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Article

# Peering into People's Brains: Neuroscience's Intrusion into Our Inner Sanctum

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*"Peering into the brain" has a number of connotations: from directly examining aspects of the functioning of an individual's brain and hence what that individual may be thinking, to investigating the power of neuroscience to provide insights into characteristic features of our humanity. This article picks up on these different connotations and surveys several areas in neuroscience that raise issues of relevance for the Christian community. This is the domain of neuroethics, with particular reference to the prospects opened up by brain imaging and, in particular, functional magnetic resonance imaging (fMRI). Use of this and allied imaging procedures opens up the possibilities of locating brain regions involved in religious experiences, from glossolalia to meditation, suggesting that there are neural correlates of activities central to Christian communities. This raises the issue of causation that is discussed by reference to the brain regions involved in "disgust," altruistic acts, and religious visions.*

*Cognitive enhancement, sometimes referred to as cosmetic neurology, is discussed within the broader canvas of the use of neurocognitive enhancers for nonmedical reasons, and the theological issues raised by this and by the use of drugs to block the formation of traumatic memories. Neural vulnerability raises the specter of those with brain injuries that lead to aberrant behavior, sometimes at odds with these individuals' moral and spiritual values; an appreciation of the pathological element in these situations is stressed. While neuroethics is not as novel as often suggested, it brings home the importance of ongoing dialogue between science and theology in understanding the prospects and limitations of the technologies, their potential contribution to human well-being, and the ever-present threat posed by unwarranted mechanistic and deterministic thinking. A framework provided by a holistic view of humans within their environment and by the importance of relationships within the human community provides an essential element in Christian thinking.*

A new term has appeared in the bioethics lexicon, namely neuroethics, a term that is beginning to appear regularly in the mainstream neuroscience literature. The introduction of a new term like this conveys a couple of overriding messages. The first is that the ethical issues within neuroscience are distinct from those of all other areas within bioethics. The second is that neuroscience is replete with ethical challenges of momentous dimensions. While I doubt the accuracy of the first of these messages, the second encapsulates challenges we need to take very seriously.

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These challenges can be resolved into concerns over the degree of control it is now possible to exert over the brains of others, the prospects opened up by the biological enhancement of people's brains—our own as well as other people's—and the prospects of discovering what it is that other people are actually thinking, how they are responding to situations and even what preferences they have in racial, sexual, and political realms. While these concerns stem from a variety of technological developments, and while they overlap in some respects, they all touch a very sensitive nerve: they enable us to peer into what makes individuals what they are and what they stand for. Inevitably, such concerns have theological as well as ethical overtones.

Surprisingly, one of the most provocative techniques is that of functional magnetic resonance imaging (fMRI) which provides a means of mapping the brain by measuring regional blood flow. Even though it is a noninvasive procedure, and hence less intrusive and threatening than ones that actually change brain processes, the potential to use it to ascertain the parts of the brain associated with social, moral, and even religious attitudes is commonly viewed as opening up radically challenging prospects. Among these are the new domains of neuromarketing, brain fingerprinting, and even "brainotyping," with its potential for assessing racial attitudes and mental health vulnerabilities.[1]

Functional MRI studies demonstrate the possibility of delving into the biological correlates of complex human processes like existential thought and decision making, moral and nonmoral social judgment, love and altruism, aspects of personality, and competitiveness.[2] While such correlations do not point unequivocally to the neural bases of morality or consciousness, their overtones are mechanistic in nature. This ability is troubling to many, since it appears to represent an unduly powerful way of manipulating people's emotions and thought patterns, and even to question what it is that makes us the sort of people we are. These concerns are particularly pertinent for the Christian community, challenging cherished concepts of the soul, personal integrity, and faith. More prosaically, although more significant clinically, fMRI could open the way to predicting later-onset neurological and psychiatric disorders.[3]

The images projected by some writers are almost frightening, as the potential horrors of a brave new world of neuromanipulation and neurocontrol hang over us. It is in this spirit that William Safire has described neuroethics as the "examination of what is right and wrong, good and bad about the treatment of, perfection of, or unwelcome invasion of and worrisome manipulation of the human brain."[4] So much in neuroethics is directed toward warnings of threats to personal identity and neural integrity, and its concerns extend well beyond issues raised by fMRI. I shall, therefore, paint on this broader canvas, using fMRI as a way into this broader debate.

## From Neuroethics to Neurotheology

These challenges have all-too-obvious ramifications for theology as well as for neuroscience. The old distinctions between brain, mind, and soul appear, at best, quaint and, at worst, a hindrance to understanding the human condition. What, then, of traditional Christian conceptions? What has happened to the soul and the "heart," both of which still feature prominently in the language and thought forms of Christian theology? What is the relationship between the brain and the human person in Christian thinking?

Where do Christians think that human choices originate? While there are undoubtedly many answers to this question from a host of different Christian traditions, any answers that pay scant attention to the brain are about to come into major conflict with neuroscience. The same applies to those Christians who refuse to face up to the deeply physical nature of our behaviors and responses. It is this that provides the context within which Christians need to examine very closely the precise language they use when describing the manner in which God deals with individuals and those individuals' responses to God and, indeed, the whole repertoire of spiritual experiences. While it may be tempting for Christians to continue using traditional thought forms (the "language of Zion"), they are being increasingly forced into translating that language into expressions that are meaningful in neuroscientific terms. A failure to do this will see Christian thought forms estranged from the culture within which Christians are living.

Bridge-building between neuroscience and religion typically centers around seeking to find a chemical or structural explanation for religious or spiritual experiences.[5] These leanings are based on a biological reductionism not warranted by the scientific evidence, but which signals a considerable ideological impetus behind the work.[6] It would be easy for theologians and Christians to overreact to such intrusions by rejecting all dialogue with neuroscience as detrimental to faith. Such a move would be a familiar reaction to the much-hyped ideological conflict between science and religion. However, this response would be both unmerited and perilous. People of faith encounter various neuroscientific technologies during their normal lives, and this will increase as these technologies become ever more sophisticated and accepted in the future. If Christians are to be in a position to face the ethical and theological conundrums posed by neuroscience, the Christian community must engage with neuroscience, actively exploring the issues it raises. Whether the findings of contemporary neuroscience pose a threat to Christian belief comes down to the role we do or do not give to the brain in helping form our view of the human person.

Even if the terms "neuroethics" and "neurotheology" raise hackles, they encapsulate features of the debate on the role of the brain in ethical and theological thinking we dare not ignore.

## Neural Correlates and Brain Imaging

To what extent is it possible to decode mental states from brain activity in humans? That was the task undertaken by John-Dylan Haynes and Geraint Rees in a 2006 review of human neuroimaging.[7] They ask the question, "Is it possible to tell what someone is currently thinking based only on measurements of their brain activity?" Their review is a detailed analysis of methodological considerations, their conclusion being: "Decoding-based approaches show great promise in providing new empirical methods for predicting cognitive or perceptual states from brain activity." Dry as that conclusion may seem, it points in the direction of being able to predict behavior from neuroimaging data, raising—as one might imagine—numerous ethical concerns.

The existing literature points toward the ability to detect the neural correlates of an increasingly wide array of conditions and traits.[8] These include conscious and unconscious racial attitudes, conscious self-regulation of emotion, a range of personality traits, personality disorders, and psychopathic conditions, serious criminal tendencies, drug abuse such as cocaine craving, preferences for products such as well-known drinks, and the decision-making process itself. All these, in their different ways, are illustrations of brain reading. While there is no doubt they raise issues of vast significance for society, since some of them are highly controversial, they must surely also force Christians to acknowledge the centrality of the brain in any model they construct of the human person.

One imagines it might, theoretically, be possible to pinpoint the parts of a person's brain that are active when that individual initially makes the crucial decision to become a follower of Jesus Christ, subsequently makes numerous moral and spiritual choices, forgives others rather than holds grudges against them, and decides to put others first by serving them. The same comments would probably apply to the act of praying, and it has even been suggested that different types of prayer would be associated with different brain regions. Changes in cerebral activity during glossolalia ("speaking in tongues") have been assessed using SPECT, an imaging technique less disruptive to the subject than fMRI.[9] When compared to a religious state involving singing in English, subjects exhibited decreased activation in the prefrontal cortices, consistent with their description of glossolalia as nonvoluntary. The scans also indicated decreased activation of the left caudate nucleus and a change in thalamic lateralization, which could be associated with the subject's altered emotional state.

At this early stage, it is worth reflecting on what information like this is actually telling us that we did not know in the absence of any understanding of brain states. First, religious experiences are accompanied by changes in neural states. This, in my estimation, is an obvious and relatively uninteresting observation, although it does underline a reality the Christian community should not ignore. Second, one would like to know whether some individuals are more amenable than others to these brain changes, and hence, whether it is easier for some to experience this particular religious phenomenon than others. Were this to be the case, it would have

theological overtones. Third, if it is possible to induce these brain changes by psychological or pharmacological means, enormous caution would be required in interpreting the resulting phenomenon as having any religious significance under those circumstances.

In the light of these comments, it is to be expected that there has been considerable interest in locating the brain regions involved in religious or spiritual experiences. Newberg and colleagues have studied changes in cerebral blood flow using SPECT during various types of meditation. Both Franciscan nuns engaging in meditative prayer and Tibetan Buddhists performing visualization meditation showed increased activity in the prefrontal cortex.[10] In many regards, this is to be anticipated in terms of what is known about the functions of this part of the brain. One would like to know whether this, in itself, helps us understand more about the practice of meditation, and even whether it is to be encouraged as a religious ritual. Or is such neuroscientific knowledge irrelevant in religious terms? An attempt to address these queries has been made by McNamara, with the proposal that activation of the frontal lobes can help explain the intrinsically rewarding nature of spiritual experiences as well as assist in the attainment of positive behaviors such as moral insight and empathy, alongside negative outcomes often associated with religion such as intolerance and fanaticism.[11]

These neuroimaging studies raise questions about the biological basis, function, and evolutionary history of religion. However, evidence for the occurrence of particular cognitive processes during religious experiences cannot address the authenticity of such experiences.[12] This is because one comes up against the ever-present question of which comes first: is it the brain state or the religious experience? A related consideration is that the same brain state may be associated with different positions on fundamental religious worldviews. For instance, one would like to know whether one could distinguish between different views on the divinity of Christ from examining people's brains. The precision required here may be forbidding, and yet it may be of far greater relevance than knowing whether someone is "religious" or "nonreligious," or even has a tendency toward fundamentalist or liberal perspectives on religious matters.

Much of this is speculation, and one may well ask whether it is profitable speculation. How much can neuroscience ever tell us about religion, and what will be the nature—let alone value—of that information? Currently investigators are attempting to assess the subjective religious experiences of individuals rather than the shared belief system that is religion embedded in its cultural-historical framework.[13] They are certainly not determining the existence or nonexistence of a divine being. But my point remains. We should not be surprised to find neural correlates with what we consider are fundamental activities within the Christian community.

## Neuroimaging and Causation

The simple act of finding neural correlates for certain behaviors or attitudes provides few, if any, insights into *causative factors*. Even if a certain brain structure were strongly associated with religious experience, this says nothing about whether the structure generates that experience. Simply because brain region "R" is active when behavior "B" is undertaken does not mean that changes in "R" cause "B" to take place. The opposite, in fact, could be the case, in that when an individual displays behavior "B," brain region "R" is modified, and if this occurs sufficiently often, there are significant changes to "R." Yet again, the interplay between "R" and "B" may be so close that the only tenable conclusion is that there is no definitive causative factor—the one feeds upon the other. But we have to dig deeper than this, since the neural correlates detectable by brain imaging may question some aspects of our moral geography.

Take the case of the commonly drawn distinction between two forms of disgust—visceral and moral. On the surface these appear to be quite different, and yet visceral disgust, which is common to human cultures worldwide, may have formed the neural basis for the evolutionary development of moral repugnance.[14] Visceral disgust functions to protect bodily purity and integrity, for example, by preventing us from eating contaminated food. This core disgust is supposedly associated with socio-moral disgust concerning more abstract issues, such as our reactions to late-term abortion, homosexuality, embryo research, or murder. One fMRI study showed that overlapping brain areas are activated whether individuals experience visceral or moral disgust, the implication being that these emotions are related.[15]

Does this mean that there is no category difference between our responses to contaminated food and late-term abortion? Are our often firmly held moral intuitions thus little more than impulsive gut reactions rather than considered moral and/or theological positions? To argue that there are no category differences is a misinterpretation of the fMRI data. The common element is provided by "disgust," but this tells us nothing about why some people find embryo research, say, disgusting, but others do not. Moral judgments are not implicitly tied in to feelings of disgust, since levels of moral disgust can decrease (or increase) as we ponder the issues at stake.

Along similar lines, the case has been made that donations made to charitable causes activate the "reward system" in the brain, in a fashion similar to its activation by food, drugs, and sex.[16] In this fMRI study, it was found that altruistic acts, such as giving away money, lit up the primitive mesolimbic reward system in the brain. From this, the authors concluded that performing charitable acts may be hard-wired into the brain; they are not a product of culture or, one assumes, of moral reflection. In the light of this provocative conclusion, it is important to remember that fMRI images are based on nothing more than changes in blood flow in the brain regions concerned. While these changes are not to be idly dismissed, the conceptual gap between them and conclusions regarding the nature of altruism is vast and debatable.

Similar comments can be made about yet another study in the same genre. In this instance, fMRI was employed to examine the brains of subjects who were set the task of choosing whether to voluntarily give money to a food bank, or "to give" through mandatory taxation.[17] Surprisingly, perhaps, even when the money went to the food bank via taxation, the reward center in their brains lit up. The authors concluded that pure altruism does exist, since satisfaction was derived from an increase in the public good in the absence of any reciprocal benefit. However, activation of the brain region was greater when the money was voluntarily given. While these results can be interpreted in different ways, it is worth noting that two of the three authors were economists, whose interest was in determining taxation policy rather than in discovering how the brain works. It may be that the results are more enlightening to neuroeconomists than to neuroscientists, let alone theologians.

Regardless of the evidential basis for the conclusions reached, they present a renewed challenge to our moral and theological decision making to demonstrate that acts of kindness and altruism are indeed motivated by compassion and moral feeling rather than by a primitive urge for the good feeling produced by neural events. Renewed efforts are needed to provide a thoroughly grounded conceptual basis for the validity of altruism; otherwise, it becomes all too easy to assert that it amounts to little more than a drive for food or sex. The relationship between the rationale underlying altruistic acts and their neural basis is in urgent need of clarification. While I have no problem in contending that a neural basis for such drives does not in itself undermine our moral faculty, since the neural events are in no way causative, the task of substantiating this will be ongoing. From my perspective, this is a task that should be welcomed by theologians as a means of widening our horizons on the contribution that neuroscience can make to theology.

Regardless of such provisos, neuroimaging is being increasingly presented as evidence in courts of law to help determine culpability. In a number of high-profile cases, the defense has sought to admit brain images as evidence of mitigated responsibility for criminal actions.[18] While this has immediate consequences for the legal profession, it also has implications for Christian thinking around the notion of moral responsibility.

One of the great problems is that brain images are visually arresting, and hence, may prove dangerously persuasive, giving the impression of greater certainty than is scientifically justifiable.[19] Nevertheless, this apparent certainty is misleading, masking as it does the social and family context within which the individual concerned was raised, educated, and later lived. It also pays little, if any, attention to the belief system of the individual, and the role this may have played in his or her actions. Consequently, brain images should only be used in a court of law to establish a correlation between a structural abnormality and a specific deficit, not to demonstrate motivation, responsibility, or a predisposition toward a particular behavior.[20] Conclusions any firmer than this are premature, considering our relatively poor

understanding of the brain and its complex interactions. Nevertheless, even a moral evil, such as violence, or a moral good, such as altruism, has a neural substrate.

It is unfortunate that some researchers use this realization to dismiss moral and religious aspirations as nothing more than the outpouring of one neurotransmitter or another. In fact, one research group is experimenting with subjecting the human brain to patterns of electromagnetic bursts that, in some subjects, stimulate out-of-body or other spiritual experiences.[21] This apparatus, dubbed the "God machine" by some, attempts to mimic the cerebral "short circuiting" which, in some epileptics, produces religious visions.

In one study, the application of specific patterns of complex magnetic fields over the right temporoparietal regions induced fears, odd smells, or feelings of another presence, in the majority of subjects.[22] While some subjects believed one of the researchers had entered the room, others attributed the feeling of a proximal sentient being to "God" or "Allah" or some other spiritual being. Persinger has hypothesized that the sensed presence is produced by a transient awareness of the right hemisphere's equivalent of the left hemisphere's sense of self.[23] The machine's effects vary in intensity among subjects, depending upon how open they are to religious experiences. Increased global geomagnetic activity at the time of the experiment was correlated with increased feelings of a sensed presence, suggesting a mechanism for increased reports of apparitions and epileptic seizures at such times.[24] Sensory experiences such as these point clearly to the need to recognize them for what they are—neurally derived sensory experiences that may or may not have any connection with the beliefs and aspirations central to Christianity (or any other religion). Christianity does not necessitate these experiences. They are sometimes found in certain Christian groups, but never in others.

All too readily, writers can fall into the trap of claiming that religious sentiments are "nothing but" a matter of neural organization, or "nothing but" the outpouring of certain neurotransmitters. They conclude that what are needed are neurotransmitters, not prayer! This will seem like a rerun of the old neural determinism argument in modern guise; however, it should now be far more obvious than was once the case, that correlations do not provide immediate answers regarding causation. In addition, it always has to be asked whether the behavior or religious experience stems from a pathological occurrence of some description. After all, neural pathologies give rise to experiences that for some have religious overtones, just as other pathologies appear to wipe out previous religious commitments. In these instances, the task is to elucidate how the behavior and belief patterns of the individual before the illness, have been modified by the pathological phenomenon. To overlook the role of the abnormality is to fall into the trap of equating pathology with normality; even though we shall see in the next section that the border between the two can be murky, this is not the same as arguing that no distinction can ever be made.

## Enhancing Our Brains

We are coming close to being able to use the growing armamentarium of neurotechnologies to do a variety of things. If we can *predict* how people will act under certain circumstances, we have the ability to intrude upon their privacy as well as to use the data to scope out sophisticated marketing campaigns. The next step would be to *modify* people's brains by using drugs that would increase or decrease the levels of neurotransmitters in targeted brain regions. Intrusions of this order could be used for therapeutic or enhancement purposes, or to modify decision-making abilities. As with all technologies, there is ample room for every kind of good and evil use. But my concern is not with the ethical issues, as much as with the underlying concepts. To what extent have Christians begun to come to grips with these developments, since they have major pastoral implications as well as fundamental conceptual ones? A useful illustration is provided by efforts at enhancing performance, including cognitive enhancement.

In the neuroscience realm, one encounters papers with titles such as "The Promise and Predicament of Cosmetic Neurology," the accompanying description to which assures us that "advances in cognitive neuroscience make cosmetic neurology in some form inevitable."[25] In another place, we encounter the promise, "Artificial Brain Parts on the Horizon" which, it is claimed, will help people with Alzheimer's disease form new memories.[26] Is thinking like this scientistic hyperbole, or are we obligated to over-

come limitations imposed upon us by our genes and our environment? However we react to possibilities like these, or to less expansive ones such as university students taking cognitive enhancing drugs to improve memory and retention when studying for exams, we are immediately confronted by profound philosophical, theological, and ethical conundrums.

Cognitive enhancement refers to the enhancement of cognitive aspects of the brain, including reasoning, perception, memory, and judgment. It is the augmenting of some aspect of the human intellect, providing people with a better comprehension of complex situations, or enabling them to devise speedier and better solutions to problems. This is the realm of psychoactive drugs, the debate about which touches on their use in therapy and also, in the words of the President's Council on Bioethics, "beyond therapy."[27]

Clinical depression is a recognized clinical entity, but what of low-grade depression, an everyday reality for countless people? If this condition is not an illness, are some of the treatments illustrations of enhancement? If this concerns us, it follows that if some forms of depression are "normal," then we should refrain from treating them. However, is there any virtue in living with sub-clinical depression if it can be treated? What we are beginning to encounter here is the very fine line between the normal and the pathological.[28]

Take another illustration, this time concerning hyperactive children who push the limits of normal behavior to its utmost. What was once considered normal, even if disruptive, is now frequently regarded as pathological. Drugs like Ritalin (methylphenidate) appear to have converted taxing behavior into a syndrome that calls out for treatment. The dividing line between normality and abnormality, between therapy and enhancement, is very fragile. It has become difficult to decide whether what we have in this instance is an example of genuine medical treatment or social manipulation.

Even more problematic is the use of neurocognitive enhancers for nonmedical reasons. For instance, drugs such as Ritalin or Adderall (dextroamphetamine), originally aimed at people with attention-deficit disorder, and Provigil (modafinil), developed to treat narcolepsy, are widely used by healthy individuals. There is good evidence that they aid concentration, alertness, focus, short-term memory, and wakefulness.[29] Another drug, Donepezil (Aricept), originally developed as a treatment for Alzheimer's disease, improves recall of training when taken by healthy, but older, pilots in a flight simulator.[30]

The move from modifying the brain to correct a perceived defect, to modifying it as an enhancement, is a defining feature of the neurotechnology landscape.[31] Psychopharmaceuticals are increasing in popularity among the healthy who seek a competitive edge. An online poll conducted by the journal *Nature* found that one in five of the scientists and researchers who responded had used methylphenidate, modafinil, or beta blockers for nonmedical purposes to stimulate concentration, focus, or memory.[32] These drugs may prove especially beneficial in a competitive environment in which some people are already taking them, thereby encouraging or even coercing others into doing so.[33] Some refer to this as cosmetic neurology, and see its development as little short of inevitable.[34] Banning the use of psychopharmaceuticals to augment cognitive abilities raises philosophical objections from libertarians, alongside practical issues regarding enforcement.[35] This social (or quasi-educational) use brings us face-to-face with the aspirations of the affluent sections of society, aided and abetted by commercial pressures within the pharmaceutical industry. It also highlights the dramatic manner in which society's values and desires can shape the direction of scientific advances.

How are Christians to respond to examples of cognitive enhancement such as these? Their mundane nature is their allure, but also their deceptiveness. Some argue that all enhancement is to be eschewed in favor of acceptance of the "given."[36] However, considering Christianity's characteristic embrace of the healing ministries and the blurred distinction between therapy and enhancement, this stance is difficult to defend on theological grounds. For instance, Peters questions whether a Christian faith that emphasizes redemption should not also embrace "all forms of human betterment, even enhancement."[37] For him, a holistic view of health, as frequently championed by Christian anthropology, may even have space for the enhancement of the social and relational aspects of our humanity.[38] These pointers are at odds with the precautionary stance often encountered in Christian thinking, a stance that tends toward acceptance of the status quo

and rejection of technological interference—in this instance, with the brain.

Quite a different scenario is opened up by drugs that block the formation of traumatic memories, or erase them once established.[39] Nonconscious pathological memories can arise from trauma, such as in combat, rape, and horrific natural disasters, and may result in posttraumatic stress disorder (PTSD). By administering beta-blockers such as propranolol, it is possible to prevent the embedding of pathological memories of fearful events, just before or after the traumatic event.[40] Alternatively, if administered during flashbacks some time after the event, it is possible to erase the pathological memories.[41] However, these drugs can also be taken to erase unpleasant memories generally considered integral to normal human life. A speculative extension of this sees the development of drugs to remove all traces of guilt, shame, or grief in healthy individuals. This is speculative, and such far-reaching effects may never eventuate. Were they to do so, the theological ramifications would be major, since they would intrude into the inner sanctum of human existence, shattering the essence of what it means to be responsible human beings.

Of course, life is never this simple, and these drugs have side effects of varying severity and concern. For instance, long-term use of psychopharmaceuticals could permanently alter the brain by inhibiting the role of normal sleep to maintain neural plasticity and consolidate new memories. Scientific and clinical caution is, therefore, the order of the day in addition to the theological caution just outlined. However, excessive speculation should not be used as a way of constraining productive theological and ethical debate on the uses of beta-blockers in memory formation.

Savulescu and Sandberg have taken the neuroenhancement debate further by proposing the use of psychopharmaceuticals to enhance romantic love and marriage.[42] They suggest that artificially manipulating levels of testosterone, oxytocin, and other hormones may help decrease the rate of divorce by enhancing pair-bonding and attachment. We may or may not take this suggestion seriously, but it does force us to ask whether there are morally relevant differences between counseling and neurostimulation. In my view there are, since the former taps into human responsibility whereas the latter completely bypasses it. Ready acceptance of neurostimulation appears to reduce human beings to nothing more than psychological machines, controlled by hormonal and neurotransmitter levels. It is the "nothing more" that is the crucial marker of a deterministic world of psychological impulses and responses.

Herein lies the key to our approach to all of the therapeutic and enhancement possibilities just discussed. As in so many areas within biomedicine, their newness betrays their sameness. Few truly original considerations are raised by neuroethics, even though it is the center of our persons that is the object of attention—be it therapy or potential "improvement." From a Christian perspective, it is what we do with the knowledge and abilities at our disposal that is crucial. Why are we moving in a particular direction and making use of certain procedures? What are our goals and what do these tell us about our dependence upon God and our relationship to him through Christ?

## Neural Vulnerability

The extent of the interdependence between the brain and person is demonstrated by the way in which pathologies of the brain can have devastating consequences for the integrity and wholeness of a person. For instance, some patients with Parkinson's disease have been transformed from law-abiding citizens into compulsive gamblers and obsessive pleasure seekers as a result, it would appear, of the dopamine enhancers they are receiving as treatment for the disease.[43] Another example is provided by patients with damage to their ventromedial prefrontal cortex, who have impaired emotional responses and make aberrant, unusually utilitarian decisions when faced with a moral dilemma.[44] The significance of this is that it applies regardless of their moral or religious commitments prior to the injury.

Recent case studies on a unique individual with bilateral amygdala damage have revealed the role of the amygdala in mediating explicit responses to social and emotional events, in contrast to the prevailing conception of the amygdala as a primitive threat detector.[45] In particular, this patient is heedless of the appropriate interpersonal distance normally maintained by a sense of social comfort between individuals. While he or she can rationally comprehend others' sense of interpersonal space,

he or she simply does not feel the discomfort that too close proximity usually brings.[46]

There is clearly a causal relationship between injury to certain brain regions and aberrant behavior. As we consider each of these (pathological) examples, we are reminded that there is an intimate link between our physical brains and our standing as human persons. We are reminded of our vulnerability, in that any intrusion into the brain is an intrusion into the center of what we are as physical beings.

Similarly, a considerable amount of attention is being devoted to exploring a genetic basis for antisocial behavior. Particular attention has focused on a gene responsible for producing a protein, monoamine oxidase A (MAOA), involved in regulating a neurotransmitter, serotonin, in the brain. An association between this gene and aggressive behavior has been found in one particular family with a high incidence of violence.[47] A subsequent study by other researchers also showed a link between the MAOA gene and antisocial behavior if the individuals concerned had also been mistreated and abused as children.[48] An Italian court has recently reduced the sentence for a convicted murderer on the grounds that his genetic predisposition to low MAOA expression (in addition to abnormal brain scans) made him more prone to violence when provoked.[49] This may well be true, but there is a major conceptual leap from here to the conclusion that this amounts to a total lack of moral responsibility. A perspective more amenable to Christian premises will assert that the ethical road is to ascertain the degree of moral responsibility within a framework of low MAOA expression. Neurogenetics may have a role in determining culpability and its admissibility as evidence in a court of law, but this does not dispense with the necessity of a moral framework.

Seeking to refute deterministic neurobiology, Murphy points out that "interactions with the environment and higher-level evaluative processes alter neural structure. Thus, behavior is seldom controlled exclusively by neurobiology."[50] In addition, "our complex neurobiology enables us to conceive of abstract goals that become causal factors in their own right."[51] The neural basis of thought and behavior in no way threatens the conception of a person as a rational being, capable of taking personal responsibility as a free agent. Neither does it even hint that we cannot act as God's agents and stewards in his created order.

It is up to us as persons to determine what we do with both our abilities and restrictions (no matter how obviously neurally based some of these may be). We are to use the resources at our disposal, rather than view ourselves as prisoners of our inheritance. The information provided by neural studies and behavioral genetics should be used to increase our repertoire of understanding, so that we can come to terms with the behavioral conundrums with which we are all confronted. In the final analysis, it is we who decide how we live and act, and what we believe. For some, this freedom is severely restricted, due to developmental restrictions or later brain injury. However, most of us are in a position to play a causal role in how we live and what we do.

## Science as a Basis for Neuroethics and Neurotheology

It should have emerged that a great deal of care is required in handling the issues at stake, especially if we wish to bring a Christian mind to bear on the issues of neuroimaging and even neuromanipulation. It is unfortunate that in the domain of neuroimaging, hyperbole has outstripped scientific reality. Joseph Fins writes,

> Despite all the futuristic warnings, imaging studies can tell us very little about disorders of consciousness … Finding the balance will be the crux of responsible neuroethics but it may be difficult because neuroethics has developed as a speculative philosophy, rather than one grounded in clinical reality. It is neither therapeutically engaged, nor directed toward the needs of patients afflicted by neuropsychiatric disorders.[52]

Neuroethical discussion should begin with a clear understanding of the capabilities as well as the limitations of the technologies,[53] which should be approached within the context of clinical medicine, something theologians have to learn as well as others. Many members of Christian communities have to grapple with the clinical realities of their vulnerable brains, whether in the form of brain injuries or neurodegenerative diseases in themselves

or in their loved ones. It is these people whom we must be mindful of in our neuroethical reflections. Unfortunately, so much of the controversy around neuroscientific technologies is with their nonmedical uses, some would say with their speculative and ephemeral uses. We need to return to how these technologies might assist in understanding the human condition, both in sickness and in health.

The role of science in this debate is central, both ethically and theologically. It is a pity that theologians sometimes pay scant attention to the contours mapped out by practicing scientists and clinicians, looking instead to ideologically driven speculation that is, rightly, opposed. Unfortunately, in doing this, they tend to ignore the legitimate contributions of scientific understanding that serve to limit both humanistic and theological hypothesizing.

As suggested previously, neuroethics is not as novel as some have indicated. Nevertheless, the challenges posed by contemporary neuroscience are of an order of magnitude greater than anything else encountered in the biomedical realm, genetics included. As embodied individuals, all aspects of our mental functioning, including belief systems, attitudes, prejudices, and predilections, have neural substrates. This is not unique to the brain, since the functioning of other bodily systems also has physical and chemical substrates. Indeed, this constitutes the basis of traditional medical diagnosis. While the degree of sophistication is undoubtedly different, there is no difference in principle.

Dialogue between science and theology is central to the neuroethical debate, as it is to all other bioethical debates. Insight into the brain, its functioning and its malfunctioning, and the manner in which we respond to each aspect, is a theological imperative. Peering into people's brains takes many forms—insight into what individuals are, insight into their motives and aspirations, insight into what they are as beings before God and made in his image. These all have theological overtones that should be of profound interest to theologians and those with pastoral responsibilities. This is our inner sanctum and neuroscience is increasingly intruding into it. The ethical demands presented by neuroscience are daunting, paralleled only by the theological implications of an increasingly detailed understanding of higher neural processes. ⊡

## Acknowledgments

I would like to thank Maja Whitaker for her superb assistance at every stage in the preparation of this article.

## Notes

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