Psychiatry in the Era of Neuroethics

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Ethical Questions at the Intersection of Neurotechnology and Psychiatry

Picture a metallic arm with spectacular titanium and stainless steel exposing inlaid microchips, boasting over 20 points of movement that closely mimic a human arm.

This is the image that graces the cover of National Geographic’s January 2010 issue, heralding the “bionic age.”¹ To be clear, it has taken decades for scientists to accept the term “bionic,” which is the merging of man with machine—once just a figment of fiction writers’ imagination. With astoundingly innovative technology, researchers are harnessing motor cortex brain signals that travel to the stump of an amputee’s limb, where electrode arrays are matched with the residual nerve endings to translate the signal into the human-like mechanical motion of a prosthetic limb. In the field of “brain bionics,” the industry of neurostimulation therapies is a ripe market. Several large corporations and more than 20 start-up companies are competing to find new applications and improve the efficacy of the major, contemporary neurostimulation modalities: deep brain stimulation, spinal cord stimulation, and vagus nerve stimulation (Table 1).²

The future is here.

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<th>Neuroethics meets psychiatric ethics</th>
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<td>For decades, neuroscientists have been cognizant of the social implications of their work, but only since 2002 has the field of “neuroethics” emerged as a formal discipline that attempts to organize and address the ethical issues in neuroscience research and technology.³ The coining of the term “neuroethics” is credited to William Safire,⁴ a former columnist for The New York Times, who</td>
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described it as “the field of philosophy that discusses the rights and wrongs of the treatment of, or enhancement of, the human brain.” A new vernacular has since transpired, with the prefix “neuro” (denoting neuroscience-based or -informed) commonly appended to a suffix such as “ethics,” “law,” “imaging,” or “enhancement.” Michael Gazzaniga, sitting with the 2004 President’s Council on Bioethics, provided a broader definition of neuroethics as the “examination of how we want to deal with the social issues of disease, normality, mortality, lifestyle, and the philosophy of living informed by our understanding of underlying brain mechanisms.”

Neuroethics has a rapidly growing literature that focuses mostly on the ethical concerns in neuroimaging and neuroenhancement. However, there has been a lack of attention from both psychiatry and neuroethics to the potential implications of neuroscience and its technologies for the diagnosis, treatment, and societal perception of mental illnesses. Increasingly, sophisticated techniques for imaging and intervening in human cognition, emotion, and behavior raise important ethical issues at the intersection of neurotechnology and psychiatry (Table 2).

### Physical manipulation of the brain

Prosthetic limbs, cochlear and retinal implants, mechanical heart valves, kidney dialysis machines, and pain pumps are examples of full- and part-time bionic human parts with cutting-edge technology that extend lives and relieve suffering. Are there any worries about becoming a bionic society? The ethical concerns achieve a sharper focus and reach higher stakes when considering neurostimulation technologies and intervention in brain function. Deep brain stimulation, for example, might soon be proved safe and effective as a means of alleviating a number of treatment-resistant psychiatric disorders, including depression, obsessive-compulsive disorder, and psychosis; yet turning off the depression, the obsessions, or bad thoughts with a neuroimplant somehow raises ethical concerns, whereas hip replacements and hearing aids do not.

The historical existence of this controversy is apparent when looking back at psychiatry’s experience with electroconvulsive therapy (ECT) and psychosurgery, and the decades of debate waged over patients’ rights and allegations of social and individual mind control, punishment for recalcitrant patients, and concerns about overuse or misuse. Despite overwhelming research in support of ECT’s safety and efficacy, this form of treatment still engenders broad skepticism, misunderstanding, distaste, and civil rights protest.

Psychosurgery is a particularly contentious practice, and yet, the outcome of deep brain stimulation may not be all that different. While the true mechanism of action of deep brain stimulation is still unclear, the prevailing theory is that the implanted electrodes create a focal inhibitory effect on the immediate surrounding brain tissue and thus achieve the ablative results similar to those of psychosurgery. Granted, an obvious major advantage to deep brain stimulation is the potential reversibility of an implanted electrode, yet it remains to be seen whether this factor is sufficient to moderate public opinion and engender wider acceptance than that of psychosurgery or ECT. In speculation, part of the reluctance to intervene physically in brain functions stems from persistent stigma and a general assumption that mental illnesses are to a greater degree under a person’s control than physical illnesses (eg, tremors, seizure, heart valve failure). Furthermore, it appears that emotional and cognitive functions garner a higher degree of sanctity and inviolability than all other
human functions. Thus, psychosurgery may seem acceptable or palliative when it is used to relieve intractable seizures, but barbaric when used for treatment-resistant schizophrenia. Likewise, while concerns are raised over a so-called brain pacemaker (the lay term for deep brain stimulation) that can modulate mood and cognition at the “flip of a switch,” people who have Parkinson disease are able to benefit from immediate, dramatic improvements in gait and motor control. Understanding the philosophical and cultural roots of such a discrepancy is a major task for psychiatry and neuroethics.

**Neuroenhancement: cosmetic psychopharmacology**

Consider the following scenario: A 21-year-old college student complains of trouble with concentrating and focusing on her schoolwork. She is an academically superb student, who has never met criteria for attention-deficit disorder as a child, and who still does not meet criteria. She finally explains that she is worried about not getting an “A” in her class, and really thinks that Adderall would help. In fact, it “worked great” when a friend had given her some before a final exam last semester.

Neuroenhancement, the popularized term for the augmentation of ostensibly normal function (such as the situation described above), has drawn scrutiny from the public and has become a topic of concern for neuroethicists. The temptation and demand for neuroenhancement is inherent in a number of common psychiatric medications. Stimulant use far exceeds the highest estimates of attention-deficit/hyperactivity disorder prevalence, particularly among college students. Modafinil is highly desired for off-label use for its ability to increase working memory, wakefulness, and attention, and possibly decrease stress hormone levels. Alzheimer medications have the small but noticeable benefit of boosting memory and attention in nondemented persons. SSRIs caught the public’s attention for the ability to make people “better than well,” particularly following Kramer’s *Listening to Prozac*, and recent studies have shown that this benefit may be related to decreased reactivity to negative affective images in healthy individuals and an increase in positive emotional recall.

**CHECKPOINTS**

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Meanwhile, an industry of neuroenhancement is growing. One private entrepreneurial company is investigating the potential of a molecule to activate genes that can strengthen synaptic connections, and hence memory.\textsuperscript{\ref{foot1}}

Pharmaceutical enhancement elicits ethical concerns about an “enhanced society” and the likelihood of unfair advantages in access that would exacerbate socioeconomic or ethnic disparities in education or employment. Perhaps individuals, physicians, society, or our policy makers have a duty to uphold distributive justice and preserve the moral values of dignity, hard work, and natural self-improvement. The ethical concerns about moral decision making have been poignantly debated in the dosing of stimulants in children to achieve parent-defined levels of cooperation and success, which ultimately results in overtreatment of the “authentic” child.\textsuperscript{\ref{foot2}}

Furthermore, psychiatrists must contend with the societal trends and demand for enhancements such as stimulants (consider the popularity of the vitamin and supplements industry). Where there is demand, there is the potential for profit; and medicine driven by profit seems to run contrary to physicians’ ethical duty to “do no harm” (all psychotropic drugs have potential adverse effects) and to use their training judiciously for the benefit of patients and society.\textsuperscript{\ref{foot22}} On the other hand, one could argue that enhancing human performance is a benefit to society, because it could increase workplace productivity or lead to advancement in areas such as science and engineering.\textsuperscript{\ref{foot23}} Recent guidelines from the American Academy of Neurology, published in 2009, are fueling the controversy by providing an alleged “primer” for physicians who choose to prescribe neuroenhancing medications.\textsuperscript{\ref{foot24,foot25}}

Examples of enhancement already exist in other areas of medicine. Elective cosmetic surgery has become tacitly condoned (if not outright glamorized at times) by contemporary society. “Cosmetic psychopharmacology” may very well become an equivalent practice of psychiatry without ethical debate, policy, and regulation. But, what is the difference between physical enhancement (eg, Botox for wrinkles, protein shakes for muscle mass) and cognitive, behavioral, and emotional enhancement? How should the line be drawn between readily available and culturally sanctioned neuroenhancements, such as methylphenidate and donepezil? The dilemma of drawing a line along the continuum of psychiatric treatment to enhancement is fundamentally reflected in psychiatry’s inability to establish a clean boundary between abnormal and normal human functioning and experience.

**Neuroimaging and diagnoses of mental illness**

In the early 1970s, the psychologist David Rosenhan\textsuperscript{\ref{foot26}} sent ostensibly normal individuals to be admitted into psychiatric hospitals; consequently, doubt was cast on psychiatry’s ability to distinguish the “sane from the insane.” The fundamental dilemma for psychiatry has always been the challenge in making a valid and reliable diagnosis of mental illness, and its persistent controversy is evident today in the midst of the American Psychiatric Association’s highly anticipated and debated DSM\textsuperscript{5}.\textsuperscript{\ref{foot27-29}}

The tradition in making psychiatric diagnoses has relied on a physician’s interpretation of patient-reported symptoms and experiences and on observable signs—a practice that has been criticized for being either invalid or unreliable, or otherwise highly susceptible to personal heuristics. Standardized tools have largely been limited to medical tests to exclude nonpsychiatric causes and to standardized psychological tests. Naturally, research has turned to neuroimaging as a potential tool for the following:

- Improving the validity of diagnostic classes
- Use as a diagnostic “laboratory” test to make individual diagnoses
- Screening for predictive and preventive psychiatry

**Improving diagnostic validity**

Neuroimaging studies are already contributing to the scientific foundation for improving the classification and validity of psychiatric diagnoses.\textsuperscript{\ref{foot28}} The optimistic view is that functional neuroimaging tests could be among the tools that produce a unique, delimiting variable, a natural boundary or zone of rarity, that separates classes of illnesses and helps disentangle co-occurring psychiatric diagnoses.\textsuperscript{\ref{foot30}} The improved validity of psychiatric diagnoses would likely make important inroads toward reducing stigma, decreasing barriers to care, and improving treatment adherence and outcomes.\textsuperscript{\ref{foot31,foot32}}

Many believe that the medicalization of mental illness through technology such as neuroimaging could decrease stigma. But the problems with stigma of mental illness are exceedingly complex, and research has shown that the medicalization of mental illness might actually worsen stigma. It seems that emphasizing the biological or genetic basis of mental illness exacerbates societal avoidance and
fear.\textsuperscript{33,34}

**Neuroimaging as a “laboratory” test**

Imagine a man charged with murder. He is innocent, and to prove it he is willing to take the newest version of a lie detector test: a functional MRI brain scan that can determine with up to a 90\% degree of accuracy whether he is answering questions truthfully or deceitfully.\textsuperscript{35,36} Two entrepreneurial companies are competing to bring this technology to the commercial market—and presumably to the courtroom. Optimists have estimated that such technology might be available within the next 5 years.\textsuperscript{37}

Lie detection sets the conceptual stage for clinical applications of functional neuroimaging as an objective laboratory test to support or confirm diagnoses on an individual level. Like structural imaging for neurology, functional neuroimaging could improve diagnostic reliability, decrease diagnostic variance, and be a useful measure for tracking treatment outcomes in mental illness. Practical concerns are raised regarding the cost, access, and efficiency of these technologies as well as the potential erosion of the physician-patient relationship, depersonalization of care, and accusations over a tendency to rely too heavily on technology, as in other areas of medicine.\textsuperscript{38}

Furthermore, there are basic concerns with the clinical use of functional imaging data. In particular, such data are susceptible to the fallacy of localization, which is the erroneous belief that the brain images show the cause of mental disorders. Increasingly, media is propagating misleading notions of “scientists finding the brain area” responsible for any given brain function. In reality, the static images demonstrate hemodynamic or metabolic activity in specific brain regions, which suggests a pathophysiological mechanism; however, the images provide no information about etiology. Meanwhile, scientists, clinicians, and philosophers continue to debate the fundamental problems that exist in the reductionism of the complex brain processes.\textsuperscript{39}

Not only is interpretation of neuroimages by the lay public naturally subject to the fallacy of localization, but psychiatrists may ultimately find it challenging to translate individual-level neuroimaging data into reliable and meaningful clinical use. Consider the dilemma of deciding whether the functional imaging data are more representative of true underlying thoughts, feelings, and intentions than the person’s subjective report. Which is of greater clinical importance: objective or subjective accounts of disability or impairment? The potential use of objective “lab” standards to determine an individual’s “level of impairment” would be a profound practical and cultural shift for psychiatry, with significant ramifications for patients and important products such as disability claims, insurance benefits, and employment.

**The definition of “personhood” and “self”**

These new methods of viewing and altering brain function raise essential questions about the concepts and definitions of self, free will, personhood, and responsibility. If personhood is grossly defined as an autonomous, thinking, feeling, and acting human being, then to what degree does an invasive deep brain stimulator or any other device affect autonomy or legal responsibility for actions?

What is the difference between a bionic body and a bionic mind? This question is a modern-day version of the fundamental philosophical question: what (if anything) is the difference between brain and mind? The societal wariness about tampering with the mind seems to calcify a belief that there is a distinction between the mental and the physical, whereas the growing scientific tendency is to view all functions of the mind as having a neurobiological basis.\textsuperscript{38} Future directions of research or inquiry might address the assumption that the public tolerates physical and behavioral intervention more than cognitive and emotional intervention, and why feelings or thought appear to be equated so intrinsically with the self.

**Conclusion**

Psychiatry has entered a new era, with opportunities to advance as the premier field of clinical neuroscience. However, new technology that permits imaging and manipulation of brain functions requires a sharp ethical focus. While the field of neuroethics has evolved to address many of the concerns specific to neuroenhancement and neuroimaging, it is necessary to broaden the ethical scope of issues to consider the profound clinical implications for the field of psychiatry.

**References:**


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