take a fine-tuned, case-by-case approach in deciding how to respond to these requests. Moreover, appellate court judges and policymakers who determine procedural rules governing litigation will need to consider the collateral consequences of wide-scale use of the tests in the courtroom. The use of these tests will not only have far-reaching implications for the outcome of court cases and the shape of future legal doctrine, but also may affect how we, as a society, think about responsibility, privacy, and justice.