

NEUROENHANCEMENT, ETHICS, & FUTURE OF DISABILITY LAW

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Introduction

The current wave of neurotechnological innovation, catalyzed in part by federal funding of neuroscience research through the Brain Research through Advancing Innovative Neurotechnologies² (“BRAIN”) Initiative in 2013, calls for further examination of the legal and ethical considerations surrounding its use. This includes technologies that link directly with the human nervous system for diagnostic, therapeutic, research, or lifestyle purposes.³ These neurotechnologies have a variety of applications, ranging from restoration to enhancement, each with varying levels of ethical concern.

Neurotechnologies that aim to restore and enhance human capabilities will likely disrupt the current legislative framework surrounding disability law. It is necessary to anticipate ethical considerations early in the neurotechnology development process and mitigate potential pitfalls and gaps in current legislation before harm results. Thus, it is vital to take a proactive approach and allow ethical inquiries to guide law and policy while these technologies are in development, rather than after the products are available on the market.

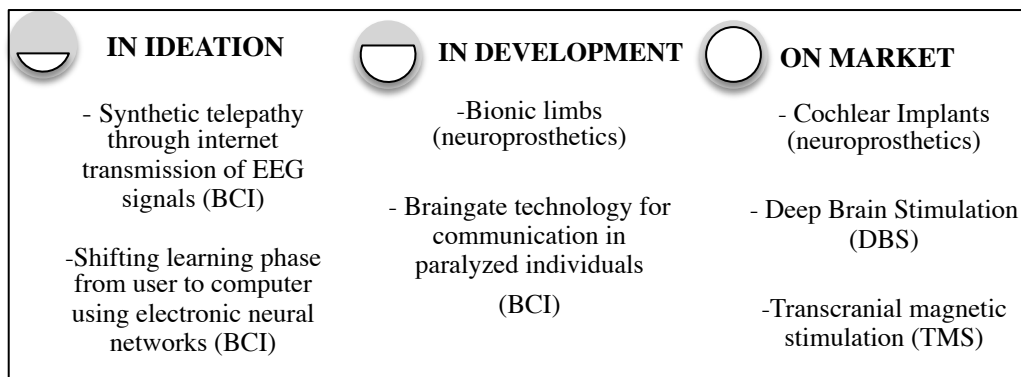
The Growing Field Of Neurotechnology

The current wave of neurotechnological innovation suggests that the United States is experiencing the beginnings of a global “revolution in neuroscience.”⁴ With growing federal funding for neuroscience research, rising venture capital investment in neurotechnology, and vast developments in the field of neurotechnology that allow us to monitor, restore, and enhance human function, it is likely that neurotechnology will soon

have disruptive social, political, and economic consequences on American society. While most neurotechnologies are still in their infancy, their future applications hold great promise, as well as great concern, for the future.⁵

Neurotechnologies, such as transcranial magnetic stimulation (“TMS”), deep brain stimulation (“DBS”), neuroprosthetics, and brain-computer interface (“BCI”) technology, currently exist on a wide spectrum of development, ranging from early phase research and clinical trials to Food and Drug Administration (“FDA”) approval and market availability, as demonstrated in Figure 1 below.⁶

Figure 1. Neurotechnology’s Spectrum of Development



The Brain Initiative & Gray Matters

In 2013, the Obama Administration proposed a \$100 million initiative to map the human brain and develop new neuroscience technologies through the BRAIN Initiative.⁷ This initiative seeks to revolutionize our understanding of the brain and develop new ways to treat, cure, and prevent brain disorders such as epilepsy, Alzheimer’s disease, and traumatic brain injury.⁸ Recognizing that novel research often raises new ethical challenges, the BRAIN Initiative pledged to adhere to high ethical standards for its research initiatives.⁹ In anticipation of social concerns in the wake of neuroscientific advancements, President Obama called upon the Bioethics Commission, an executive

advisory panel focusing on medicine, science, ethics, religion, law, and engineering, to consider the ethical and social issues surrounding neuroscience in July 2013 as part of the BRAIN Initiative.¹⁰ To that end, the Bioethics Commission released Volume I of “Gray Matters: Integrated Approaches for Neuroscience, Ethics, and Technology” (“the Report”) in May 2014, which provides a broad overview of the ethical issues surrounding neuroscience and stresses the importance of integrating ethics into research from the earliest planning phases.¹¹ The Report also provides a cursory overview of some ethical considerations surrounding neuroscience, including privacy, cognitive enhancement and justice, and the ethically problematic history of psychosurgery.¹²

The Report leaves much to be desired, however, when it comes to practical application of ethical approaches.¹³ In the Hastings Center Report, bioethicist Ronald Green argues that even as a preliminary proposal, “the recommendations in Gray Matters do not go far enough.”¹⁴ Green calls for the formation of a full ethical, legal, and social implications (“ELSI”) initiative for neuroethics to create a more innovative and comprehensive body of ethical recommendations to support far-ranging research.¹⁵ Nevertheless, the Bioethics Commission is expected to expand its analysis beyond research and will consider the ethical and societal implications of neuroscience applications more broadly in the forthcoming installment of “Gray Matters.”¹⁶

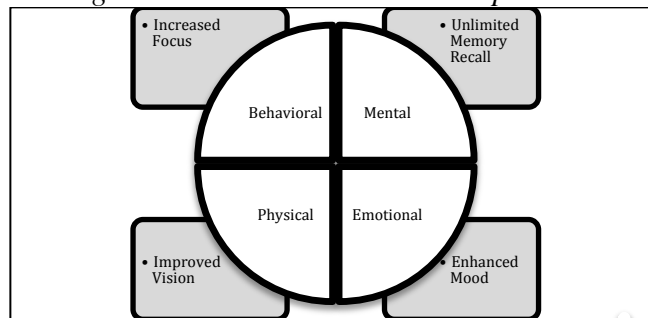
Neurotechnology & Potential For Human Enhancement

These neurotechnologies have a variety of applications, ranging from restoration to enhancement, each with varying levels of ethical concern. Least ethically problematic is the restoration of senses for individuals with disabilities, as with the use of cochlear implants as a neuroprosthetic to restore hearing in deaf individuals. Similarly, the use of

neurotechnology for treatment of neurological disorders, such as using TMS as a neurostimulator to treat depression, does not ignite robust ethical debate. On the other hand, the use of neurotechnology for human enhancement purposes, such as neuroprosthetics for enhanced senses, would certainly raise complex and contentious ethical concerns.

As demonstrated in Figure 2 below, the emerging market for human enhancement includes improvement in behavioral (i.e. increased focus), physical (i.e. improved vision and hearing), emotional (i.e. enhanced mood), and mental (i.e. unlimited memory recall) capacities.¹⁷ This figure demonstrates the breadth of influence that neurotechnologies may have on the human body. As neurotechnologies have the capacity to augment our abilities beyond baseline across a wide range of capabilities, their use may challenge traditional notions of personal identity and what it means to be human.

Figure 2. Neuroenhancement Capabilities



The Eroding Dichotomy Between Restoration And Enhancement

A key inquiry in the conversation surrounding human enhancement is whether a particular technology has a *restorative* function or an *enhancement* function.¹⁸ Indeed, there has been much debate amongst scholars regarding the dichotomy between these terms. It is necessary to grapple with “where to draw the threshold line between restoration and enhancement--or whether to draw the line at all.”¹⁹

Traditionally, the term “restoration” indicates a “medical, surgical or psychological treatment aimed at reinstating individuals with diseases or impairments to their original or to a so-defined ‘normal’ physical and mental state of health or aimed at preventing diseases or disabilities.”²⁰ Conversely, “enhancement” is generally a term used to “describe efforts to increase or improve the condition, capacities and performance of healthy person.”²¹

Unlike restorative treatments required by necessity, devices and surgeries for enhancement are elective procedures the risks of which are not outweighed by therapeutic benefits. As the FDA does not review surgical procedures associated with the implantation of such neurotechnology devices, the procedures themselves, as well as the devices, may have an effect on the brain and lead to unanticipated changes in cognition, personality, or mood.²²

While some argue that there is a “red line” to distinguish between therapy and enhancement, others argue that these concepts are evolving and context-specific on social constructions.²³ As restorative neurotechnologies also have the potential for enhancement, the dichotomy will likely continue to erode. Cortical implants, for example, may be considered therapy when used to assist the blind in restoring vision, but may be considered enhancement when used to expand the visible spectrum of light in otherwise healthy individuals.²⁴ Therefore, the terms “restoration” and “enhancement” are not mutually exclusive.²⁵

Ethical Considerations Surrounding Neuroenhancement

Although many of the ethical issues surrounding neuroscience are not wholly unique to the field, they encompass certain ethical considerations uniquely associated

with the brain. More so than other technologies, advances in neuroscience raise questions about the human experience, such as personal identity, free will, and autonomy.²⁶ Accordingly, as neurotechnologies grow in their applications beyond the field of medicine, it is imperative to carefully consider how such advancements in technology should be used.²⁷ Taking into consideration the exceptional nature of the human brain, it is appropriate to approach neurotechnology with weightier ethical inquiry than that of other types of medical technology. Moreover, the potential for neurotechnology to disclose sensitive information that is preferred to be kept confidential violates the longstanding value of privacy and may lead to stigma or discrimination.

For example, neurotechnology offers insights into the brain that raise ethical concerns about privacy, particularly concerning an individual's ability to choose how personal, sensitive, or intimate information is acquired.²⁸ Information gleaned from neurotechnology may provide information about one's behavioral predisposition, as mentioned above, including racial prejudices, pedophilia, compulsive gambling, sexual preference, political preference, extroversion and introversion, cooperativeness, and dangerousness, which has been used to determine psychopathy.²⁹ The existing legal and ethical framework seems insufficient to "give individuals sufficient control over the use and disclosure of their functional neuroimaging information by third parties (confidentiality), the collection of their functional neuroimaging information by third parties (privacy), and the self-revelation of their functional neuroimaging information (identity)."³⁰ As neurotechnology becomes developed in a way that can potentially monitor or predict private thoughts, ethical considerations must be further deliberated to anticipate potential social consequences, such as stigma and discrimination, and mitigate

potential concerns through the development of law and policy.

Legal And Policy Implications Surrounding Neurotechnology, Neuroenhancement & Disability Law

Neurotechnology is expanding the depth and breadth of the ability spectrum.³¹ While it is true that neurotechnology may “level the playing field” for individuals with disabilities, thus compensating for the “unfairness of natural inequalities” in abilities, it may also broaden the inequalities that exist in our society by improving upon those with normal physical and mental functioning.³² Thus, neurotechnology may reinforce existing educational, economic, and other disparities.³³

If neurotechnological enhancement becomes as commonplace as predicted, it is possible that one day the enhanced majority may view their unenhanced counterparts as disabled.³⁴ Some scholars go so far as to say that society is already well on its way to this reality.³⁵ With restorative neurotechnology doubling as enhancement neurotechnology, the disabled may improve their abilities beyond the baseline average. It is not implausible that a healthy individual may also want to engage with neurotechnology to enhance his or her mental or physical abilities.³⁶ As both disabled and healthy individuals are increasingly willing to restore or augment their abilities through neurotechnology, we must reassess the legislative definition of disability.

Ethical principles should guide statutory developments to protect against violations of privacy and stigma and discrimination. Specifically, ethics will inform changes to the existing legislative framework for protecting individuals with disabilities against discrimination under the Americans With Disabilities Act (“ADA”). In addition, ethics will provide a context for developing legislation, such as the proposed Neuro Information Nondiscrimination Act (“NINA”), to safeguard ethical principles of privacy

and autonomy and protect against stigma and discrimination based on information surrounding the brain before a condition manifests.

The Americans With Disabilities Act (“ADA”)

The ADA was signed into law by President Bush on July 26, 1990 as a "declaration of equality for people with disabilities" to end the "unjustified segregation and exclusion of persons with disabilities from the mainstream of American life."³⁷ Based on ethical principles of equality, justice, and civil rights, the ADA protects disabled individuals from discrimination in employment, education, and public access settings.³⁸ This Section focuses on Title I of the ADA, which prohibits discrimination against individuals with disabilities in the workplace and requires reasonable accommodations for individuals with disabilities.³⁹ The ADA defines disability as "a physical or mental impairment that substantially limits one or more of the major life activities of [an] individual; a record of such impairment; or being regarded as having such an impairment."⁴⁰

In its current form, the ADA is not adequately flexible to respond to changes in society that may result from neuroscience and technology. If conventional human abilities become inferior absent enhancing interventions, the ADA seems insufficient to protect the "unenhanced" as "disabled." Moreover, as neurotechnologies have the ability to fully restore and enhance the abilities of individuals with impairments, the ADA will be challenged to consider mitigating factors when determining disability status for protection under the ADA.

Initially, the ADA failed to address whether courts should consider mitigating measures when determining an individual's disability status.⁴¹ In 1999, the Supreme

Court addressed this issue in *Sutton v. United Air Lines, Inc.*, holding that mitigating factors, including medication or mechanical devices, should be taken into account when determining one's disability status.⁴² In *Sutton*, plaintiffs filed suit against an airline that refused to hire them because of their severe nearsightedness.⁴³ The Supreme Court held under the ADA, plaintiffs were not considered disabled because they were not substantially limited in a major life activity due to the restorative function that corrective lenses provided.⁴⁴ Moreover, the Supreme Court clarified the definition of disability under the ADA, holding that “[a] disability exists only when an impairment ‘substantially limits’ a major life activity, *not where it ‘might,’ ‘could,’ or ‘would’ be substantially limiting if mitigating measures were not taken.*”⁴⁵ Disability advocates and scholars criticized the *Sutton* ruling for denying the “disabled” coverage based on the “mitigating measures” the Court employed, and thus unduly limiting the ADA's coverage.⁴⁶

In 2008, Congress passed the ADA Amendments Act (“ADAAA”). The amendments prohibit “mitigating factors” from being taken into account when determining one's disability status under the ADA, thus overturning the *Sutton* decision.⁴⁷ The applicable language of the ADAAA states: “[t]he determination of whether an impairment substantially limits a major life activity shall be made without regard to the ameliorative effects of mitigating measures” including drugs, medical devices, and assistive technologies.⁴⁸ The definition of “major life activity” was amended to “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.”⁴⁹ Under the ADAAA, modifications, additions, or enhancements are irrelevant in determining whether an individual is

disabled under the law.⁵⁰ Despite Congress's beneficent intentions to extend broad coverage to those with disabilities with the ADAAA, the amendments are insufficient to protect individuals against discrimination in light of neuroenhancement technologies.

As mitigating factors become more advanced and commonplace, due in part to advancements in neuroscience and technology, the ADA appears insufficient to eliminate discrimination based on disability. By categorically prohibiting courts from considering mitigating measures, an individual who corrects a disability through restorative measures, and becomes enhanced in the process, may still bring suit under the ADA.⁵¹ Conversely, an individual without enhancements may not bring suit under the ADA for cases involving discrimination by those with enhancements toward those who have none. This seems to violate the spirit of the legislation. Some futurist scholars, such as Collin Bockman, suggest that Congress should consider amending the ADA allow courts to consider mitigating factors that have been employed by the claimant, when those factors are:

“a prosthetic or implanted medical device that (1) interfaces with the claimant's nervous system either directly or in such a way that operating the device is accomplished through thought alone; and (2) compensates for the claimant's impairment to such an extent that a reasonable person would consider the impairment completely eliminated or transformed into an advantage over ordinary human capabilities.”⁵²

Moreover, there is no provision in the ADA that protects individuals from “comparative discrimination,” where “enhanced individuals discriminate against an otherwise ordinary individual whom they consider ‘disabled’ due to his lack of upgrades.”⁵³ While the notion of an “enhanced majority” may seem futuristic, it is, in fact, a feasible, if not likely, circumstance of the future. It seems certain that neurotechnologies will continue

to monitor, alter, and enhance the human body.⁵⁴ Neurotechnology that is currently in development may one day be used for enhancement in the mainstream. Thus, individuals with ordinary human capabilities may be considered less-abled than those with enhancements. Individuals without enhancements may experience express or implied coercion to obtain enhancements in order to be competitive.⁵⁵ To ensure that the unenhanced do not experience discrimination in favor of an enhanced individual, Congress must consider “comparative discrimination” in developing more comprehensive protections against discrimination based on disability.

The issue of “comparative discrimination” hinges on the definition of disability and who may be considered disabled. A criticism of the ADA, and of the ADA generally, is that it fails to define disability as a social construct determined by societal norms.⁵⁶ Many disability advocates, particularly social-constructivists, reject the dichotomy between the terms disabled and non-disabled.⁵⁷ Instead of this dichotomy, disability should be interpreted as a fluid and context-sensitive concept.⁵⁸ Advancements in neurotechnology will challenge our notions of disability, ability, and enhancement, thus necessitating that Congress reassess the legislative definition of disability.⁵⁹ Contemporary disability theory focuses on how society creates disability.⁶⁰ Accordingly, the ADA must be amended yet again to address the “increasingly broad spectrum of ability that will accompany humanity through the twenty-first century.”⁶¹

NEURO INFORMATION NONDISCRIMINATION ACT (NINA)

In addition to the ADA, which protects individuals from discrimination after a condition manifests in the individual, some scholars propose NINA to address concerns arising from stigma and discrimination surrounding information gleaned from the human

brain before it manifests into a condition. NINA, based largely on the concept of the Genetic Information Nondiscrimination Act (“GINA”), will address the potential of neuroscience-based discrimination in employment and insurance.⁶² As a federally-funded research program, the BRAIN initiative will likely follow the same path at the Human Genome Project. Just as the Ethical, Legal and Social Implications (“ELSI”) Research Program in the Human Genome Project identified ethical considerations surrounding stigma and discrimination due to genetic information that gave rise to GINA, ethical research by the Bioethics Commission surrounding the Brain Initiative will likely give rise to similar concerns about stigma and discrimination surrounding neurological information to provide a foundation for NINA.

GINA was signed into law in May 2008.⁶³ GINA protects job applicants and employees from discrimination based on their genetic information.⁶⁴ The law prohibits employers from requesting, requiring, or purchasing genetic information with respect to an employee, including personal genetic tests and the genetic tests of family members.⁶⁵ GINA prohibits employers from taking adverse employment action against an individual based on this genetic information.⁶⁶ Adverse employment action includes firing, demoting, or failing to promote a qualified person. GINA also prohibits employers from harassing an employee because of his or her genetic information.⁶⁷ Harassment includes making derogatory remarks about an applicant or employee’s genetic information, or that of an employee’s relative, to the extent that it is so severe or pervasive that it creates a hostile or offensive work environment.⁶⁸ GINA is intended to protect individuals during the time-span between the time an individual’s genetic information reveals the

probability of a condition and the time the condition manifests in that individual, when the ADA would protect the individual against discrimination.

GINA is not without flaws. Some critics argue that the legislation is impractical because there exists no efficient, affordable way to separate genetic information from non-genetic information in health records. Mark Rothstein of the Hastings Center warns against genetic exceptionalism and instead encourages broad policy reform on all medical information, rather than genetic-specific legislation.⁶⁹ Legislative distinctions between genetic information and traditional health information may reinforce the stigma of genetic disorders by treating them differently from non-genetic conditions, thereby worsening the conditions that the law seeks to remedy.⁷⁰ While many would argue that it is still better to enact a genetic-specific law than nothing at all, critics warn that “enacting feel-good legislation with little substantive protection may mislead the public.”⁷¹ These critiques would likely be similar if NINA were to be passed by Congress. Accordingly, it is important to anticipate potential social consequences of neuro-specific legislation.

NINA, if passed by Congress, would prohibit employers from requesting, acquiring, or disclosing the neurological information of their employees.⁷² It would also prohibit employers from discriminating on the basis of neurological information, which would not be protected by the ADA until this information becomes expressed in the individual in a manner that gives rise to disability.⁷³ Most importantly, NINA, championing individuals’ right to be free from coercive pressure, would prevent employers from compelling applicants or employees to engage in neuroenhancement and

prohibit discrimination on the basis of the use or nonuse of neuroenhancement measures.⁷⁴

For example, if some commercial airline pilots choose to engage in neuroenhancement and subsequently score better on a performance-based test than those who chose not to enhance, NINA may limit employment decisions based on the results in order to preserve freedom of choice.⁷⁵ While there should not be blanket restrictions on performance-based testing, factors such as the degree of enhancement and the intent of the employer in administering such a test should be taken into consideration.⁷⁶

Regardless of whether a separate piece of legislation like NINA is passed or the protections are incorporated into pre-existing nondiscrimination laws, neurological information discrimination is likely to be a burgeoning field of human rights law in the coming years. It is necessary to take a proactive approach. The government must take action to keep pace with neuroscience developments before individuals are harmed from inadequate legal protections.⁷⁷ Such legislation should be passed before products enter the market to ensure that scientific progress does not beat congressional action to the finish line due to its lengthy and bureaucratic nature.⁷⁸ While bioethics-focused government action has been largely reactionary, society “can't afford to take one step forward in science but two steps back in civil rights.”⁷⁹

Conclusion

The disruptive power of technology raises ethical questions in every field, but none more complex than neurotechnology. As neuroscientific developments continue to advance at an exceptional rate, the risks and benefits of such technologies must be assessed through ethical principles and frameworks, like those provided by the Bioethics

Commission, to anticipate and mitigate potential concerns.

More importantly, it is critical to take a proactive approach and allow our ethical inquiries to guide law and policy, rather than sitting upon our ethical analyses. In a field as complex a neurotechnology, it is vital to anticipate ethical considerations early in the development process and mitigate potential pitfalls and gaps in current legislation as a result of developments in neurotechnology to ensure that the law keeps pace with the scientific process.

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² For the purposes of this article, neurotechnology is defined as any technical or computational tool that measures, analyzes, or alters chemical or electrical signals in the nervous system. Univ. of Freiburg, *Neurotechnology: A Definition*, <http://www.neurotechnology.uni-freiburg.de/definicion> (last visited October 22, 2014).

³ Henry T. Greely, *Law and the Revolution of Neuroscience: An Early Look in the Field*, 42 AKRON L. REV. 687, 688 (2009).

⁴ Greely, *supra* note 3, at 687.

⁵ Eric Chan, *The Food and Drug Administration and the Future of the Brain-Computer Interface: Adapting FDA Device Law to the Challenges of Human-Machine Enhancement*, 25 J. MARSHALL J. COMPUTER & INFO. L. 117, 163 (2007).

⁶ *Id.*

⁷ NAT'L INST. OF HEALTH, *Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative* (2013), <http://www.nih.gov/science/brain/>.

⁸ Press Release, President Obama, White House, Office of the Press Sec'y, *Remarks by the President on the BRAIN Initiative and American Innovation* (Apr. 2, 2013), available at <http://www.whitehouse.gov/the-press-office/2013/04/02/remarks-president-brain-initiative-and-american-innovation>.

⁹ *Id.*

¹⁰ PRESIDENTIAL COMM'N FOR THE STUDY OF BIOETHICAL ISSUES, *GRAY MATTERS: INTEGRATIVE APPROACHES FOR NEUROSCIENCE, ETHICS, AND SOCIETY* (2014), available at <http://www.bioethics.gov/sites/default/files/Gray%20Matters%20Vol%201.pdf>.

¹¹ *Id.*

¹² *Id.* at 9.

¹³ *Id.* at 6.

¹⁴ Ronald M. Green, *The Need for a Neuroscience ELSI Program*, HASTINGS CENTER REP., July-Aug. 2014, at 44.

¹⁵ *Id.*

¹⁶ Mary Darby, *Bioethics Commission Deliberates Neuroscience-Related Recommendations*, The Blog of the Presidential Comm'n for the Study of Bioethical Issues (Nov. 5, 2014), <http://blog.bioethics.gov/2014/11/05/bioethics-commission-deliberates-neuroscience-related-recommendations-2/#sthash.20QVpy2u.dpuf>.

¹⁷ *Id.*

¹⁸ *Id.*

- ¹⁹ See generally Isabel Karpin & Roxanne Mykitiuk, *Going Out on a Limb: Prosthetics, Normalcy and Disputing the Therapy/Enhancement Distinction*, 16 MED. L. REV. 413 (2008) (criticizing the distinction between therapy and enhancement as unsound).
- ²⁰ Michael H. Shapiro, *Does Technological Enhancement of Human Traits Threaten Human Equality and Democracy?*, 39 SAN DIEGO L. REV. 769, 778 (2002).
- ²¹ *Id.*
- ²² RICHARD A. DEYO, HOPE OR HYPE: THE OBSESSION WITH MEDICAL ADVANCES AND THE HIGH COST OF FALSE PROMISES 157 (2005).
- ²³ See Greely, *supra* note 3, at 90 (suggesting that restorative technologies will soon also become enhancement technologies).
- ²⁴ Steven Kotler, *Vision Quest*, WIRED (Oct. 9, 2002), <http://www.wired.com/wired/archive/10.09/vision.html> (describing how cortical implants could increase human vision beyond natural capabilities).
- ²⁵ *Id.*
- ²⁶ PRESIDENTIAL COMM'N FOR THE STUDY OF BIOETHICAL ISSUES, *supra* note 10.
- ²⁷ See generally John P. Donoghue, *Connecting Cortex to Machines: Recent Advances in Brain Interfaces*, 5 NATURE NEUROSCIENCE 1085 (2002), available at <http://www.nature.com/neuro/journal/v5/n11s/pdf/n947.pdf>.
- ²⁸ Stephanie A. Kostiuk, *After GINA, NINA? Neuroscience-Based Discrimination In The Workplace*, 65 VAND. L. REV. 933, 958 (2012).
- ²⁹ *Id.* at 935.
- ³⁰ Stacey A. Tovino, *Functional Neuroimaging Information: A Case for Neuro Exceptionalism?*, 34 FLA. ST. U. L. REV. 415, 418 (2007).
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- ³² See generally Marion Albers, *Chapter 16 Enhancement, Human Nature, and Human Rights*, 35 IUS Gentium 235 (2014).
- ³³ Anjan Chatterjee, *The Promise And Predicament Of Cosmetic Neurology*, J MED ETHICS 110, 113. (2006).
- ³⁴ *Sutton v. United Air Lines, Inc.*, 527 U. S. 471, 482 (1999).
- ³⁵ Collin R. Bockman, *Cybernetic-Enhancement Technology and the Future of Disability Law*, 95 IOWA L. REV. 1315, 1318 (2010). at 1320. (Chan, for example, suggests that “a patient undergoing restorative surgery might ask for enhancement instead: if the doctor is using lasers to correct her vision to the baseline of 20/20, why not go for 20/15, or even 20/8?”); JAMES HUGHES, *CITIZEN CYBORG: WHY DEMOCRATIC SOCIETIES MUST RESPOND TO THE REDESIGNED HUMAN OF THE FUTURE* 68-73 (2004).
- ³⁶ *Id.*
- ³⁷ 20 Am. Jur. Proof of Facts 3d 361 (Originally published in 1993).
- ³⁸ Americans with Disabilities Act of 1990 (ADA), 42 U. S. C. §§ 12101-12213 (2006).
- ³⁹ *Id.*
- ⁴⁰ Elizabeth W. Malloy, *Something Borrowed, Something Blue: Why Disability Law Claims Are Different*, 33 CONN. L. REV. 603, 604-05 (2001).
- ⁴¹ See Bockman, *supra* note 35.
- ⁴² Debra Burke & Malcolm Abel, *Ameliorating Medication and ADA Protection: Use It and Lose It or Refuse It and Lose It?*, 38 AM. BUS. L. J. 785, 793-800 (2001) (analyzing the *Sutton* case and describing the background of the use of mitigating-measures and the ADA).
- ⁴³ *Id.*
- ⁴⁴ *Id.*
- ⁴⁵ *Id.* (emphasis added).
- ⁴⁶ See Bockman, *supra* note 35.
- ⁴⁷ ADA Amendments Act of 2008, sec. 2, § 12102(4)(A)-(B), 122 Stat. at 3553 (amending Americans with Disabilities Act of 1990 (ADA), 42 U. S. C. §12102 (2006)).
- ⁴⁸ *Id.*
- ⁴⁹ *Id.*
- ⁵⁰ See Bockman, *supra* note 35, at 1322.
- ⁵¹ *Id.* at 1336-37.
- ⁵² *Id.* at 1339.

⁵³ *Id.* at 1337.

⁵⁴ Donoghue, *supra* note 27.

⁵⁵ See Bockman, *supra* note 35, at 1322.

⁵⁶ See generally GERARD GOGGIN & CHRISTOPHER NEWELL, DIGITAL DISABILITY: THE SOCIAL CONSTRUCTION OF DISABILITY IN NEW MEDIA 148-49 (2003) (exploring how disability is socially constructed).

⁵⁷ See Lisa Eichhorn, *Applying the ADA to Mitigating Measures Cases: A Choice of Statutory Evils*, 31 ARIZ. ST. L. J. 1071, 1077-79 (1999) (describing disability as a “fluid, socially constructed concept”).

⁵⁸ Catherine Rengel, *The Americans with Disabilities Act and Internet Accessibility for the Blind*, 25 J. MARSHALL J. COMPUTER & INFO. L. 543, 543-50 (2008).

⁵⁹ Bockman, *supra* note 35, at 1317-18.

⁶⁰ See generally GERARD GOGGIN & CHRISTOPHER NEWELL, DIGITAL DISABILITY: THE SOCIAL CONSTRUCTION OF DISABILITY IN NEW MEDIA 148-49 (2003) (exploring how disability is socially constructed).

⁶¹ See Bockman, *supra* note 35.

⁶² Kostiuk, *supra* note 28, at 965.

⁶³ Genetic Information Nondiscrimination Act of 2008, Pub. L. No. 110-233, 122 Stat. 881 (2008).

⁶⁴ *Id.*

⁶⁵ *Id.*

⁶⁶ *Id.*

⁶⁷ *Id.*

⁶⁸ *Id.*

⁶⁹ Mark A. Rothstein, *Genetic Exceptionalism & Legislative Pragmatism*, 35 HASTINGS CENTER REP., July-Aug. 2005, at 27.

⁷⁰ *Id.*

⁷¹ *Id.*

⁷² See Kostiuk, *supra* note 28.

⁷³ *Id.* at 935.

⁷⁴ *Id.* at 967.

⁷⁵ *Id.* at 976.

⁷⁶ *Id.*

⁷⁷ *Id.* at 944.

⁷⁸ *Id.* at 974.

⁷⁹ Joan O’C. Hamilton, *If They Could Read Your Mind*, STANFORD MAG (Jan. 21, 2010), available at https://alumni.stanford.edu/get/page/magazine/article/?article_id=36320.