NOTES

After GINA, NINA? Neuroscience-Based Discrimination in the Workplace

INTRODUCTION

In 1990, the Human Genome Project ("HGP") was formed to decipher and sequence the human genome, to develop new tools to obtain and analyze genetic data, and to make the information widely available.[1] Researchers completed the HGP in 2003 with the genetic technology and resources developed providing new opportunities for medical progress.[2] In particular, discoveries about the genetic basis of illness and the development of genetic testing allowed for earlier diagnosis and detection of genetic predispositions to disease.[3] These advances, however, also gave rise to the potential misuse of genetic information, as revealed by genetic testing, to discriminate against and stigmatize individuals.[4] More specifically, for example, they created the opportunity for financially motivated employers to use genetic information to avoid employing workers likely to take sick leave, file for workers' compensation, or use health benefits. To fully protect the public from discrimination and allay any concerns about the potential for discrimination, in May 2008, President George W. Bush signed the Genetic Information Nondiscrimination Act[5] ("GINA") into law. This long-awaited statute paved the way for individuals to take full advantage of the promise of personalized medicine without fear of discrimination on the basis of genetic information acquired by employers.[6]

The field of neuroscience is following in the footsteps of genetics. Large research initiatives, such as the Human Connectome Project, are currently underway to map the axonal connections of the human brain and to correlate these circuits with disease and behavior.[7] Discoveries about the neurological bases of disease have

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1. NAT'L INSTS. OF HEALTH, HANDBOOK: HELP ME UNDERSTAND GENETICS 132–35 (2011) [hereinafter HANDBOOK], *available at* http://ghr.nlm.nih.gov/handbook.pdf; Francis S. Collins et al., *New Goals for the U.S. Human Genome Project: 1998–2003*, 282 SCIENCE 682, 683–85 (1998).

2. Genetic Information Nondiscrimination Act of 2008 § 2, Pub. L. No. 110-233, 122 Stat. at 881–83 (2008) (discussing congressional findings); U.S. Dep't of Energy Office of Sci., *Potential Benefits of Human Genome Project Research*, HUMAN GENOME PROJECT INFORMATION, http://www.ornl.gov/sci/techresources/Human_Genome/project/benefits.shtml (last modified Oct. 9, 2009).

3. *See* discussion *infra* Part I.A.

4. *See* discussion *infra* Part I.B.

5. Genetic Information Nondiscrimination Act of 2008, Pub. L. No. 110-233, 122 Stat. 881 (2008).

6. *See id.* § 2, 122 Stat. at 881–83 (detailing the congressional findings that led to the creation of this bill).

7. Press Release, Nat'l Inst. of Mental Health, NIH Launches the Human Connectome Project to Unravel the Brain's Connections (July 16, 2009), *available at*

already allowed neuroscientists to use patterns of brain structure and function, as revealed by neuroimaging, to identify neural correlates of disease and predict an individual's predisposition to future disease.[8] Most importantly, however, this neuro information is susceptible to the same forms of employer misuse as genetic information.[9] In fact, Donald Kennedy, neurobiologist and once editor-in-chief of *Science*, has already made reference to a "brainome," similar to a "genome":

> Far more than our genomes, our brains are us, marking out the special character of our personal capacities, emotions and convictions. I already don't want my employer or my insurance company to know my genome. As to my brainome, I don't want *anyone* to know it for any purpose whatsoever. It is . . . my most intimate identity.[10]

This Note explores the feasibility of implementing a GINA-like statute to protect the privacy of individuals' neuro information and to prevent employment discrimination based on that information. While GINA applies to both insurance companies and employers, the motivations and legal issues surrounding insurance discrimination and employment discrimination vary. Consequently, the analysis of and approaches to the issues raised in these two contexts should also vary. This Note solely focuses on employment discrimination and Title II of GINA as guidance. Future scholarship should inquire about the need for prohibitions against the use and acquisition of neuro information in the insurance industry.

This Note begins by reviewing the events leading up to the enactment of GINA. Part I examines the scientific advancements stemming from the Human Genome Project, focusing on the predictive nature of genetic testing. It then discusses the concerns of scientists and government officials related to the real-world application of these scientific advancements, more specifically, the concern that employers would utilize such predictive information to discriminate against applicants and employees. Part I concludes with a discussion of Congress's finding regarding the inadequate protection against such discrimination under existing federal statutes and an overview of the protections provided for by GINA.

Part II discusses how advancements in neuroimaging present similar opportunities for discrimination in the workplace. First, it describes recent advancements in neuroimaging and the massive

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http://www.nimh.nih.gov/science-news/2009/nih-launches-the-human-connectome-project-to-unravel-the-brains-connections.shtml.

8. *See* discussion *infra* Part II.A.

9. *See* discussion *infra* Part II.B.

10. Joan O'C. Hamilton, *If They Could Read Your Mind*, STANFORD MAG., Jan.–Feb. 2004, *available at* http://alumni.stanford.edu/get/page/magazine/article/?article_id=36320.

research initiatives of the Human Brain Project and the Human Connectome Project. It then explains how neuroimaging technology, like genetic testing, may be used to identify neurological predispositions to certain diseases and behavior. Part II concludes by exploring why, similar to congressional findings in the context of genetic information, existing federal statutes are insufficient to protect against employer acquisition and misuse of predictive neuro information. Part III then examines how neuroscience creates the opportunity for new forms of discrimination, beyond those considered in the context of genetics in enacting GINA. It describes recent advancements in neuroenhancements, specifically neuro-pharmaceuticals, and how employers may discriminate on the basis of the use of such enhancers.

Finally, Part IV proposes a new piece of federal legislation, the Neuro Information Nondiscrimination Act, to alleviate some of the emerging problems in the area of neuroscience-based employment discrimination. To the extent that the discrimination concerns raised by neuro information are similar to those raised by genetic information, the genetic-information protections in GINA provide a framework for developing similar neuro-information protections. However, to the extent that neuro information raises discrimination concerns above and beyond those raised by genetic information, such as in the realm of neuroenhancement, novel approaches are necessary.

I. GENETIC INFORMATION NONDISCRIMINATION ACT OF 2008: LEGISLATIVE HISTORY, FINDINGS, AND MOTIVATIONS

Representative Louise Slaughter (D-NY) introduced in the House of Representatives in 1995 the first federal legislation to prevent genetic discrimination.[11] While some in the healthcare, research, and policy communities considered the measure forward-looking, others called it premature, as scientists had just begun sequencing the human genome.[12] Nevertheless, anticipating an imminent explosion in the clinical relevance of genetic information and the corresponding concern of Americans that employers could use

11. Lauren Elizabeth Nuffort, *The Genetic Information Nondiscrimination Act of 2008: Raising a Shield to Genetic Discrimination in Employment and Health Insurance*, HEALTH LAW., June 2009, at 1, 9.

12. *Id.*

their genetic information against them, many science professionals became convinced that reforms were needed as soon as possible.[13]

A. From the Human Genome Project to Genetic Testing: Uncovering the Human Blueprint

In 1990, an international, collaborative research effort called the Human Genome Project ("HGP") was formed to map and understand all of the genes of human beings, or the human genome.[14] The National Institutes of Health ("NIH") and the U.S. Department of Energy directed the HGP.[15] The main goals of the HGP were "to provide a complete and accurate sequence of the 3 billion DNA base pairs that make up the human genome" and to locate "all of the estimated 20,000 to 25,000 human genes."[16] In addition, the HGP "sought to develop new tools to obtain and analyze the data and to make this information widely available."[17]

Researchers completed the HGP in 2003,[18] with the genetic technology and resources developed profoundly impacting medical research and promising to revolutionize the wider spectrum of clinical medicine.[19] Deciphering the sequence of the human genome created major new opportunities for medical progress, including improved diagnosis of disease and earlier detection of genetic predispositions to disease.[20] Dr. Francis Collins, then director of the National Center for Human Genome Research Institute and now director of the NIH, described the potential impact the information and tools generated by the HGP posed for medicine and public health during congressional testimony before the Senate Health, Education, Labor and Pensions Committee:

> The human genome sequence provides foundational information that now will allow development of a comprehensive catalog of all of the genome's components, determination of the function of all human genes, and deciphering of how genes and

13. *Id.*

14. HANDBOOK, *supra* note 1, at 132–34.

15. *Id.* at 134; Collins et al., *supra* note 1, at 683.

16. HANDBOOK, *supra* note 1, at 135; *see also* Collins et al., *supra* note 1, at 683–85 (discussing how one of the goals of the HGP is to sequence the human genome).

17. HANDBOOK, *supra* note 1, at 135; *see also* Collins et al., *supra* note 1, at 683–85 (explaining the goals of the HGP).

18. HANDBOOK, *supra* note 1, at 136.

19. U.S. Dep't of Energy Office of Sci., *supra* note 2.

20. Genetic Information Nondiscrimination Act of 2008 § 2, Pub. L. No. 110-233, 122 Stat. at 881–83 (2008) (discussing congressional findings); U.S. Dep't of Energy Office of Sci., *supra* note 2 (listing some of the major findings).

> proteins work together in pathway and networks. Completion of the human genome sequence offers a unique opportunity to understand the role of genetic factors in health and disease and to apply that understanding rapidly to prevention, diagnosis, and treatment.[21]

The most immediate and practical application to come out of the HGP was genetic testing.[22] A gene is the "basic physical and functional unit of heredity."[23] Genes, made up of deoxyribonucleic acid ("DNA"), contain the "recipes" for protein creation and "provide the structural components of all our cells and tissues as well as specialized enzymes for all essential chemical reactions."[24] Every individual has two copies of each gene, having inherited one copy from each parent.[25] While most genes are the same in all people, a small number of genes—less than one percent—differs slightly between people.[26] Alleles are "forms of the same gene with small differences in their sequence of DNA bases."[27] Some of this variation in DNA sequence accounts for physical differences between people and for differences in susceptibility to disease.[28]

Rare sequence variations, called mutations, can cause or vastly increase the risk of certain diseases by producing "faulty proteins that function at less-than-normal levels or . . . are completely nonfunctional."[29] Genetic tests inspect the DNA sample an individual provides and look for mutated sequences.[30] Genetic tests regarding a

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21. NANCY LEE JONES & AMANDA K. SARATA, CONG. RESEARCH SERV., RL30006, GENETIC INFORMATION: LEGAL ISSUES RELATING TO DISCRIMINATION AND PRIVACY 1 (2008) (quoting *The Future of Genomics: Hearing Before the Subcomm. on Health of the H. Comm. on Energy and Commerce*, 108th Cong. 1 (2003) (statement of Francis S. Collins, Director of Human Genome Research Institute, National Institutes of Health)), *available at* http://biotech.law.lsu.edu/crs/RL30006_20080310.pdf.

22. U.S. Dep't of Energy Office of Sci., *Gene Testing*, HUMAN GENOME PROJECT INFORMATION, http://www.ornl.gov/sci/techresources/Human_Genome/medicine/genetest.shtml (last modified Sept. 17, 2010) (providing a general overview of gene testing).

23. HANDBOOK, *supra* note 1, at 12.

24. Denise Casey, *What Can the New Gene Tests Tell Us?*, JUDGES' J., Summer 1997, 14, 14.

25. HANDBOOK, *supra* note 1, at 12. In a small percentage of clinical pregnancies, an individual may be born with one chromosome less than the normal number, or monosomy, or may be born with an additional chromosome, or trisomy. Terry J. Hassold & Patricia A. Jacobs, *Trisomy in Man*, 18 ANN. REV. GENETICS 69, 69 (1984).

26. *1000 Genomes*, BROAD INST., http://www.broadinstitute.org/science/projects/1000-genomes (last visited Oct. 23, 2011); *see also* HANDBOOK, *supra* note 1, at 9–11 (confirming this fact and also providing a general overview of DNA).

27. HANDBOOK, *supra* note 1, at 12.

28. Casey, *supra* note 24, at 14–15.

29. *Id.* at 16.

30. *See* U.S. Dep't of Energy Office of Sci., *supra* note 22. ("For some types of gene tests, researchers design short pieces of DNA called probes, whose sequences are complementary to the mutated sequences. These probes will seek their complement among the three billion base pairs

suspected genetic condition come in two forms: (1) diagnostic testing, which is "used to confirm or rule out a known or suspected genetic disorder in a symptomatic individual"; and (2) predictive testing, which is "offered to asymptomatic individuals," often "with a family history of a genetic disorder."[31] Predictive testing can further be broken down into two types: (1) presymptomatic—"eventual development of symptoms is certain when the gene mutation is present"—and (2) predispositional—"eventual development of symptoms is likely but not certain when the gene mutation is present."[32]

Through the HGP, scientists have shown that straightforward inherited errors in genes, capable of presymptomatic testing, account for a small number of diseases, including Huntington's disease.[33] In contrast, more complex inheritance, capable of only predispositional testing, increases an individual's risk of developing a large number of disorders, including cancer, heart disease, and diabetes.[34] Scientists have also found genetic predispositions to certain behaviors, claiming to have discovered a "violent gene,"[35] a "warrior gene,"[36] and a "monogamy gene."[37] Currently, genetic tests encompass more than

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of an individual's genome. If the mutated sequence is present in the patient's genome, the probe will bind to it and flag the mutation. Another type of DNA testing involves comparing the sequence of DNA bases in a patient's gene to a normal version of the gene.").

31. Nat'l Ctr. for Biotechnology Info., *Uses of Genetic Testing*, GENETESTS, http://www.ncbi.nlm.nih.gov/projects/GeneTests/static/concepts/primer/primerusesof.shtml (last updated Mar. 19, 2004) [hereinafter GENETESTS].

32. *Id.*

33. DEP'T OF LABOR ET AL., GENETIC INFORMATION AND THE WORKPLACE (1998), *available at* http://www.genome.gov/10001732.

34. *Id.*

35. *See* Niall Firth, *The 'Violent' Gene: Genetic Mutation Found Only in Finnish Men that Makes Them Fight*, DAILY MAIL, Dec. 23, 2010, http://www.dailymail.co.uk/sciencetech/article-1341100/The-violent-gene-Genetic-mutation-Finnish-men-makes-fight.html (discussing a genetic mutation that makes Finnish men more impulsive and aggressive, especially when drunk); *see also* Avshalom Caspi et al., *Role of Genotype in the Cycle of Violence in Maltreated Children*, 297 SCIENCE 851, 853 (2002) (suggesting that children with high MAOA gene expression were less likely to be violent).

36. *See 'Warrior Gene' Linked to Gang Membership, Weapon Use*, SCIENCEDAILY, June 5, 2009, http://www.sciencedaily.com /releases/2009/06/090605123237.htm (noting that boys who carry a certain gene are more likely to join gangs and engage in violence).

37. *See* Priya Shetty, *Monogamy Gene Found in People*, NEWSCIENTIST (Sept. 1, 2001, 10:00 PM), http://www.newscientist.com/article/dn14641-monogamy-gene-found-in-people.html (describing the discovery of a certain gene that may determine how well you will bond with a partner).

two-thousand conditions,[38] with many of these tests available in clinics and some even offered directly to consumers.[39]

B. Imperfect Prediction and Employer Misuse

The reports and testimony prepared in the context of the congressional debates surrounding GINA recognized that these scientific advances in genetics, while promising, were not without potential problems. The knowledge and tools stemming from the HGP provided new opportunities for medical progress.[40] Most notably, discoveries about the genetic basis of illness allowed for earlier detection of illness and for the development of more effective therapies to treat disease.[41] However, these advances also gave rise to the potential misuse of genetic information to discriminate against or to stigmatize individuals in the workplace.[42] For instance, an employer may choose to penalize prospective or current employees merely because they have a higher probability of contracting a certain disease or disorder in the future.

The ethical, social, and legal implications of genetic research have long been the subject of significant scrutiny. From its inception, the HGP devoted a portion of its funding to conducting research on the Ethical, Legal, and Social Implications ("ELSI") of genomics and "to develop[ing] recommendations to address the research, health and public policy implications of the rapidly accumulating genetic knowledge and technologies."[43] ELSI realized that while the HGP

38. GENETESTS, *supra* note 31 (reporting that as of February 9, 2012, there were 2,539 conditions that were able to be genetically tested for).

39. Kathy Hudson et al., *Keeping Pace with the Times: The Genetic Information Nondiscrimination Act of 2008*, 358 NEW ENGLAND J. MED. 2661, 2661 (2008).

40. Genetic Information Nondiscrimination Act of 2008 § 2, Pub. L. No. 110-233, 122 Stat. 881, 881–82 (2008) (discussing congressional findings).

41. *Id.*

42. *Id.*

43. *Genetic Information in the Workplace: Hearing Before the S. Comm. on Health, Educ., Labor & Pensions*, 106th Cong. (2000) (statement of Francis S. Collins, Director of Human Genome Research Institute, National Institutes of Health) [hereinafter *Workplace Hearings*], *available at* http://www.genome.gov/10001380; *see also* U.S. Dep't of Energy Office of Sci., *Ethical, Legal and Social Issues*, HUMAN GENOME PROJECT INFORMATION, http://www.ornl.gov/sci/techresources/Human_Genome/elsi/elsi.shtml (last updated Aug. 24, 2011) (discussing how the Human Genome Project has consistently dedicated three to five percent of its budget to ELSI activities). As of 2006, this amounted to over $150 million, "leading to hundreds of articles, books, conferences, and other research and educational activities on the ethical, legal, and social implications of genetics." Henry T. Greely, *Neuroethics and ELSI: Similarities and Differences*, 7 MINN. J.L. SCI. & TECH., 599, 604 (2006).

opened major new opportunities for medical progress, the predictive nature of genetic testing was not without unique legal and ethical implications.[44] The "proper uses of such predictive technologies," as well as "the propriety of various users," such as employers, garnered much of the attention of ELSI throughout the years.[45] Most importantly, "[e]arly research and subsequent policy deliberations conducted by the ELSI program . . . led to a series of recommendations for safeguarding the privacy and fair use of genetic information in . . . the workplace."[46] Those recommendations, published in *Science* magazine in the mid-1990s,[47] served as a model for much of the modern workplace legislation in this context.[48]

The congressional debates leading up to the enactment of GINA echoed the concerns raised by ELSI regarding the potential for employers to discriminate on the basis of genetic predisposition. An intra-agency report described how the science behind the use of genetic testing to predict future conditions was imperfect:

> Genetic technologies, such as simple DNA tests, increasingly are becoming available to identify people who might have an increased likelihood of developing a disorder. The majority of diseases Americans encounter, however, do not result solely from genetic predisposition but from the interaction of genes with environmental factors, including occupation, diet, and lifestyle. Consequently, genetic tests alone cannot predict with certainty whether a person with a particular genetic error will in fact develop a disease.[49]

During congressional testimony before the Senate Health, Education, Labor and Pensions Committee, Dr. Francis Collins expressed concern about the misuse of genetic information, stating that, "while genetic information and genetic technology hold great promise for improving human health, they can also be used in ways that are fundamentally unjust," specifically "[g]enetic information can be used as the basis for insidious discrimination."[50] In particular, Paul Steven Miller, commissioner of the U.S. Equal Employment

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44. Collins et al., *supra* note 1, at 687–88.

45. Greely, *supra* note 43, at 611.

46. *Workplace Hearings*, *supra* note 43 (statement of Francis S. Collins, Director of Human Genome Research Institute, National Institutes of Health).

47. Karen Rothenberg et al., *Genetic Information and the Workplace: Legislative Approaches and Policy Challenges*, 275 SCIENCE 1755, 1756–57 (1997) (listing five recommendations for state and federal policymakers).

48. *Workplace Hearings*, *supra* note 43 (statement of Francis S. Collins, Director of Human Genome Research Institute, National Institutes of Health).

49. DEP'T OF LABOR ET AL., *supra* note 33.

50. *Workplace Hearings*, *supra* note 43 (statement of Francis S. Collins, Director of Human Genome Research Institute, National Institutes of Health).

Opportunity Commission ("EEOC"), expressed to the Committee that the "surge in genetic research and technology, fueled in large part by the Human Genome Project," has resulted in the "risk that employers will misinterpret and misuse genetic test results to weed out persons according to their *perceived* health risks based on genetic information."[51]

One report described the cost-cutting motivation of employers to use such imperfect predictive tests, stating that "[b]ased on genetic information, employers may try to avoid hiring workers who they believe are likely to take sick leave, resign, or retire early for health reasons (creating extra costs in recruiting and training new staff), file for workers' compensation, or use health care benefits excessively."[52] Concern with respect to genetic information's imperfect predictive ability was not limited to the individual's health. Although not as extensively discussed by ELSI or Congress, there was also concern over employers using genetic information to predict behavior or personality.[53] For example, Congress feared that employers might test potential employees to determine who is more likely to be diligent or loyal based on their genetic predispositions. Overall, although it may be economically efficient from the perspective of the employer, there was a concern that making employment decisions on the basis of predispositions conflicted with society's merit-based belief in judging individuals on their abilities alone. President Bush, in a 2001 radio address to the nation, stated that such utilization of "medical speculation" by employers is "unjustified."[54] Denying employment to an individual based on a predisposition "violates our country's belief in equal treatment and individual merit"[55] and is inconsistent with the

51. *Workplace Hearings*, *supra* note 43 (statement of Commissioner Paul Steven Miller, EEOC) (emphasis added), *available at* http://www.genome.gov/10001390.

52. DEP'T OF LABOR ET AL., *supra* note 33.

53. *See* Thomas F. Wieder, *Privacy Protection is Needed for DNA*, 2002 L. REV. MICH. ST. U. DETROIT C. L. 927, 928–29 (discussing the eugenics movement in which individuals that were "feeble minded," "criminalistic," and "inebriate" were considered to be in a socially inadequate class, subject to sterilization due to their undesired behavioral characteristics); *see also* Symposium, *The Human Genome Project, DNA Science and the Law: The American Legal System's Response to Breakthroughs in Genetic Science*, 51 AM. U. L. REV. 451, 464–65 (2002) (discussing potential employee discrimination on the basis of genetic markers corresponding to cognitive skill).

54. President George W. Bush, Radio Address by the President to the Nation (June 23, 2001), *available at* http://www.genome.gov/11510235.

55. *Id.*

American principle that "people should be judged based upon their abilities, and not based upon fears, myths or stereotypes."[56]

C. Inadequate Existing Federal Statutory Protections

From the time of GINA's inception to its enactment, a "hotly contested" debate ensued in Congress over the need for reform.[57] While the debate initially ignited in the 104th Congress, the arguments and views supporting and opposing the legislation remained consistent for the most part from one legislative session to the next.[58] Opponents of federal legislation, including members of the insurance industry and employers represented by the Genetic Information Nondiscrimination in Employment ("GINE") Coalition, extensively argued that other bodies of federal law were sufficient to deal with any misuse of genetic information by employers.[59] These opponents cited the Americans with Disabilities Act ("ADA"),[60] Title VII of the Civil Rights Act of 1963 ("Title VII"),[61] and Executive Order 13,145 To Prohibit Discrimination in Federal Employment Based on Genetic Information ("Executive Order 13,145")[62] to support their position that the passage of GINA would only create confusion and unnecessary costs.[63] Proponents of federal nondiscrimination legislation countered that "current laws [were] not clear on protection."[64] Further, since the existing federal laws had not been

56. *Workplace Hearings*, *supra* note 43 (statement of Commissioner Paul Steven Miller, EEOC). A joint report by the Department of Labor, the Department of Health and Human Services, the EEOC, and the Department of Justice similarly found that "genetic predisposition or conditions can lead to workplace discrimination, even in cases where workers are healthy and unlikely to develop disease or where the genetic condition has no effect on the ability to perform work." DEP'T OF LABOR ET AL., *supra* note 33.

57. Nuffort, *supra* note 11, at 9.

58. *Id.* at 9–10.

59. *Id.* at 10–11.

60. Americans with Disabilities Act (ADA) of 1990, Pub. L. No. 101-336, 104 Stat. 327 (1990) (codified as amended in scattered sections of 29 U.S.C., 42 U.S.C., & 47 U.S.C.).

61. 42 U.S.C. § 2000 (2006).

62. 65 Fed. Reg. 6877 (Feb. 10, 2000).

63. JONES & SARATA, *supra* note 21, at 3 (quoting *Genetic Non-Discrimination: Examining the Implications for Workers and Employers: Hearing Before the Subcomm. on Employer-Employee Relations of the House Comm. on Educ. and the Workforce*, 108th Cong. 37 (2004) (testimony of Lawrence Lorber, on behalf of the U.S. Chamber of Commerce)); Nuffort, *supra* note 11, at 4, 10–11.

64. Nuffort, *supra* note 11, at 4.

properly tested in court, the proponents argued that the scope of their protection was "highly speculative."[65]

The insufficient protections afforded genetic information by Title VII and Executive Order 13,145 were easily discernible. Title VII is limited to prohibiting employment discrimination on the basis of race, color, religion, sex, and national origin.[66] Therefore, under Title VII, "employees can prevail on a claim [only] if they establish that the employer singled out a specific protected class for genetic testing."[67] Executive Order 13,145 narrowly prohibits the federal government from taking adverse employment actions based on an employee's "protected genetic information" and therefore did not protect the majority of Americans who were not employed or applying for employment with the federal government.[68] However, more time and effort were required to identify the gaps and uncertainties of protection under the ADA before Congress ultimately concluded that new legislation was necessary.

Reports and hearings conducted during the congressional debate revealed that the currently existing federal framework provided under the ADA did not protect workers from requirements or requests to provide genetic information to their employers or from the employer purchasing an employee's genetic information from a data bank.[69] Under the statute, an employer may not make medical inquiries about an applicant before extending a conditional offer of employment.[70] However, "once a conditional offer of employment has been extended, but before the individual begins work, the employer may obtain extensive medical information about the applicant, including genetic information."[71]

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65. *Id.*

66. 42 U.S.C. § 2000e-2(a); Joanne Barken, Note, *Judging GINA: Does the Genetic Information Nondiscriminaton Act of 2008 Offer Adequate Protection?*, 75 BROOK. L. REV. 545, 560–61 (2009).

67. Barken, *supra* note 66, at 560–61; *see also* Christine Formas Norris, Note, *The Genetic Information Nondiscrimination Act of 2008: History, Successes, and Future Considerations*, 7 U. MD. L.J. RACE RELIGION GENDER & CLASS 192, 206 (2007) (discussing the inadequate legal protections provided by Title VII in the realm of employment discrimination on the basis of genetic information).

68. Barken, *supra* note 66, at 561–63.

69. DEP'T OF LABOR ET AL., *supra* note 33; *see also Workplace Hearings*, *supra* note 43 (statement of Commissioner Paul Steven Miller, EEOC) ("[T]he ADA does not protect workers from requirements or requests to provide genetic information to their employers.").

70. 42 U.S.C. § 12112(d)(2)(A) (2006); DEP'T OF LABOR ET AL., *supra* note 33.

71. DEP'T OF LABOR ET AL., *supra* note 33; *see also* Norman-Bloodsaw v. Lawrence Berkeley Lab., 135 F.3d 1260, 1273 (9th Cir. 1998) (finding no ADA violation when genetic tests were administered after the job was offered and prior to employment).

For example, in *Norman-Bloodsaw v. Lawrence Berkeley Laboratory*, the Court of Appeals for the Ninth Circuit ruled that an employer's practice of testing for the sickle-cell trait, among other things, did not constitute a violation of the ADA.[72] The complaint alleged that the defendants violated the ADA by requiring such genetic testing because the required testing constituted medical examinations and medical inquiries that were "neither job-related nor consistent with business necessity."[73] The court upheld the dismissal of the ADA claims, finding that since the medical inquiries were conducted as part of an employment entrance examination, they "need not be concerned solely with the individual's 'ability to perform job-related functions' " nor must they be "job-related or consistent with business necessity."[74] Thus, considering the seemingly limitless scope of "preplacement examinations"[75] allowed under the ADA, during this time, an employer could go as far as "to obtain and store genetic samples of job applicants, require genetic screening as a condition of employment, or purchase genetic information about applicants from a genetic information data bank."[76]

Furthermore, proponents of GINA showed that the ADA was insufficient to prohibit employers, once they are in possession of genetic information, from misusing the information to discriminate.[77] Title I of the ADA, which protects individuals seeking work or working in the private sector from discrimination on the basis of disability, makes no explicit mention of genetic information. Rather, the ADA contains broad language prohibiting discrimination against a "qualified individual with a disability" in hiring, promotion, discharge, compensation, and other terms and conditions of employment.[78] The ADA defines an individual with a disability as a person with "(A) a physical or mental impairment that substantially limits one or more of the major life activities of such individual; (B) a record of such an

72. *Norman-Bloodsaw*, 135 F.3d at 1273–74.

73. *Id.* at 1273.

74. *Id.* (citing 42 U.S.C. § 12112(d)(2), (d)(4) in part).

75. *Id.* at 1264.

76. DEP'T OF LABOR ET AL., *supra* note 33. In addition, under the ADA, "once the applicant is hired the employer may request medical information that is job related and consistent with business necessity." *Id.* This may be allowed, even though genetic test information alone is not a reliable basis for concluding that someone has an actual disease. *Id.*

77. DEP'T OF LABOR ET AL., *supra* note 33.

78. 42 U.S.C. §§ 12,111–17.

impairment; or (C) being regarded as having such an impairment."[79] While the ADA clearly protects an employee who develops a genetically related illness when the illness begins to limit a major life activity substantially, it fails to address whether an employee's genetic information, which indicates the likelihood of developing a future disease, can constitute a bona fide disability.[80]

In 1995, the EEOC stated its position that the ADA "regarded as" prong protects individuals with genetic markers for illness, disease, or other disorders from discrimination in employment.[81] However, as several GINA-related reports and hearings emphasized, EEOC policy guidance does not have the same force of law as a federal statute.[82] In fact, courts in the past have disagreed with the EEOC's regulations under the ADA.[83] Therefore, given this limited and uncertain protection and "in light of the accelerated pace of genetic discovery, the uniqueness of genetic information, [and] the great potential for discrimination,"[84] Congress concluded that additional legislation was necessary to ensure adequate protections against both obtainment and unfair use of genetic information by employers.[85]

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79. § 12102(1); *see* 42 U.S.C.A. § 12102(3)(A) (West 2012) ("An individual meets the requirement of 'being regarded as having such an impairment' if the individual establishes that he or she has been subjected to an action prohibited under this Act because of an actual or perceived physical or mental impairment whether or not the impairment limits or is perceived to limit a major life activity.").

80. DEP'T OF LABOR ET AL., *supra* note 33; Mark S. Dichter & Sarah E. Sutor, *The New Genetic Age: Do Our Genes Make Us Disabled Individuals Under the American with Disabilities Act?*, 42 VILL. L. REV. 613, 620 (1997).

81. U.S. EQUAL EMP'T OPPORTUNITY COMM'N, COMPLIANCE MANUAL § 902 (1995); *see also* Press Release, EEOC, EEOC Settles ADA Suit Against BNSF for Genetic Bias (Apr. 18, 2001) *available at* http://www.eeoc.gov/eeoc/newsroom/release/4-18-01.cfm (quoting EEOC Commissioner Paul Steven Miller as saying, "Employers must understand that basing employment decisions on genetic testing is barred under the ADA's 'regarded as' prong, as stated in EEOC's 1995 policy guidance on the definition of the term 'disability.' ").

82. DEP'T OF LABOR ET AL., *supra* note 33; *Workplace Hearings*, *supra* note 43 (statement of Commissioner Paul Steven Miller, EEOC).

83. *See* Sutton v. United Airlines, 527 U.S. 471, 479–80 (1999) (finding that the EEOC did not possess agency regulation-writing authority with respect to the ADA's definitions).

84. DEP'T OF LABOR ET AL., *supra* note 33.

85. *See* Genetic Information Nondiscrimination Act of 2008 § 2(5), Pub. L. No. 110-233, 122 Stat. 881, 882 (2008) ("Congress has collected substantial evidence that the American public and the medical community find the existing patchwork of . . . Federal laws to be confusing and inadequate to protect them from discrimination.").

D. Text of GINA

After a thirteen-year legislative battle, President George W. Bush signed the Genetic Information Nondiscrimination Act of 2008 into law. In the time between GINA's inception and its enactment, the field of genomics had grown exponentially.[86] Congress passed the bill, intending for GINA to replace the "existing patchwork of . . . Federal laws" and "to fully protect the public from discrimination and allay their concerns about the potential for discrimination, thereby allowing individuals to take advantage of genetic testing, technologies, research, and new therapies."[87]

GINA, referred to by Senator Edward Kennedy as "the first major new civil rights bill of the new century,"[88] is a complex bill that prohibits employment and insurance discrimination based on genetic information. Title I bars group health plans and health insurers from conditioning the insurance of healthy individuals solely on genetic information.[89] Title II parallels language from Title VII of the Civil Rights Act of 1964 and applies to employers, employment agencies, labor organizations, and employee and apprenticeship training programs.[90] It prohibits such entities from requesting or requiring genetic information, from discriminating on the basis of genetic information, and from disclosing an employee's genetic information.[91]

First, Title II makes it an "unlawful employment practice" for an employer, employment agency, labor organization, or training program to request, require, or purchase the genetic information of an employee or of a family member of the employee.[92] The statute carves out six exceptions to this prohibition for employers and five exceptions—which effectively mirror employer exceptions one through five—for other nonemployer Title II entities.[93]

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86. *See* discussion *supra* Part I.A.

87. Genetic Information Nondiscrimination Act of 2008 § 2(5), 122 Stat. at 882 (congressional findings).

88. Hudson et al., *supra* note 39, at 2662.

89. Genetic Information Nondiscrimination Act §§ 101–106, 122 Stat. at 883–905. This Note focuses on employment discrimination on the basis of neuro information and therefore will not discuss Title I of GINA in depth.

90. §§ 202–206, 122 Stat. at 905–14.

91. *Id.*

92. §§ 202(b), 203(b), 204(b), 205(b), 122 Stat. at 907, 909, 910, 912.

93. §§ 202(b), 203(b), 204(b), 205(b), 122 Stat. at 907, 909, 910, 912. These employer exceptions include: (1) where the employer inadvertently requires or requests genetic information; (2) where the genetic information is provided to the employer as part of an employer-administered wellness program, offering health and genetic services; (3) where the

Second, Title II makes it unlawful for employers and employer organizations to discriminate on the basis of genetic information. GINA forbids an employer from discharging or refusing or failing to hire an employee because of genetic information.[94] It also makes it unlawful for an employer to discriminate against any employee with "respect to compensation, terms, conditions, or privileges of employment" because of genetic information.[95] Similarly, GINA forbids an employment agency from refusing or failing to refer for employment any individual because of genetic information;[96] forbids a labor organization from excluding or expelling from membership any individual because of genetic information;[97] and forbids training programs from discriminating against any individual because of genetic information with respect to admission to or employment in any program to provide apprenticeship or other training.[98] GINA also makes it unlawful for Title II entities to "limit, segregate, or classify" an employee in any way that would deprive him of employment opportunities or would adversely affect his status as an employee on the basis of genetic information.[99] Further, such nonemployer entities are forbidden from causing or attempting to cause an employer to discriminate against an individual on the basis of genetic information.[100]

Finally, Title II of GINA provides for the confidential treatment of genetic information if an employer or employer entity comes into possession of such information about an employee or member.[101] The statute requires that the entity maintain genetic information on separate forms and in separate medical files and treat the information as a confidential medical record.[102] GINA makes it

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employer requires or requests genetic information to comply with certification provisions of the Family Medical Leave Act of 1993; (4) where the employer purchases genetic information that is commercially and publicly available; (5) where the employer requests or requires genetic information to monitor the biological effects of toxic substances in the workplace; and (6) where the employer conducts DNA analysis for law enforcement purposes as a forensics laboratory. § 202(b), 122 Stat. at 907.

94. § 202(a)(1), 122 Stat. at 907.

95. *Id.*

96. § 203(a)(1), 122 Stat. at 908.

97. § 204(a)(1), 122 Stat. at 910.

98. § 205(a)(1), 122 Stat. at 911.

99. §§ 202(a)(2), 203(a)(2), 204(a)(2), 205(a)(2), 122 Stat. at 907, 908–09, 910, 912.

100. §§ 203(a)(3), 204(a)(3), 205(a)(3), 122 Stat. at 909, 910, 912.

101. § 206, 122 Stat. at 913–14.

102. § 206(a), 122 Stat. at 913.

unlawful for a Title II entity to disclose genetic information concerning an employee or member, except in a few limited circumstances.[103]

Legal scholars have been quick to point out the shortcomings of GINA.[104] However, despite its imperfection, most agree that the statute is an "important recognition of the power of genetic medicine, the injustice of discrimination based on genetic factors beyond individual control, and the importance of health care and employment to each individual."[105] GINA surely is not an end to the problems of genetic discrimination, but it ensures that conversation and debate continue to occur in the field so that present and future legislation can evolve on pace with the spectacular advancements in genetic science.

II. THE POTENTIAL FOR PREDICTIVE NEUROIMAGING-BASED DISCRIMINATION

Legal scholars and scientists agree that the world is in the middle of a "revolution in neuroscience."[106] Compared to thirty years ago, scientists now know far more about the structure and function of the human brain.[107] In the past decade alone, some claim that neuroscience has entered "a period of extraordinary, perhaps unprecedented promise."[108] This revolution in neuroscience, like most science revolutions, was made possible by a revolution in tools—

103. § 206(b), 122 Stat. at 913–14. A Title II entity may disclose genetic information: (1) to the employee or labor organization member at the written request of the employee or labor organization member; (2) to an occupational or health researcher in compliance with federal regulations; (3) to court officials in response to a court order; (4) to government officials investigating compliance with Title II of GINA; (5) to the extent such disclosure is made in connection with the employee's compliance with the Family Medical Leave Act of 1993; and (6) to a federal, state, or local public health agency. *Id.*

104. *See* Cheryl Erwin, *Legal Update: Living with Genetic Information Nondiscrimination Act*, 10 GENETICS MED. 869, 871–72 (2008) (discussing how GINA still provides a number of legal ways for employers to access employee's genetic information and how GINA fails to address the coercive effects that employers may exert on applicants to provide their genetic information); Norris, *supra* note 67, at 193 (discussing how GINA does not regulate genetics research that can reinforce racial, ethnic, and other stereotypes); Mark A. Rothstein, *Is GINA Worth the Wait?*, 36 J.L. MED. & ETHICS 174, 174 (2008) (describing GINA as being "fatally flawed" due to its failure to adequately protect the privacy of employee health information).

105. Erwin, *supra* note 104, at 872; *see also* Paul R. Billings, *Beyond GINA*, 14 NATURE MED. 806, 806 (2008) ("GINA is . . . a sentinel step in the adaptation of our society to deeper understanding of our personal genetics and as a moment of restatement of our most deeply held values."); Rothstein, *supra* note 104, at 177 (stating that GINA is valuable for its "symbolism" as declaring a national policy against discrimination on the basis of genetic information).

106. Henry T. Greely, *Law and the Revolution of Neuroscience: An Early Look in the Field*, 42 AKRON L. REV. 687, 688 (2009).

107. *Id.*

108. Hamilton, *supra* note 10.

imaging, statistical, and databank tools.[109] The combination of advancements in these powerful, emerging tools has made it possible to use neuroimaging, similarly to genetic information, to predict an individual's future propensity for disease or behavior. Neuroimaging studies can look at different patterns of brain images taken under varying circumstances and then can correlate these patterns with different behaviors or conditions.[110] Therefore, while genetics affords insights into an individual's future health conditions and behavior by developing the association between a person's genes and bodily states, neuroscience focuses on brain structure and functioning that can indicate normal and abnormal patterns and correlates such patterns with present or future health and behavior.

A. From the Human Brain Project to Predictive Neuroimaging: Uncovering the Human Brainprint

Advancements in neuroimaging have made it possible, for the first time, to look inside a living, healthy human brain noninvasively and to see its detailed structure and functioning.[111] These advancements also allow neuroscientists to begin to correlate the physical states of the brain, revealed by these tools, with the states of the mind that certain activities produce.[112] Neuroimaging may reveal the structure of the living brain, through technologies such as computer-assisted tomography ("CAT") scans or magnetic resonance imaging ("MRI"), or it may show the function of different parts of the living brain, through positron emission tomography ("PET") scans, single photon emission computed tomography ("SPECT") scans, electroencephalography ("EEG"), or functional magnetic resonance imaging ("fMRI").[113]

Functional magnetic resonance imaging is "one of the most exciting windows into the black box" of the brain.[114] An fMRI scan utilizes the tendency of nerve cells to metabolize oxygen in the blood

109. Greely, *supra* note 106, at 688.

110. *Id.*

111. *Id.*

112. *Id.*

113. *See* Committee on Science and Law, *Are Your Thoughts Your Own?: "Neuroprivacy" and the Legal Implications of Brain Imaging*, 60 RECORD 407, 410–11 (2005) (discussing the underlying technology and uses of CAT, PET, SPECT, MRI, fMRI, and EEG scanning).

114. JONATHAN D. MORENO, MIND WARS: BRAIN RESEARCH AND NATIONAL DEFENSE 98 (2006).

surrounding the cells when they are activated.[115] The scan then records the difference between oxygenated and nonoxygenated blood cells so that more active neurons can be identified and distinguished from less active ones.[116] By using this scanning ability while an experimental subject performs or undergoes a specific task or experience, scientists can correlate activated neural systems and mental activity.[117]

Recently, several major information-gathering initiatives in neuroscience are attempting to use these advancements in neuroimaging of brain structure and function to show propensity for developing certain diseases and mental abnormalities. One of these initiatives is the Human Brain Project, which commenced around the same time as the HGP.[118] From 1993 through 2005, the Human Brain Project awarded over $100 million in grants toward achieving its goal of "stimulat[ing] the development of advanced technologies for sharing data on the brain through digital databases of brain images and mapping."[119] One of its greatest accomplishments was the creation of the fMRI Data Center, a public repository of neuroimaging information.[120] The neuroscientists that spearheaded the fMRI Data Center stated that they hoped it would spur discoveries in neuroscience the same way that GenBank, a public database of gene sequences that operated alongside the HGP,[121] had spurred discoveries in genetics.[122] The fMRI Data Center makes raw data from neuroimaging studies available to researchers and organizes the data so that interesting features can be extracted from it systematically.[123]

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115. *Id.*

116. *Id.*

117. *Id.* at 98–99.

118. Press Release, Nat'l Inst. of Mental Health, Making Sense of the Brain's Mind Boggling Complexity (Apr. 16, 2004), *available at* http://www.nimh.nih.gov/science-news/2004/making-sense-of-the-brains-mind-boggling-complexity.shtml.

119. Kurt Samson, *Will the Demise of the NIH Human Brain Project Hurt the Growth of Neuroinformatics?*, NEUROLOGY TODAY, Mar. 7, 2006, at 34, 34–35.

120. *Id.* at *35*; *General Information*, THE FMRI DATA CTR., http://www.fmridc.org/f/fmridc/aboutus/index.html (last visited Oct. 23, 2011).

121. *See* Press Release, Nat'l Inst. of Health, GenBank Celebrates 25 Years of Service with Two-Day Conference (Apr. 3, 2008), *available at* http://www.nih.gov/news/health/apr2008/nlm-03.htm (discussing how the Human Genome Project would send GenBank sequence data as it was generated).

122. *Open Your Mind*, THE ECONOMIST, May 23, 2002, http://www.economist.com/node/1143317.

123. *Id.*; *General Information*, THE FMRI DATA CTR., http://www.fmridc.org/f/fmridc/aboutus/index.html (last visited Oct. 23, 2011).

In 2009, utilizing advancements in neuroimaging and in neuroinformatics generated by the Human Brain Project,[124] NIH launched the Human Connectome Project.[125] Just as the HGP mapped the entire human genome, the Human Connectome Project aims to gain insight into how brain connections underlie brain function by systematically mapping the axonal connections of the entire, living human brain.[126] By combining powerful, emerging technologies, the Human Connectome Project will map the brain's circuits and then attempt to link these circuits to the full spectrum of brain function in health and disease.[127] Connectivity patterns revealed by imaging of brain structure and function will be combined with behavioral testing and genotyping in an effort to determine how small changes in brain connectivity relate to individual differences in behavior and disease.[128]

Additionally, this past year, a team of researchers published the first analysis from a related endeavor, called the 1000 Functional Connectomes Project, that illustrated the success that projects such as the Human Connectome Project may yield.[129] The team, led by Michael Milham, a neuroscientist at New York University Childhood Study Center, analyzed a collection of fMRI data sets donated by researchers from thirty-five centers around the world.[130] The sets consisted of data from more than fourteen-hundred subjects who underwent fMRI scans to assess their brain activity when their minds were at rest.[131] The study revealed that resting-state fMRI data—previously thought by neuroscientists to be only white noise—can be pooled reliably to unveil an underlying "universal architecture of

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124. In announcing that it would not accept any more grant applications in 2005, essentially ending the Human Brain Project initiative, Dr. Michael Huerta, director of the Office of Interdisciplinary Research and Scientific Technology at the National Institute of Mental Health, said that the project had been a success and that neuroinformatics can now be mainstreamed into other research at NIH. Samson, *supra* note 119, at 35.

125. Press Release, Nat'l Inst. of Mental Health, NIH Launches the Human Connectome Project to Unravel the Brain's Connections (July 16, 2009), *available at* http://www.nimh.nih.gov/science-news/2009/nih-launches-the-human-connectome-project-to-unravel-the-brains-connections.shtml.

126. *Id.*

127. *Id.*

128. Christophe Lenglet et al., *Deciphering the Human-Brain Connectome*, SPIE NEWSROOM (Dec. 7, 2010), http://spie.org/x43323.xml?pf=true&ArticleID=x43323.

129. Elie Dolgin, *This is Your Brain Online: The Functional Connectomes Project*, 16 NATURE MED., 351, 351 (2010).

130. Michael P. Milham et al., *Toward Discovery Science of Human Brain Function*, 107 PROC. NAT'L ACAD. SCI., 4734, 4734 (2010).

131. *Id.*

activity connections within the brain."[132] Even more exciting, while the human functional connectome overall has a common architecture, "each individual's functional connectome exhibits unique features, with stable, meaningful interindividual differences in connectivity patterns and strengths."[133] This suggests that, just as there is predictable genetic variation in different alleles at particular loci in the genome, there are also consistent loci of variability between individuals in their functional connectomes.

The discoveries made by the 1000 Functional Connectomes Project and the future discoveries to come from the Human Connectome Project will allow for "systematic explorations of healthy and diseased brains to discover hitherto unknown underlying differences."[134] This moves the field in the direction of being able to objectively test and predict serious mental illness, neurological disorders, and personality traits on a large scale.[135] Eventually, "data from myriads of neuroscientific studies may be integrated in databases, similar to gene and protein sequence databases," to create a "human brainome"[136] or "brain atlas" that will provide "a probability distribution for different cerebral characteristics and some indication of 'normal' brain activity [and structure]."[137] Then, just as with genetic tests, an individual's brain could be scanned and compared to normal brain activity and structure. Any differences between the scan and normality could be thought of as "brain mutations," similar to gene

132. Dolgin, *supra* note 129, at 351; *see also* Milham et al., *supra* note 130, at 4735–38 (discussing the feasibility of pooling resting state fMRI datasets across research centers).

133. Milham et al., *supra* note 130, at 4734–36 (finding that "centers demonstrated a high degree of agreement on which connections are characterized by relative variance or invariance").

134. Dolgin, *supra* note 129, at 351 (discussing how large databases of brain images, such as the 1000 Functional Connectomes resource, can serve as a reference of activity patterns within the human brain, allowing for "systematic explorations of health and diseased brains to discover hitherto unknown underlying differences"); *see also* Huda Akil, *Challenges and Opportunities in Mining Neuroscience Data*, 331 SCIENCE 708, 709–10 (2011) (discussing how the Human Connectome Project will provide data mining options to reveal connectivity differences between subpopulations that are selected by different phenotypes); Tal Yarkoni, *Cognitive Neuroscience 2.0: Building a Cumulative Science of Human Brain Function*, 14 TRENDS COGNITIVE SCI. 489, 492 (2010) (discussing how the 1000 Functional Connectomes Project and Human Connectome Project will provide "immense amounts of information on brain connectivity").

135. Dolgin, *supra* note 129, at 351.

136. Committee on Science and Law, *supra* note 113, at 428 (discussing how reference has been made to a "brainome" similar to a "genome").

137. *Id.* at 428, 432; *see also* Yarkoni, *supra* note 134, at 494 box 3 (discussing as a possible future development, "fully automated quantitative mapping between cognitive and neural states" whereby "[r]esearchers would upload observed activation maps to a database as input and receive as output probabilistic estimates of [] psychological states").

mutations, perhaps indicating an increased susceptibility to certain diseases, mental abnormalities, or behaviors.

Some predict that it may be up to a decade before a fully automated quantitative brain map is clinically available.[138] However, it could be much sooner. Nora Volkow, director of the U.S. National Institute on Drug Abuse, is already impressed by the "mindboggling" consistency of the data published in the analysis of the 1000 Functional Connectomes Project.[139] She recently stated, "I could use that data set to assess whether the connectivity patterns that I'm seeing in my patient actually differ in any significant way from this data set, which I can use as reference."[140]

An excellent example of how a functional neuroimage can show an asymptomatic individual to be predisposed to a disease comes in the field of Alzheimer's disease research. Brain imaging has enabled researchers to better understand vulnerability to Alzheimer's disease and the mechanisms leading to disease onset.[141] As recently as a few decades ago, a compartmentalized model of Alzheimer's disease was widely accepted in the field.[142] Researchers believed that "people either had [Alzheimer's disease] pathological changes, in which case they had dementia, or they did not have such changes and were cognitively normal."[143] With advancements in neuroscience technology, however, an amended view of the disease has developed. It is now believed that "both [Alzheimer's disease] pathological processes and clinical decline occur gradually over time, with dementia representing the end stage of many years of accumulation of these pathological changes."[144] In addition, these pathological changes begin to develop decades before the earliest clinical symptoms manifest.[145] Neuroimaging studies have revealed neuroimaging correlates of

138. *See* Yarkoni, *supra* note 134, at 494 box 3 (predicting that in ten years, there will be "fully automated quantitative mapping between cognitive and neural states").

139. Dolgin, *supra* note 129, at 351.

140. *Id.*

141. Martha J. Farah, *Neuroethics: An Overview*, *in* MARTHA J. FARAH, NEUROETHICS, AN INTRODUCTION WITH READINGS 1, 4 (2010).

142. Clifford R. Jack et al., *Hypothetical Model of Dynamic Biomarkers of the Alzheimer's Pathological Cascade*, 9 LANCET NEUROLOGY 119, 119 (2010).

143. *Id.*

144. B.C. Dickerson et al., *Alzheimer-Signature MRI Biomarker Predicts AD Dementia in Cognitively Normal Adults*, 76 NEUROLOGY 1395, 1395 (2011) (discussing how Alzheimer's disease neuropathology develops "in cognitively normal (CN) adults and caus[es] dysfunction and cell death in neuronal systems subserving cognition, eventually leading to the clinical syndrome"); Jack et al., *supra* note 142, at 119.

145. Dickerson et al., *supra* note 144, at 1402; Jack et al., *supra* note 142, at 119.

incipient Alzheimer's disease, which, in some cases, may herald the clinical onset several years in advance.[146]

While the exact neuropathological process is yet to be fully understood, currently available evidence suggests the initiating event in the disease is the abnormal processing of beta amyloid peptide.[147] This abnormal processing leads to the formation and depositing of amyloid plaques, neuronal degeneration, and, ultimately, cognitive impairment.[148] Scientists are now able to use various neuroimaging scans, particularly MRI and PET scans, to look into the brains of healthy living individuals and see the extent to which beta amyloid protein coats their neurons, forming amyloid plaques,[149] and the extent to which their brains are experiencing neuronal degeneration.[150] Although most people develop some plaques and experience some cell degeneration as they age, those with Alzheimer's tend to do so far more and tend to do so in a predictable pattern, beginning in areas important for memory before spreading to other regions.[151] Scientists cannot yet accurately calculate the likelihood that someone with a given amount of amyloid plaque or atrophy in certain regions of the brain at age forty will have Alzheimer's disease at age sixty-five, but in a few years this should be possible.[152]

One recent study found that cortical thinning, a brain abnormality associated with neuronal degeneration, is detectable in asymptomatic individuals nearly a decade before they are diagnosed with Alzheimer's disease dementia and is useful not only for assessing risk of Alzheimer's disease but also for predicting the amount of time before the onset of dementia.[153] The study looked at the cortical thickness of certain regions of the brain known to be associated with Alzheimer's disease and found that the thickness corresponded to the likelihood that an individual would develop Alzheimer's disease over the next decade.[154] Researchers scanned the brains of individuals and measured their cortical thickness and then followed the subjects for

146. Dickerson et al., *supra* note 144, at 1395–96; Jack et al., *supra* note 142, at 119.

147. Jack et al., *supra* note 142, at 119.

148. *Id.*

149. Greely, *supra* note 106, at 689.

150. Dickerson et al., *supra* note 144, at 1395–96.

151. *See* Dickerson et al., *supra* note 144, at 1395 (discussing cell atrophy); *What is Alzheimer's?*, ALZHEIMER'S ASS'N, http://www.alz.org/alzheimers_disease_what_is_alzheimers.asp#brain (last visited Jan. 10, 2011) (discussing plaques and tangles).

152. Greely, *supra* note 106, at 690.

153. Dickerson et al., *supra* note 144, at 1395.

154. *Id.* at 1396, 1398.

ten years to determine whether they developed the disease.[155] Of the individuals found to have a baseline low thickness, fifty-five percent developed the disease.[156] In contrast, only twenty percent of those with average baseline thickness developed the disease, while none of the individuals with high baseline thickness developed the disease.[157] Further, the researchers found that of those individuals who developed Alzheimer's disease, the baseline thickness was a strong predictor of the time the individuals had before dementia manifested: those with the lowest baseline thickness developed the disease faster than those with relatively higher baseline thickness.[158] Similar efforts are also underway to use fMRI to find neural correlates of other neurological disorders, such as Parkinson's disease[159] and multiple sclerosis.[160] Scientists are also close to being able to predict mental disorders, such as schizophrenia[161] and depression,[162] based on neuroimaging.

Furthermore, just like genetics, neuroimaging also affords the possibility of predicting future behavior. Several neuroscience studies show promise in predicting an individual's predisposition to future dangerousness by finding that the structure and functioning of the brain of a psychopath are different from those of a nonpsychopath

155. *Id.* at 1396.

156. *Id.* at 1398.

157. *Id.*

158. *Id.* at 1398, 1400 fig.3.

159. Cornelius Weiller et al., *Role of Functional Imaging in Neurological Disorders*, 23 J. MAGNETIC RESONANCE IMAGING 840, 850 (2006).

160. *Id.*

161. In a study of individuals at risk for developing schizophrenia, researchers found evidence suggesting that the onset of brain volume decrement may closely pre-date the overt manifestations of schizophrenia, making brain volume abnormalities potential predictors for early identification. *See* Beng-Choon Ho, *MRI Brain Volume Abnormalities in Young, Nonpsychotic Relatives of Schizophrenia Probands Are Associated with Subsequent Prodromal Symptoms*, 96 SCHIZOPHRENIA RES. 1, 13 (2007) (finding that with prodromal symptoms assessed in these individuals one year after the MRI scans, initial grey matter deficits as well as larger white matter volumes correlated significantly with greater severity of subsequent prodromal symptoms).

162. One prospective study conducted a CT scan of 525 elderly subjects without depression and then compared the images to the development of major and minor depression in the subjects at a five-year follow-up. Pernille J. Olesen et al., *Temporal Lobe Atrophy and White Matter Lesions Are Related to Major Depression Over 5 Years in the Elderly*, 35 NEUROPSYCHOPHARMACOLOGY 2638, 2638–45 (2010). The study concluded that the presence of temporal lobe atrophy independently predicted major depression, after controlling for various confounders. *Id.*

starting from a young age.[163] Numerous studies suggest that the presence of an abnormal brain electrical response following demanding attentional stimuli, emotional word stimuli, and concrete or abstract work stimuli is "nearly diagnostic" of psychopathy.[164] In one study, forty of forty-one criminal psychopaths were characterized by the presence of the particular brain electrical response, while none of the thirty-nine nonpsychopathic individuals exhibited the response.[165] In fact, PET images have already been used in criminal cases to argue that a defendant was biologically predisposed to committing a crime and should, therefore, be spared a conviction or death sentence.[166] Kent Kiehl, an expert in the field, predicts that "within a few years the field of psychopathy will parallel other, more mature, research fields that have made excellent progress using neuroimaging techniques as diagnostic tools."[167]

Similarly, some scientists maintain that socially relevant characteristics, such as unconscious racial attitudes, have detectable neural correlates. In a now well-known and controversial study, Elizabeth Phelps and colleagues at New York University "used fMRI to explore the neural substrates involved in the unconscious evaluation of Black and White social groups."[168] Researchers used previously developed behavioral measures to estimate the degree of unconscious racial bias of the subjects and then used fMRI to acquire brain images from the subjects while presenting them with pictures of unfamiliar Black and White faces.[169] The study found that variability in the activation of the amygdala of subjects—a region associated with emotional learning and that registers fear—correlated with the

163. SAGE CTR. FOR THE STUDY OF THE MIND, UNIV. OF CAL. SANTA BARBARA, A JUDGE'S GUIDE TO NEUROSCIENCE: A CONCISE INTRODUCTION 49 (2010) (discussing studies that support the hypothesis that the emotional regions of the brain, the limbic or paralimbic system, are disordered in psychopathy starting from a very early age).

164. *Id.* at 50.

165. Kent Kiehl et al., *Brain Potentials Implicate Temporal Lobe Abnormalities in Criminal Psychopaths*, 115 J. ABNORMAL PSYCHOL. 443–53 (2006).

166. Judy Illes & Eric Racine, *Imaging or Imagining? A Neuroethics Challenge Informed by Genetics*, 5 AM. J. BIOETHICS 5, 18 (2005). Evidence of brain damage to explain a defendant's history of criminally violent behavior could also be used against a defendant, as the jury may conclude that the defendant is beyond rehabilitation and likely to act criminally again in the future. *See* Cullen v. Pinholster, 131 S. Ct. 1388, 1410 (2011) (holding that new evidence of brain damage is "by no means clearly mitigating, as the jury might have concluded that [the defendant] was simply beyond rehabilitation").

167. SAGE CTR. FOR THE STUDY OF THE MIND, *supra* note 163, at 51.

168. Elizabeth A. Phelps et al., *Performances on Indirect Measures of Race Evaluation Predicts Amygdala Activation*, 12 J. COGNITIVE NEUROSCIENCE 729, 729 (2000).

169. *Id.* at 730–33.

previously measured degree of unconscious bias.[170] This led to the conclusion that "representations of social groups that differ in race evoke differential amygdala activity and such activation is related to unconscious social evaluation."[171]

In reacting to Phelps's research, some speculated that functional neuroimaging could reveal individuals' racial preferences and prejudices.[172] In response, Phelps issued a statement expressly warning against hastily jumping to such conclusions, stating that such research methods "should not and cannot be assumed . . . to reveal an individual's hidden racism."[173] Further, she warned that it would be "improper to use [the methods] in any selection or diagnostic context."[174] Nevertheless, many still insist that, at the very least, the results show the ability to detect the seeds of racial prejudice which could or could not become actual racism.[175] Relatedly, neuroscientists are investigating neurological predisposition to pedophilia,[176] compulsive gambling,[177] sexual preference,[178] political preference,[179] extroversion and introversion,[180] and cooperativeness.[181]

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170. *Id.* at 732–33.

171. *Id.* at 733.

172. Stacey A. Tovino, *Functional Neuroimaging Information: A Case for Neuro Exceptionalism?* 34 FLA. ST. U. L. REV. 415, 426 (2006) (discussing articles, as well as news and radio headlines, following Phelps's research).

173. Press Release, N.Y. Univ., NYU/Yale Research Team Explores Neural Basis of Racial Evaluation (Sept. 18, 2000), *available at* http://www.sciencedaily.com/releases/2000/09/000913203757.htm.

174. *Id.*

175. Austin Cline, *Brain Privacy: Are Your Thoughts Safe? MRIs Revealing More than Even You Know About Yourself*, ABOUT.COM, http://atheism.about.com/library/FAQs/phil/blphil_ethbio_brainpriv.htm (last visited Jan. 16, 2011).

176. *See* Martin Walter et al., *Pedophilia Is Linked to Reduced Activation in Hypothalamus and Lateral Prefrontal Cortex During Visual Erotic Stimulation*, 62 BIOLOGICAL PSYCHIATRY 698, 698–701 (2007) (finding abnormal activation in subcortical and cortical regions in pedophilia during visual-erotic stimulation with adults).

177. *See* Paolo Cavedini et al., *Frontal Lobe Dysfunction in Pathological Gambling Patients*, 51 BIOLOGICAL PSYCHIATRY 334, 334–41 (2002) (finding a link between pathological gambling and other disorders that involve a diminished ability to evaluate future consequences, which may be explained by an abnormal functioning of the orbitofrontal cortex).

178. *See* Felicitas Kranz & Alumit Ishai, *Face Perception Is Modulated by Sexual Preference*, 16 CURRENT BIOLOGY 63, 63 (2006); Dick F. Swaab, *Sexual Orientation and its Basis in Brain Structure and Function*, 105 PROC. NAT'L ACAD. SCI., 10,273, 10,273 (2008), *available at* http://www.pnas.org/content/105/30/10273.full.pdf (finding that viewing a female face produced a strong reaction in the reward circuitry of the thalamus and medial prefrontal cortex of heterosexual males and homosexual women, whereas in homosexual males and heterosexual women, these structures reacted more strongly to the face of a man).

179. *See* John Tierney, *Using M.R.I.'s to See Politics on the Brain*, N.Y. TIMES, Apr. 20, 2004, at A1 (finding that images of the September 11, 2001, terrorist attacks caused the amygdala, an

B. Imperfect Prediction and Employer Misuse

Advancements in predictive neuroimaging may aid in the identification of neural structure and function underlying disease and behavior and may even raise the possibility to cure some diseases. However, like genetic testing, this scientific accomplishment is not without potential problems. Neuro information suffers from the same imperfections that plagued genetic testing—brain images indicating a propensity for disease or behavior do not necessarily mean that the disease or behavior will materialize.

No less than the genome, the brain is "an extraordinarily complex combinatorial system."[182] Despite the recent advancements in the field, there still remains a sizeable gap between the ability to identify existing brain structures and functioning and the understanding of their corresponding implications for an individual's health and behaviors.[183] In addition, the brain image itself represents unparalleled complexity—from the specialized medical equipment needed to acquire a scan, to the array of parameters used to elicit activations and the statistical thresholds set to draw out meaningful patterns, to the expertise required for the interpretation of the maps themselves.[184] These limitations in scientific understanding, the shortcomings of the underlying technology, and the subjective nature of interpretation leave room for error, variation, and bias in neuroimaging test results.[185] Therefore, and of great relevance to

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area of the brain associated with fear and anger, to light up more vividly in Democrats than in Republicans).

180. *See* Turhan Canli et al., *An fMRI Study of Personality Influences on Brain Reactivity to Emotional Stimuli*, 115 BEHAV. NEUROSCIENCE 33, 33 (2001) (finding that in response to emotionally evocative stimuli, certain regions of the brain were activated in different degrees among patients identified as possessing the personality trait extroversion versus those with neuroticism).

181. *See* James K. Rilling et al., *A Neural Basis for Social Cooperation*, 35 NEURON 395, 395 (2002) (finding that when researchers scanned the brains of subjects as they played the Prisoner's Dilemma, mutual cooperation was associated with consistent activation in regions of the brain linked to reward processing, proposing that the pattern of neural activation positively reinforced reciprocal altruism, thereby motivating subjects to resist the temptation to act in their immediate self-interest).

182. Ronald M. Green, *From Genome to Brainome: Charting the Lessons Learned*, *in* NEUROETHICS: DEFINING THE ISSUES IN THEORY, PRACTICE, AND POLICY 105, 114 (Judy Illes ed., 2004).

183. *Id.* at 113.

184. Turhan Canli & Zenab Amin, *Neuroimaging of Emotion and Personality: Scientific Evidence and Ethical Consideration*, 50 BRAIN & COGNITION, 414, 424–26 (2002); Committee on Science and Law, *supra* note 113, at 435; Illes & Racine, *supra* note 166, at 8 tbl.1.

185. Committee on Science and Law, *supra* note 113, at 435.

disease and behavior prediction, neural pathways that are structured or function one way in one individual can produce entirely different outcomes in another. For example, one study noted that while damage to the ventromedial prefrontal region of the brain is associated with acquired sociopathy, it is also true that there are individuals who have all the expected structural characteristics for the disease but who never exhibit it.[186] Thus, "even dramatic cerebral anomalies or idiosyncrasies may not correspond to predictable behaviors, thoughts, or emotions" across individuals.[187]

Barbara Koenig, associate professor of medicine and former executive director of the Stanford Center for Biomedical Ethics, worries in particular about the misuse of such probabilistic information on future disease and behavior. Koenig has said, "[T]he brain offers a seductive promise of prediction. Whether or not those predictions prove to be scientifically accurate may be less important than our belief in their power."[188] As discussed in the congressional debate leading to the enactment of GINA, although predictive testing may be only probabilistic, it may still prove economically efficient from the perspective of an employer to rely on the information in making employment decisions.[189] In pre-employment testing, an employer may not require certainty that an individual will manifest a disease or evidence a harmful trait.[190] Merely probabilistic information is valuable in that it conveys the knowledge that the possession of a particular DNA sequence, or brain function or structure, places the applicant at a higher risk of doing so.[191] When processing large numbers of applicants, an employer can significantly reduce costs by denying employment to those whose test results show them to be at a higher risk for a disease or other detrimental trait.[192]

For example, an employer may be financially incentivized to use neuroimaging correlates of Alzheimer's disease in making its hiring decisions. Aside from the emotional toll that Alzheimer's disease can have on both the patient and caregivers, the disease creates staggering financial burdens. The average lifetime cost of care

186. Green, *supra* note 182, at 114 (discussing the study, Jorge Moll et al., *Morals and the Human Brain: A Working Model*, 14 NEUROREPORT 299, 300 (2003).

187. *Id.* at 109.

188. Hamilton, *supra* note 10.

189. *See* discussion *supra* Part I.B.

190. Green, *supra* note 182, at 113.

191. *Id.*

192. *Id.*

for an individual with the disease is $170,000.[193] Alzheimer's disease costs businesses in the United States $61 billion annually, according to a report commissioned by the Alzheimer's Association.[194] Of that figure, $24.6 billion go toward Alzheimer health care, and $36.5 billion result from lost productivity, absenteeism, and worker replacement.[195] Furthermore, the costs to businesses are only expected to rise: experts project the prevalence of Alzheimer's disease to quadruple by 2050.[196] This means that one in every forty-five Americans will be afflicted with the disease.[197] What if an employer could predict with *some degree* of probability, out of forty-five job applicants, who that one was going to be? As discussed above, this may soon, if not already, be a real possibility. Furthermore, with it now illegal to use genetic testing in this context, neuroimaging may be an attractive alternative for employers.

C. Inadequate Existing Federal Statutory Protections

Just as Congress found there was insufficient existing protection against genetic-information acquisition and misuse pre-GINA,[198] existing federal statutes are inadequate to protect against the acquisition and misuse of neuro information by employers.[199] The insufficient protections afforded to neuro information by Title VII of the Civil Rights Act of 1964 and by Executive Order 13,145 are, again, readily apparent. Title VII is limited to barring discrimination in employment on the basis of race, color, religion, sex, and national origin.[200] Therefore, employees and job applicants can prevail on Title VII claims only if they establish that the employer singled out a specific protected class for neuroimaging.[201] Executive Order 13,145 prohibits federal departments and agencies from taking adverse employment actions based on employees' "protected genetic

193. Richard L. Ernst & Joel W. Hay, *The U.S. Economic and Social Costs of Alzheimer's Disease Revisited*, 84 AM. J. PUB. HEALTH 1261, 1262 (1994).

194. ROSS KOPPEL, ALZHEIMER'S ASS'N, ALZHEIMER'S DISEASE: THE COSTS TO U.S. BUSINESSES IN 2002, at 2 (2002).

195. *Id.*

196. Claudia H. Kawas & Ron Brookmeyer, *Aging and the Public Health Effects of Dementia*, 344 NEW ENGLAND J. MED. 1160, 1160–61 (2001).

197. *Id.*

198. *See* discussion *supra* Part I.C.

199. *See* Tovino, *supra* note 172, at 465–69 (discussing the lack of sufficient protection afforded to neuroimaging information by currently existing federal statutes).

200. 42 U.S.C. § 2000e-2(a) (2006).

201. *See* discussion *supra* Part I.C.

information"[202] and therefore does not even apply to neuro information. Also consistent with the congressional findings in the context of genetic information, the ADA does not protect workers from requirements or requests to provide neuro information to their employers or from an employer purchasing an employee's neuro information from a data bank, once a job offer of employment has been made but before the individual begins work.[203] Worth further inquiry is whether neuro information is protected by the ADA Amendments Act's ("ADAAA")[204] expanded definition of "disability," enacted shortly after the passage of GINA, and whether acquisition of and discrimination based on neuro information is protected by the Federal Employee Polygraph Protection Act of 1988 ("EPPA")[205]—a statute particular to neuroimaging that was not discussed in the debates leading to the enactment of GINA.

The ADAAA was enacted on September 25, 2008, with the purpose of "reinstating a broad scope of protection."[206] The Amendments retained the broad definition of "disability" to include an individual with "a physical or mental impairment that substantially limits one or more major life activities of such individuals" and an individual "being regarded as having such an impairment" and made no explicit mention of neuro information.[207] The ADAAA, however, expanded the definition of "disability" in two ways: (1) by clarifying that the term "major life activities" includes "major bodily functions"; and (2) by lessening what is required to come within the "regarded as" prong.

First, the ADAAA revised the definition of "major life activities" to include "the operation of bodily function, including but not limited to, functions of the immune system, normal cell growth, digestive, bowel, bladder, neurological, brain, respiratory, circulatory, endocrine, and reproductive functions."[208] Previously, the EEOC had

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202. 65 Fed. Reg. 6877, 6878 (Feb. 10, 2000).

203. *See* discussion *supra* Part I.C; *see also* Tovino, *supra* note 172, at 466–67 (discussing how at the "preplacement stage" an employer could require an employee to consent to a "broad-based fMRI screening"). Further, once the applicant is hired, the employer may request medical information, including neuro information, that is considered job related and consistent with business necessity. *Id.* at 467.

204. ADA Amendments Act of 2008, Pub. L. No. 110-325, 122 Stat. 3553 (amending sections of 42 U.S.C.).

205. Federal Employee Polygraph Protection Act ("EPPA") of 1988, Pub. L. No. 100-347, 102 Stat. 646 (codified as amended at 29 U.S.C. §§ 2001–2009 (2006)).

206. ADA Amendments Act § 2(b)(1), 122 Stat. at 3554 (codified at 42 U.S.C. § 12101).

207. § 4(a), 122 Stat. at 3555 (codified at 42 U.S.C. § 12102(1)).

208. § 4(a), 122 Stat. at 3555 (codified at 42 U.S.C. § 12102(2)(B)).

taken the position that "major life activities" included only "basic activities" such as walking, speaking, communicating, and working.[209] Thus, under the amended definition, an individual will now be considered to have a "disability" if he or she currently has an impairment that substantially limits major bodily functions, regardless of whether the impairment would substantially limit what one generally considers day-to-day activities. To determine whether this new addition to the definition of "major life activities" would cover neural correlates that predict future onset of disease, a further inquiry must be made into the ADAAA's meaning of "substantially limits."

The ADAAA expressly rejected the strict standard previously enunciated by the Supreme Court in *Toyota Motor Manufacturing, Kentucky, Inc. v. Williams*,[210] that to be substantially limited in performing a major life activity under the ADA, "an individual must have an impairment that prevents or severely restricts the individual from doing activities that are of central importance to most people's daily lives."[211] While in rejecting this standard the statute might provide some guidance in determining whether an impairment substantially limits what the EEOC traditionally considered to be "major life activities," it provides little help in determining whether an impairment limits major bodily functions. In fact, neither the text of the ADAAA nor the recently enacted EEOC regulations clarify exactly what it means to substantially limit major bodily function. The new EEOC regulations do, however, provide a list of illustrative examples that seem to suggest that neural correlates for disease in asymptomatic individuals would not be considered an impairment substantially limiting brain or neurological function. In describing impairments that substantially limit brain and neurological function, the EEOC exclusively lists conditions that are currently manifested and diagnosable.[212] For instance, the EEOC states that cerebral palsy, autism, bipolar disorder, obsessive-compulsive disorder, and schizophrenia substantially limit brain function.[213] Similarly, the EEOC regulations state that muscular dystrophy and epilepsy substantially limit neurological function.[214] Thus, while the ADAAA

209. U.S. EQUAL EMP'T OPPORTUNITY COMM'N, COMPLIANCE MANUAL § 902 (1995).

210. 534 U.S. 184 (2002).

211. ADA Amendments Act § 2(b)(4), 122 Stat. at 3554 (codified at 42 U.S.C. § 12,101(b)(4)).

212. *See* 29 C.F.R. § 1630.2(j) (2011) (listing conditions that would be considered to substantially limit major bodily function).

213. 29 C.F.R. § 1630.2(j).

214. *Id.*

clearly protects employees once they have developed a neurological or psychological condition, it fails to address whether an employee's neuro information, which indicates the likelihood of developing a future condition, can constitute an impairment that substantially limits one or more major life activities.

Second, the ADAAA clarified that an individual is "regarded as having such an impairment" if the individual has been subjected to adverse employment action "because of an actual or perceived physical or mental impairment whether or not the impairment limits or is perceived to limit a major life activity."[215] In doing so, the ADAAA expressly rejected the Supreme Court's more burdensome reasoning in *Sutton v. United Air Lines, Inc.*,[216] that to come within the "regarded as" prong, an employer "must believe either that one has a substantially limiting impairment that one does not have or that one has a substantially limiting impairment when, in fact, the impairment is not so limiting."[217] However, it is still unclear whether an employee fired for a not-yet-manifested condition could claim that the employer perceived him or her as having an impairment. The new standard still appears to require that the employer perceived the individual as *currently* having an impairment, regardless of whether or not the individual actually has the impairment, and regardless of whether or not the impairment limits or is perceived by the employer as limiting a major life activity. Therefore, for the time being, it seems that an employer that takes adverse employment action against an individual due to neuro information indicating propensity to manifest an impairment in the future would not be considered to be perceiving the individual as currently having an impairment. Furthermore, the likely protection provided for by the statute in the context of predictive neuroimaging is even less promising than it was in the context of genetic testing. Unlike for genetic information, the EEOC has not supported the position that the ADA "regarded as" prong protects individuals with neural correlates for illness, disease, or disorders from discrimination in employment. Overall, even though the ADAAA was enacted to provide a broader scope of protection, it still would not sufficiently prohibit employers from using neuro information to

215. ADA Amendments Act § 4(a), 122 Stat. at 3555 (codified at 42 U.S.C. § 12,102).

216. 527 U.S. 471 (1991).

217. *See* ADA Amendments Act § 2(b)(3), 122 Stat. at 3554 (codified at 42 U.S.C. 12101) (rejecting the Court's reasoning in *Sutton*, in favor of a more broad view with regards to coverage under the third prong of the definition of disability).

predict the future health of job applicants and to discriminate on that basis.

An additional source of protection that must be considered in conjunction with neuroimaging is EPPA.[218] EPPA prohibits private employers from directly or indirectly requiring or requesting that employees or job applicants submit to any lie detector test.[219] In addition, covered employers cannot accept or use the results of such a test nor can they take any adverse employment action against an employee or applicant for refusal to take such a test or on the basis of such test results.[220] The statute also restricts who can disclose information obtained from a lie detector test.[221]

EPPA defines the term "lie detector" broadly to include "a polygraph, deceptograph, voice stress analyzer, psychological stress evaluator, or *any other similar device* (whether mechanical or electrical) that is used, or the results of which are used, for the purpose of rendering a diagnostic opinion regarding the honesty or dishonesty of an individual."[222] Numerous studies have demonstrated that neuroimaging is capable of detecting deception, and, in fact, several companies are currently marketing their neuroimaging lie detection services directly to employers for such purposes.[223] Presumably, neuroimaging would come within the "any other similar device" prong of the statute's definition of "lie detector" if the exam or results were used for detecting honesty or dishonesty. Therefore, for the moment, it seems that EPPA could be interpreted to prohibit covered employers from requiring neuroimaging examinations to form the basis of an opinion regarding an individual's dishonesty and from

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218. Federal Employee Polygraph Protection Act ("EPPA") of 1988, Pub. L. No. 100-347, 102 Stat. 646 (codified as amended at 29 U.S.C. §§ 2001–2009 (2006)).

219. 29 U.S.C. § 2002.

220. *Id.*

221. 29 U.S.C. § 2008. Such information may be disclosed by an examiner only to: the examinee or a person designated by him or her; the employer that requested the test; or any court, governmental agency, arbiter, or mediator in accordance with a court order requiring the production of such information. *Id.* The employer who requested the test may disclose its results only to the employee or to a government agency, but only insofar as the information is an admission of criminal conduct. *Id.*

222. 29 U.S.C. § 2001(3) (emphasis added).

223. *See* SAGE CTR. FOR THE STUDY OF THE MIND, *supra* note 163, at 13–23 (discussing numerous peer-reviewed studies on the use of neuroimaging to detect deception); *Customers-Corporations*, NO LIE MRI, http://noliemri.com/customers/GroupOrCorporate.htm (last visited Jan. 26, 2012) (discussing how No Lie MRI could be used by corporations as a substitute for drug screenings, resume validations, and security background checks, leading to a streamlined hiring process and a more honest employee base).

using such results to take adverse employment action.[224] However, neuroimaging would not come within the definition of "lie detector" if the exam or results were used for nondeception reasons, such as to form a conclusion about future propensity to disease.[225] Thus, EPPA would still not provide any limitation on an employer requesting an employee or applicant to submit to neuroimaging exams for such nondeception reasons or any limitation on the employer using the results of such nondeception neuroimaging exams in making employment decisions.

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224. Tovino, *supra* note 172, at 468; *see also* Committee on Science and Law, *supra* note 113, at 414–15 (submitting that various forms of brain imaging would likely constitute a lie detector under EPPA if used to detect honesty or dishonesty). *But see Customers—Corporations*, NO LIE MRI, http://noliemri.com/customers/GroupOrCorporate.htm (last visited Jan. 26, 2012) (stating that No Lie MRI is "unaware of any law that would prohibit its use for employment screening"). The company implies that EPPA only "prohibits truth verification/lie detection testing for employees that is based on measuring the autonomic nervous system (e.g. polygraph testing)," and since MRI "measures the central nervous system directly," it is "not subject to restriction by these laws." *Id.* Furthermore, the court in *Veazey v. Communications & Cable of Chicago, Inc.* stated that in order to understand and interpret EPPA, it is helpful to consider the history of the lie detector and its impact on employees. 194 F.3d 850, 855 (7th Cir. 1999). Congress enacted EPPA in 1988 in response to concerns that employers were often misusing lie detectors or their derivatives and were too frequently relying on inaccurate, inconclusive, or unfounded lie detector results to make employment decisions. *Id.* at 858 (citing S. REP. NO. 100-284, at 46 (1988), *reprinted in* 1988 U.S.C.C.A.N. 726, 734). In passing the statute, Congress considered many studies about the reliability of polygraph techniques and the efficacy of countermeasures taken by the examinee deliberately to obscure accurate readings with several studies showing accuracy rates of sixty percent and below. *Id.* at 855–58 (discussing multiple studies); *see, e.g.*, J. KUBIS, U.S. ARMY LAND WARFARE LAB., TECH. REPORT NO. LWL-CR-03B70, COMPARISON OF VOICE ANALYSIS AND POLYGRAPH AS LIE DETECTING PROCEDURE (1973) (finding accuracy rates of below sixty percent); Gordon H. Barland & David C. Raskin, *An Evaluation of Field Techniques in Detection of Deception*, 12 PSYCHOPHYSIOLOGY 321, 321 (1975) (noting an error rate of fifty-five percent). Therefore, it is unclear under this reasoning whether neuroimaging technology that detects lies with greater accuracy would be covered by the statute.

225. A more complex question is whether EPPA would protect against an employee's neuro information regarding his *ability or propensity* to deceive. In fact, a recent study indicates that fMRI may be used to show an individual's ability to deceive intentionally by having the test subject respond truthfully or falsely to a series of yes/no questions regarding autobiographical information. Jennifer M. Nunez et al., *Intentional False Responding Share Neural Substrates with Response Conflict and Cognitive Control*, 25 NEUROIMAGE 267–77 (2005). It is unclear whether this kind of neuro information would be protected under EPPA, because the test indicates an individual's *propensity or ability* to deceive as a personality or behavioral characteristic—not whether they are or are not telling the truth in response to a specific question or set of questions.

III. ADDITIONAL CONSIDERATIONS RELEVANT TO NEUROSCIENCE-BASED DISCRIMINATION: NEUROENHANCEMENT

The predictive ability of brain scanning is not the only neurotechnology that raises issues of employment discrimination. Drug companies are pushing ahead with neuropharmaceuticals, which are able to manipulate a person's strength, memory, ability to concentrate, and capacity to learn above "normal." Once these drugs are available, the pressures of the marketplace—not to mention potential military uses—may compel society to embrace them to remain competitive.[226] In fact, considering the financial appeal that these drugs may have to employers by way of increasing employee alertness and improving cognitive performance and productivity, employers may wish to discriminate against applicants and employees based on the use or nonuse of neuroenhancements.

Attempts by human beings to use chemical substances to alter normal affective and cognitive traits are as old as drinking coffee or alcohol.[227] Until recently, however, pharmaceutical options had either limited effectiveness or significant risks of addiction and side effects that limited their attractiveness and ability to be extensively used as an employment discrimination technique.[228] This situation is changing. Several neuropharmaceuticals for cognitive enhancement have already been approved by the Food and Drug Administration ("FDA") and are being utilized by the military, long-distance business travelers, and ambitious entrepreneurs. The Defense Advanced Research Projects Agency ("DARPA"), the central research and development organization for the Department of Defense, has invested millions of dollars through its Preventing Sleep Deprivation program in developing neuropharmaceuticals that could act as a human enhancement drug in minimizing sleep while also retaining cognitive capacity.[229] In its own words, DARPA "is investigating ways to prevent fatigue and enable soldiers to stay awake, alert, and effective for up to seven days straight without suffering any deleterious mental or

226. Anjan Chatterjee, *The Promise and Predicament of Cosmetic Neurology*, 32 J. MED. ETHICS 110, 111 (2006).

227. Martha J. Farah & Paul Root Wolpe, *Monitoring and Manipulating Brain Function: New Neuroscience Technologies and Their Ethical Implications*, 34 HASTINGS CTR. REP., May–June 2004, at 35, 41.

228. *Id.*

229. MORENO, *supra* note 114, at 116–18.

physical effects and without using any of the current generation of stimulants."[230]

One drug that has shown promise in accomplishing this goal is modafinil. Modafinil, marketed as Provigil®, was developed by a French firm to fight narcolepsy and sold to U.S. drugmaker Cephalon.[231] The French Foreign Legion used the drug in Gulf War I, and unconfirmed news sources report that coalition troops used the substance during the drive to Baghdad in early 2003.[232] Rather than stimulating the entire central nervous system like an amphetamine would, modafinil "nudges the brain toward wakefulness through specific pathways."[233] The compound can therefore keep users awake for two or three days with negligible side effects and little risk of addiction.[234]

Other than soldiers and individuals suffering from neurological disorders, modafinil has received attention from long-distance business travelers and is expected by many to be the next craze on college campuses, replacing stimulants such as Ritalin.[235] In fact, the drug has already been referred to as the "entrepreneur's drug of choice" around Silicon Valley, where some executives say they use it regularly to work twenty-hour days.[236] Although a prescription is needed for the drug, it may be easier to get from a doctor than one may think. Modafinil is approved in the United States to treat several neurological disorders, but also to treat "shift work sleep disorder."[237] Shift work sleep disorder is generously described as sleepiness during

230. Jonathan Moreno, *DARPA On Your Mind*, 6 CEREBRUM 92, 94 (2004).

231. Richard Martin, *It's Wake-Up Time*, WIRED, Nov. 2003, http://www.wired.com/wired/archive/11.11/sleep.html.

232. MORENO, *supra* note 114, at 115; Martin, *supra* note 231.

233. MORENO, *supra* note 114, at 115.

234. Scott Grady et al., *Effect of Modafinil on Impairments in Neurobehavioral Performance and Learning Associated with Extended Wakefulness and Circadian Misalignment*, 35 NEUROPSYCHOPHARMACOLOGY 1910, 1910 (2010).

235. MORENO, *supra* note 114, at 115.

236. Michael Arrington, *How Many Silicon Valley Startup Executives Are Hopped up on Provigil?* TECH CRUNCH (July 15, 2008), http://techcrunch.com/2008/07/15/how-many-of-our-startup-executives-are-hopped-up-on-provigil/. Also, famous American basketball player Diana Taurasi was temporarily suspended by the Turkish Basketball Federation after she tested positive for the drug during a routine screening. *Taurasi Cleared of Drug Accusation*, N.Y. TIMES, Feb. 16, 2011. The lab that conducted the positive test later retracted its report after it evaluated Taurasi's statements in her defense, repeatedly denying using performance-enhancing drugs. *Id.*

237. PROVIGIL, http://www.provigil.com/ (last visited Feb. 1, 2012).

scheduled waking hours for those who work at night or on rotating shifts.[238]

Several studies on the effectiveness of modafinil have even focused on its utility to healthy employees by replicating the circumstances of shift workers and measuring cognitive performance. Cephalon and the Air Force Office of Scientific Research sponsored a study in which sixteen healthy subjects were deprived of sleep for twenty-eight hours and then allowed to sleep from 11 a.m. to 7 p.m. for four days and to stay awake at night.[239] The study found that the subjects on modafinil did far better on cognitive tests than those given a placebo.[240] Similar studies have also shown modafinil to be more effective than caffeine or amphetamines in mitigating adverse effects on performance or safety associated with prolonged wakefulness, and without any of the adverse side effects.[241] For example, one recent study showed that treatment with modafinil significantly attenuated the performance decrements for cognitive throughput, visual attention, and reaction times and led to fewer bouts of inadvertent sleep during scheduled waking.[242] The study concluded that these features "suggest that modafinil might be a particularly relevant countermeasure against the deleterious effects of prolonged work hours, shift work, and transmeridian travel."[243]

DARPA has also been investigating the potential of another class of drugs: ampakines.[244] Ampakines have shown clinical promise in treating dementia and symptoms of schizophrenia by improving cognition when used with antipsychotic medications.[245] Thus, while modafinil is attractive for its enhancement potential as an antisleep agent, ampakines are desirable for their potential to improve cognitive abilities above what are typically thought of as normal. Ampakines work by binding to AMPA-type glutamate receptors in the brain.[246]

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238. *Id.*

239. MORENO, *supra* note 114, at 116.

240. *Id.*

241. Grady et al., *supra* note 234, at 1916–18.

242. *Id.* at 1915–18.

243. *Id.* at 1915–16; *see also* James K. Walsh et al., *Modafinil Improves Alertness, Vigilance, and Executive Function During Simulated Night Shifts*, 27 SLEEP 434, 434 (2004) ("The physiologic sleepiness and neurobehavioral deficits that occurred during the hours of a typical night shift were clearly attenuated by modafinil.").

244. MORENO, *supra* note 114, at 118.

245. *Id.*

246. Julia Boyle et al., *Acute Sleep Deprivation: The Effects of the AMPAKINE Compound CX717 on Human Cognitive Performance, Alertness and Recovery Sleep*, J. PSYCHOPHARMACOLOGY, Sept. 2011, at 1.

This binding boosts the activity of glutamate, a neurotransmitter, and improves the brain's ability to encode memory and to learn.[247] Because of their short half-life of only a few hours, ampakines have few side effects.[248] Thus, these agents can selectively increase cerebral activation without the deleterious effects of excessive arousal that may impair performance.[249] A DARPA-funded study at Wake Forest University School of Medicine has shown that a single dose of CX717, a type of ampakine, completely reversed deficits in performance accuracy and reaction time associated with sleep deprivation in monkeys.[250] In addition, specific changes in the electrical activity of the brain that occurred after sleep deprivation returned to the non-sleep-deprived state in the CX717 group of monkeys.[251] Even more exciting, a recent human trial sponsored by Cortex Pharmaceuticals found that when taken by sixteen healthy men deprived of sleep, the compound improved their performance on memory and attention tests with minimal side effects.[252]

IV. NEURO INFORMATION NONDISCRIMINATION ACT

Although neuroscientists and ethicists have begun to confer about the emerging ethical and legal issues stemming from the advancement in neuroscience research, there has been nothing comparable to the ELSI initiative in the field.[253] This is important because ELSI played a pivotal role in the enactment of GINA by developing a series of recommendations that served as a model for the future workplace legislation.[254] ELSI also paved the way for hundreds of articles, books, conferences, and other research and educational activities that made the public aware of the implications of genetics

247. *Id.* at 1.

248. Allison Motluk, *New Drug Offers Jitter-Free Mental Boost*, NEW SCIENTIST, May 5, 2005, http://www.newscientist.com/article/dn7342-new-drug-offers-jitterfree-mental-boost.html.

249. *Id.*

250. *DARPA Extends Research Funding for the Prevention of Sleep Deprivation, Which Includes AMPAKINE Technology*, BUSINESS WIRE, June 8, 2004, *available at* http://www.businesswire.com/news/home/20040608005212/en/DARPA-Extends-Research-Funding-Prevention-Sleep-Deprivation.

251. *Id.*

252. Boyle et al., *supra* note 246, at 10.

253. Green, *supra* note 182, at 105.

254. *Workplace Hearings*, *supra* note 43 (statement of Francis S. Collins, Dir., Nat'l Human Genome Res. Inst., Nat'l Insts. of Health).

and that gave the issue political clout.[255] Unlike the HGP, which devoted three to five percent of its budget to the ethical, legal, and social implications of such research initiatives, neither the Human Brain Project nor the Human Connectome Project created such government funding appropriation.[256] Why is this so? Some believe that it reflects a lesser degree of government involvement in neuroscience or fewer public fears about the misuses of neuroscience research.[257] Whatever the explanation, this departure is not justified. As this Note argues, developments in neuroscience are just as likely to have significant effects on ethics, law, and society as those in genetics,[258] especially in the realm of employment discrimination. Therefore, federal legislation entitled the Neuro Information Nondiscrimination Act ("NINA") should be considered to prohibit employers from (1) requesting, acquiring, or disclosing neuro information and from discriminating on the basis of neuro information, and (2) requesting or requiring that applicants or employees engage in neuroenhancement and from directly or indirectly discriminating on the basis of the use or nonuse of neuroenhancement techniques.

A. Title I: Neuro Information, Employer Acquisition, and Discrimination

Given that brain images, like genetic information, are expected to predict susceptibility to disease, parallel concerns arise about ensuring that such information is not relied on to unjustly deny employment. Neuroimaging is already capable of predicting disease and behavior on a small scale. In a few years, with discoveries from the Human Connectome Project and the 1000 Functional Connectomes Project, such predictions will be possible on a large scale.

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255. *See* Greely, *supra* note 43, at 604, 623–33 (discussing how the ELSI program led to extensive educational activities on the implications of genetics and how there was a need for "political cover" on the issues involved).

256. Committee on Science and Law, *supra* note 113, at 427.

257. Green, *supra* note 182, at 105; *see also* Greely, *supra* note 43, at 632–36 (discussing how ELSI was a "product of three factors: a major scientific initiative funded by federal agencies, the ready availability of money to spend on ethics, and a need for political cover" and how the field of neuroscience lacks these factors).

258. *See also* Hamilton, *supra* note 10 (quoting Judy Illes et al., *From Neuroimaging to Neuroethics*, 6 NATURE NEUROSCIENCE 203, 205 (2003) ("Our analysis shows a steady expansion of studies with evident social and policy implications, including studies of human cooperation and competition, brain differences in violent people and genetic influences on brain structure and function.")).

Nevertheless, despite the advancements in the field, there is, and surely will remain in the foreseeable future, a gap between the scientific knowledge needed to identify existing brain structures and functioning and the understanding of their corresponding implications for an individual's health and behaviors. Further, the brain image itself represents unparalleled complexity attributable to the specialized equipment, statistical thresholds, and expertise required for interpretation. These limitations in the science and technology will lead to neuroimaging results in one individual producing entirely different outcomes in another. However, as illustrated in the context of genetic information, these technical deficiencies will not deter employers from finding it economically efficient to acquire such information and to rely on it in making employment decisions. Since such predispositional decisionmaking violates society's beliefs in merit-based advancement, Title I of NINA should mirror Title II of GINA in preventing the acquisition and misuse of neuro information by employers.

Many argue, however, that the legal implications of neuroimaging may be less extensive than those for genetics because of the difference in accessibility of information between the two fields.[259] With genetics, an individual's complete genome is present in practically every cell in the body.[260] Since people potentially leave some of their DNA almost everywhere they go, it is relatively easy for a person—or employer—to obtain a sample of DNA from another person without his or her knowledge or consent.[261] Furthermore, this DNA sample is easily convertible into an extraordinary amount of genetic information—technologies such as polymerase chain reaction make it possible to amplify even the smallest traces of DNA.[262] Companies have offered genetic tests directly to consumers for years at low prices.[263] Many have been "hawking tests on the Internet," and some companies, such as Pathway Genomics, have even attempted to sell genetic testing devices at Walgreens alongside toothpaste and deodorant.[264]

259. Green, *supra* note 182, at 107–08.

260. *Id.* at 107.

261. *Id.* at 107–08.

262. *Id.*

263. *Id.*

264. Rob Stein, *Company Plans to Sell Genetic Testing Kit at Drug Stores*, WASH. POST, May 11, 2010, at A1.

While it is true that such ease of unconsented access to neuro information does not currently exist, technologies are being developed to overcome such access limitations in the future.[265] More importantly, however, the main concern of Congress in enacting GINA was not that employers would test employees without their knowledge, but that employers could request or require genetic information from applicants and employees or obtain the genetic information from research databases.[266] This concern is equally present in the context of neuro information.

As the price of neurotechnologies continues to decline, the concern that employers may require that applicants or employees undergo neuroimaging is likely to materialize. One company currently markets its fMRI brain-scanning services directly to employers at thirty dollars per minute, noting that such "scans may not be prohibitively expensive for all employers, especially those who hire well-paid professional or executive personnel."[267] Furthermore, neuroimaging research databases are especially susceptible to employer misuse. Scientists routinely strip neuroimaging data of direct identifiers, such as names and birth dates, to render the data not identifiable prior to data sharing.[268] Although these types of confidentiality measures may be sufficient in the realm of genetic information, rendering data not identifiable is further complicated in the neuroimaging context because of the existence of computer

265. Researchers are currently working on technologies to remotely detect brain activity, creating the potential in the future for an individual's brain to be scanned without them consenting or having any knowledge. Nita Farahany, *The Government Is Trying to Wrap Its Mind Around Yours*, WASH. POST, Apr. 13, 2008, at B3; *see also* C.J. Harland et al., *Electric Potential Probes—New Directions in the Remote Sensing of the Human Body*, 13 MEASUREMENT SCI. & TECH. 163, 163 (2002) (reporting on the use of technology to measure the heart at great distances); C.J. Harland et al., *Remote Detection of Human Electroencephalograms Using Ultrahigh Input Impedance Electric Potential Sensors*, 81 APPLIED PHYSICS LETTERS 3284, 3286 (2002) (showing that it is possible to detect brain electrical activity with a three-millimeter air gap between the scalp and the sensor); Yu M. Chi, *Non-Contact Low Power EEG/ECG Electrode for High Density Wearable Biopotential Sensor Networks* 246–250 (Sixth International Workshop on Wearable and Implantable Body Sensor Networks, 2009) (reporting that it is possible to detect brain electrical activity with a three-millimeter air gap between the scalp hair and the sensor); Yu M. Chi & Gert Cauwenberghs, *Wireless Non-Contact EEG/ECG Electrodes for Body Sensor Networks* 297–301 (International Conference on Body Sensor Networks, 2010) (same); R.J. Prance et al., *Biological and Medical Applications of a New Electric Field Sensor* 3–4 (Proceedings of the ESA Annual Meeting on Electrostatics, Paper N2, 2008) (reporting on the use of technology to measure the heart at great distances).

266. *See* discussion *supra* Part I.C.

267. Tovino, *supra* note 172, at 465 (citing e-mails from Joel Huzzeniga, CEO, No Lie MRI, to author (May 17, 2006, 05:56 CST; May 23, 2006, 12:36 CST) (on file with author Torvino)).

268. Tovino, *supra* note 172, at 447.

software capable of generating images of a subject's cranio-facial features from raw neuroimaging data.[269] Indeed, based on various features of neuroimages, an individual's face can be reconstructed under certain conditions, thereby providing material for the reidentification of test subjects.[270]

Others contend that while legislation may at some point be required to protect employees' neuro information, the science and technology are not advanced enough yet to require enacting it now.[271] However, a lesson should be gleaned from the *thirteen-year* legislative battle faced by GINA. Senator Olympia Snowe, cosponsor of the original bill to prohibit genetic discrimination, observed at the time the bill was first introduced that "the completion of the human genome seem[ed] far away."[272] But, due to the lengthy congressional debates and timeliness of the bureaucratic process, the science ended up outpacing congressional action.[273] In the time it might take for congressional action to catch up with neuroscience, the harsh reality is that people will suffer from inadequate legal protections.[274] Society "can't afford to take one step forward in science but two steps back in civil rights."[275] Therefore, it is important to "grapple" with this issue now by enacting forward-looking legislation before the science and technology reach their full predictive potential and become part of everyday life.[276] As Senator James Jeffords championed in the context of GINA, Congress should "take that rare opportunity to be ahead of the curve and enact legislation to preempt discriminatory practices and prevent them from ever happening."[277]

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269. *Id.*

270. Arthur W. Toga, *Neuroimage Databases: The Good, the Bad and the Ugly*, 3 NATURE REVIEWS NEUROSCIENCE 302, 307–08 (2002).

271. *See* Yarkoni, *supra* note 134, at 494 box 3 (discussing how it could be more than a decade before a fully automated quantitative brain map is clinically available).

272. Nuffort, *supra* note 11, at 10 (statement of Sen. Olympia Snowe).

273. *Id.*

274. NAT'L P'SHIP FOR WOMEN & FAMILIES, FACES OF GENETIC DISCRIMINATION: HOW GENETIC DISCRIMINATION AFFECTS REAL PEOPLE 2 (2004) [hereinafter FACES], *available at* http://www.nationalpartnership.org/site/DocServer/FacesofGeneticDiscrimination.pdf?docID=971 (quoting Sen. Thomas A. Daschle).

275. *Id.*

276. *See* Hamilton, *supra* note 10 (noting that it is important to somehow "grapple" with these concerns now before the technologies become part of daily life); *see also* Jessica L. Roberts, *Preempting Discrimination: Lessons from the Genetic Information Nondiscrimination Act*, 63 VAND. L. REV. 439, 462 (2010) (discussing how GINA was enacted preemptively, with little evidence indicating that there was actual discrimination taking place on a large scale at the time).

277. Roberts, *supra* note 276, at 470.

Consequently, despite differences in ease of access and in the developmental stage of the underlying technologies, Title I of NINA should parallel GINA Title II and prohibit employers from: (1) requiring or requesting that employees or potential employees take a neuroimaging test or provide neuro information as a condition of employment; (2) using neuro information to discriminate against, limit, segregate, or classify employees in a way that would deprive them of employment opportunities; and (3) disclosing the neuro information of employees after coming into possession of it.

B. Title II: Neuroenhancement and Employment Discrimination

GINA did not address the issue of genetic enhancement, most likely because the methods of genetic enhancement are experimental, are not FDA approved, and are prohibitively expensive.[278] In contrast, in terms of the race toward enhancement, neuroscience is already more advanced than genetics.[279] Therefore, in order for federal legislation to expansively prohibit employment discrimination on the basis of neuroscience-based technology, it must incorporate an additional section, not provided for in GINA, regarding explicit and implicit discrimination on the basis of neuroenhancment.

NINA Title II should generally prohibit employers from requesting or requiring that applicants and employees use neuroenhancement techniques and from making employment decisions based on such use or nonuse. Soldiers in the United States have long been offered stimulant medication to enhance alertness, including modafinil,[280] and are legally required to take medications if ordered for the sake of their military performance.[281] Military

278. There are some ways available to genetically enhance humans, for example, through gene therapy and prenatal diagnosis. In gene therapy, one gene is inserted into a genome to replace another gene. U.S. Dep't of Energy Office of Sci., *Gene Therapy*, HUMAN GENOME PROJECT INFORMATION, http://www.ornl.gov/sci/techresources/Human_Genome/medicine/genetherapy.shtml (last modified Aug. 24, 2011). Current gene therapy is experimental and has not proven very successful in clinical trials. *Id.* The FDA has not yet approved any human gene therapy product for sale. *Id.* Amniocentesis and preimplantation genetic diagnosis were originally developed to detect serious genetic or chromosomal disorders. Green, *supra* note 182, at 107. Some predict that as our ability to identify genetic bases of phenotypical traits grows, we may eventually see parental requests to move in the direction of enhancement based on qualities such as intelligence, height, and eye color. *Id.*

279. *See* Green, *supra* note 182, at 107; discussion *supra* Part III (discussing the currently available and utilized neuropharmaceuticals).

280. MORENO, *supra* note 114, at 114–16.

281. Henry Greely et al., *Towards Responsible Use of Cognitive-Enhancing Drugs by the Healthy*, 456 NATURE 702, 703 (2008).

physicians, citing the dangers of sleep-restricted environments, claim an obligation to "help healthy individuals optimize their cognitive potential."[282] Presumably, the government has determined that the safety benefits that the drug creates for the soldiers and those in proximity to the soldiers in the context of serious military operations outweigh any adverse side effects.[283] As Henry Greely, director of Stanford's Center for Law and the Biosciences, points out, "For similar reasons, namely the safety of the individual in question and others who depend on that individual in dangerous situations, one could imagine other occupations for which enhancement might be justifiably required."[284] Appropriate policy in NINA should accord to Greely's directive and generally prohibit employers from requesting or requiring employees to use neuroenhancement techniques, but should allow for exceptions in specific circumstances where—due to the specific occupation, the substantial gains in safety, and the safety of the enhancement to its user—such enhancement is in society's best interest.

Title II should also prohibit employers from indirectly discriminating against applicants and employees on the basis of use or nonuse of neuroenhancements. This issue is more "complex in that it pits the rights of some potential employees to choose to enhance against the rights of others to be free from the [implicit] coercive pressure to enhance."[285] For example, if some commercial airline pilots choose to engage in neuroenhancement and score higher on an employer-administered performance-based test than those who choose not to enhance, should an employer be prohibited from making employment decisions based on the results of the test? Federal legislation should aim at preserving this freedom of choice and allowing employers to make employment decisions on the basis of performance, but also should prevent employers from using the results of performance-based tests as a pretext for discrimination. Consideration should be given to the degree of enhancement, the correlated ability for the performance-based test to detect the enhancement, and the intent of the employer in administering such a test.

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282. Michael Russo et al., Letter to the Editor, *Cosmetic Neurology: The Controversy Over Enhancing Movement, Mentation, and Mood*, 64 NEUROLOGY 1320, 1321 (2005).

283. Greely et al., *supra* note 281, at 703.

284. *Id.*

285. J.M. Appell, *When the Boss Turns Pusher: A Proposal for Employee Protections in the Age of Cosmetic Neurology*, 34 J. MED. ETHICS 616, 617 (2008).

CONCLUSION

Thomas Jefferson, one of this country's foremost political and scientific leaders, wrote, "[L]aws and institutions must go hand in hand with progress of the human mind. As . . . new discoveries are made [and] new truths disclosed . . . institutions must advance also, and keep pace with the times."[286] Brain information, like genetic information, has the potential to yield great benefits as well as great dangers. Due to the probabilistic predictive quality of both types of data, concerns arise about ensuring that such information is not used to unjustly deny employment. Furthermore, advancements in neuropharmaceuticals create new risks of discrimination based on the use or nonuse of enhancement techniques. GINA-like federal legislation is essential to dispel such concerns and to protect applicants and employees from neuroscience-based discrimination in the workplace.

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286. FACES, *supra* note 274, at 2.

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