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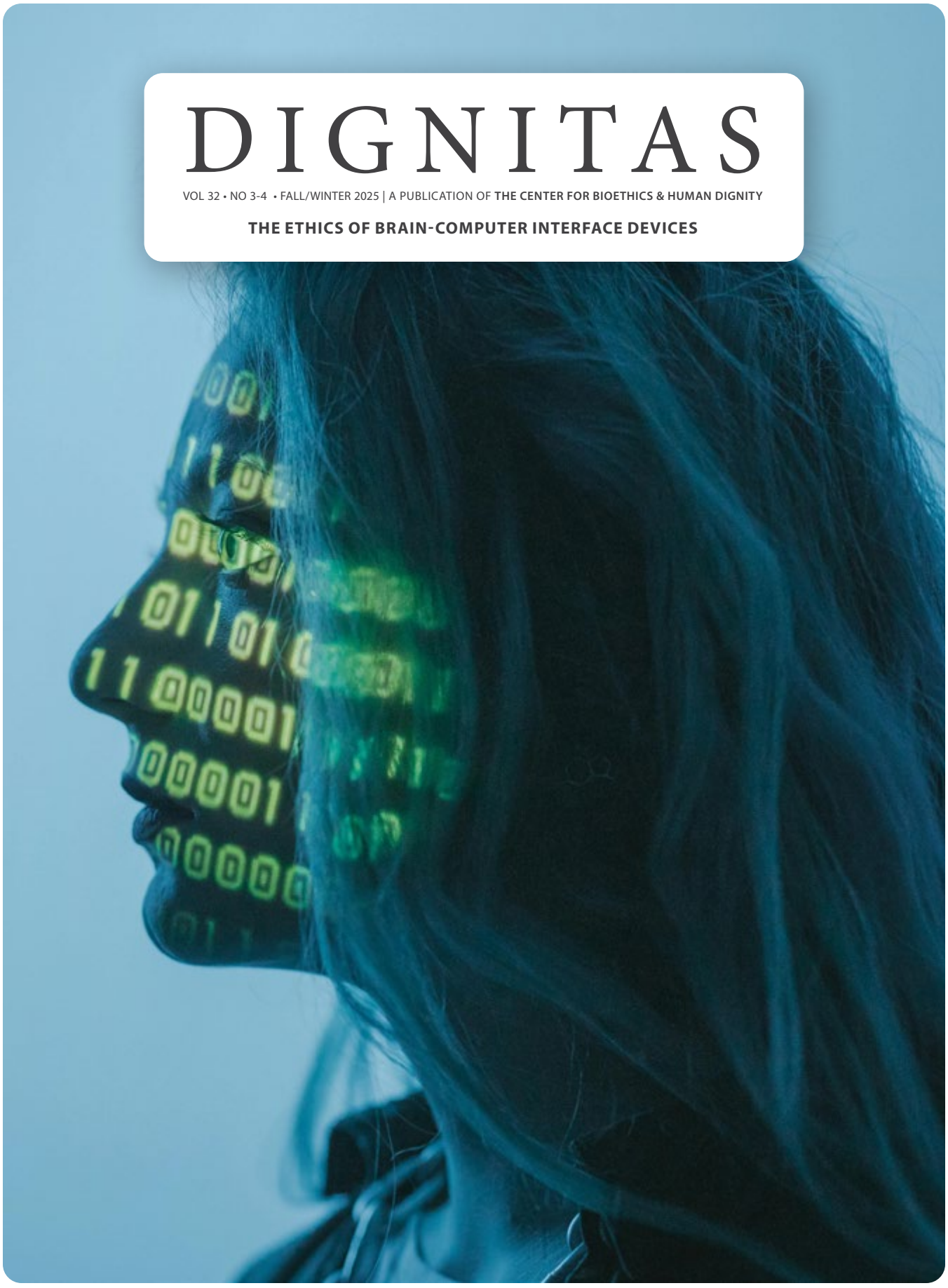
THE ETHICS OF BRAIN-COMPUTER INTERFACE DEVICES



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EDITORIAL

Anna B. Vollema, PhD (Cand.) | Managing Editor
Matthew Eppinette, MBA, PhD | Editor

Brain-Computer Interface devices (BCIs) are among the many emerging issues of our modern age, an era Michael Sleasman has termed "Bioethics 2.0." Whereas Bioethics 1.0 centered on questions of life and death, Bioethics 2.0 addresses the vast and global impact of rising technologies and the possibility of "redefining" what it means to be human.[1]

As Elon Musk's company Neuralink plans high-volume brain implantation of BCIs in 2026,[2] it is pertinent for Christian bioethicists to consider the ethical implications of such technology. This themed issue of *Dignitas* seeks to raise key questions and initiate dialogue toward a robust Christian exploration of the topic, probing such matters as BCIs' ability to promote or inhibit virtue, the relationship between the brain and the mind in its consideration, and the impacts of a Christian understanding of *Imago Dei* on its implementation. Each author has sought to avoid the extremes of technophilia and technophobia, instead probing key questions related to theological anthropology and how such truths should inform our use of BCIs to heal and not harm.

Also included in this issue, guest writer Richard Townsend provides a review of Michael Egnor and Denyse O'Leary's *The Immortal Mind: A Neurosurgeon's Case for the Existence of the Soul.* Heather Zeiger, CBHD's Research Analyst, keeps us informed on key bioethical news items and global health headlines. The wisdom of keynote speakers from CBHD's 2025 annual conference, *Living in the Biotech Century: The First 25 Years,* has been collated by Operations & Events Manager Bryan Just.

As the first in our articles exploring the ethics of Brain-Computer Interface (BCI) technology, Laura A. Cheshire investigates the implementation of BCIs (also called "Brain-Machine Interfaces" or "BMIs") in light of a virtue-ethic approach. In "Neuroengineering Hope and Harm: Ethical Dilemmas of Brain-Machine Interfaces," Cheshire asserts, "rapidly evolving technology requires an enduring, biblically grounded ethical framework that can guide us in ascertaining how the technologies in question may impede or promote virtue, and consequently, human flourishing." She traces the technology's history back to the 1970s and its development for research purposes. Due to brain neuroplasticity and advances in technology, BMIs can now bridge cognitive activity and physical interaction with the world. Thus, Cheshire probes such topics as physical safety, brain-to-brain interfacing, and cognitive enhancement to discern potentials for both hope and harm based on a Christian understanding of human flourishing. The virtues of love and stewardship, anchored in an understanding of humans as the *Imago Dei,* in contrast to a transhumanist vision of the human person, undergird her analysis. Chesire commends the possibility of restorative intervention with proper ethical boundaries and cautions against cognitive enhancement anchored in a transhumanist definition of being human.

William P. Cheshire provides a foundational analysis of the question, "What is the brain in relation to the mind?" Only with due consideration to such a question can one begin to grapple with the ethics of BCIs. He "defends the thesis that satisfactory answers to the difficult ethical questions

Anna Vollema and Matthew Eppinette, "Editorial," *Dignitas* 32, no. 3-4 (2025): 1-2.

raised by BCIs are to be found in a nonreductive understanding of human nature that recognizes that we are more than just physical matter." Exploring how the brain and BCIs interact, Cheshire notes ways this technology is incapable of fully expressing human thought and behavior. He then reviews the theological concept of the *Imago Dei,* emphasizing that it should not be reduced to merely physical properties but represents a relational dynamic with one's creator and savior. Describing the philosophy of substance dualism—the idea that there exists separate material and immaterial aspects to being human—in contrast to the view that human beings are merely or only physical, material beings, Cheshire promotes dualism as a Christian understanding of the human person. If science is allowed to reduce being human to merely physical properties, the immaterial mind is lost, and metaphysical questions are neglected. These technical, philosophical, and theological aspects of Cheshire's argument converge to honor the body, mind, and soul in his technological-responsibilist position, an approach that views technology as a non-neutral tool and examines ways in which it might promote or inhibit human flourishing based on how it is shaped and how it shapes human beings.

Fazale (Fuz) D. Rana focuses on ways BCI technology might be used as a restorative intervention. Considering those diseases or injuries that prohibit a person from fully interacting with the world (for instance, people with locked-in syndrome), the use of a BCI may provide hope when used ethically and responsibly. Wanting to correct the caricature of such technology painted by an oversimplistic critical approach, Rana provides an introduction to the distinction between invasive and non-invasive forms and their medical and nonmedical uses. He then uses these categories to explore brain-to-brain interfacing (BBI) and cognitive enhancement. After summarizing the key ethical concerns with the implementation of BCI technology, Rana turns to exploring personhood and the protection of human dignity. Refuting a functional view of personhood that affords dignity only if certain capacities are present, he asserts that a Christian perspective deems all human beings as possessing inherent worth. When considering the image of God, Rana suggests that the resemblance, representative/functional, and relational views all describe different aspects of the *Imago Dei,* and they should be integrated. However, he elevates the resemblance view for this article. Emphasizing a holistic dualistic account of the material-immaterial interaction, with the understanding that the mind and the brain interplay with one another, the use of a BCI for a person living with disability enables them to express those aspects of the resemblance view that they were previously unable to. However, he also cautions against wholesale acceptance of this technology, instead encouraging a case-by-case evaluation.

CBHD announced LeTourneau University as its new host school earlier this year. As "*The* Christian Polytechnic University," the institution shares our mission to provide theologically rich education in answer to pressing issues in science and technology. In partnership with the school, we will continue to foster dialogue, provide clarity, and produce resources that seek wisdom as we maneuver our ever-advancing Med-Tech world.

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3

Neuroengineering Hope and Harm: Ethical Dilemmas of Brain-Machine Interfaces

Laura A. Cheshire, BA | Guest Contributor

Introduction

Brain-machine interfaces (BMIs), also referred to as brain-computer interfaces (BCIs), have rapidly been gaining popularity as a topic of conversation for bioengineers and ethicists as well as for the public.[1] It is no surprise that a technology that promises to restore function to those who have lost it or who never had it in the first place would be so appealing. Headlines such as "Brain Implants Give People Back What They Lost" communicate that BMIs are a solution to neurological ailments such as paraplegia, which rob people of being able to engage with the world in the same fashion as those with fully abled bodies.[2] BMIs appear to be a very hopeful technology, but we must not be too quick to adopt such radical solutions to our ailments without proper consideration of the limitations and ethical concerns that may come with them. Rapidly evolving technology requires an enduring, biblically grounded ethical framework that can guide us in ascertaining how the technologies in question may impede or promote virtue, and consequently, human flourishing. As such, BMIs must be held up to a framework of virtue ethics as we attempt to establish which aspects of them are ethically permissible, if any. Doing so will inform further evaluation of how BMIs may be appropriately utilized in accordance with the virtues they may foster that embrace God's design for humanity or vices they may incite that guide us away from his design and dishonor God himself.

Background

BMIs were first devised in 1973 and quickly became a controversial area of research due to their alluring but intimidating potential.[3] With groundbreaking studies revealing the intricacies of neurons, researchers grew more interested in exploring brain structures and activity, particularly through the use of bundles of microelectrodes implanted in various locations in the brain.[4]

It was only a short time—less than ten years—before the capacity for recording neurons jumped from a few neurons at a time to one hundred neurons at a time.[5] This opened up a world of possibilities for neuroscience research. Implantable BMIs were developed during this time as well, with the original intent of analyzing the physiological structures of the brain. It quickly became evident that BMIs could be utilized not only for research purposes but also for practical applications such as neuroprostheses, assisting in the restoration of function for those who have impaired mobility—specifically, people with missing or damaged body parts or severe paralysis due to "trauma to the nervous systems, notabl[e] spinal cord injuries or neurodegenerative diseases."[6]

At the same time, many people regard BMIs such as brain implants with trepidation, uneasy with the idea of a machine embedded into the human brain. Though this wariness about new technology is not unwarranted, it is the case that many other technologies we view as commonplace today were once considered just as unnerving. For example, the cochlear implant, first successfully implanted in 1961 by Dr. William House and approved by the FDA in 1984,

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was not initially well-received.[7] As it became further developed and increasingly used, many continued to meet cochlear implantation with skepticism and opposed its use despite its success.[8] Keeping this in mind, we can approach the issue of brain-machine interfaces more openly.

BCIs or BMIs operate by processing the real-time brain activity of the user to manipulate external devices.[9] Through mechanisms including a sensor, decoder, and translator, brain signals can be processed and applied to a device—for example, a computer, robot arm, or drone—in order to coordinate unconventional forms of communication that do not rely on physiological functioning.[10] Most BMIs decode the subject's electrophysiological signals to determine the physiological intent. [11]

There exist invasive and non-invasive BMIs, both of which carry a set of immediate and long-term risks for the user.[12] Brain implants that are surgically interwoven into brain matter, such as those created by Elon Musk's company Neuralink, would constitute invasive BMIs. These are more accurate than non-invasive BMIs but hold more risk due to factors such as surgical complications.[13]

BMI Successes Due to Neuroplasticity

The implications of being able to train human brains to interact physically with the world by merely thinking about an action are astonishing. Noland Arbaugh, the first person to have been successfully implanted with a Neuralink chip, has experienced great joy in his newfound ability to control a computer cursor through electrophysiological signal in spite of his quadriplegia.[14]

The effectiveness of BMIs can be attributed to the incredible neuroplasticity of the brain.[15] The brain's malleability throughout the lifetime of a person makes it possible to build new neural networks continuously and allows for the brain to change in response to both environmental stimuli and activity within the brain itself.[16] For those recovering from a stroke, for instance, neuroplasticity plays a salient role in regaining motor function.[17] The fluidity of these rapidly evolving networks also means that synaptic connections between neurons can be altered and even eliminated should they go underused, establishing a "use-it-or-lose-it" phenomenon.[18]

Neuroplasticity uniquely equips the brain to perform motor tasks through a BMI in a way very similar to how it would when learning any traditional motor activity.[19] BMIs stimulate areas of the brain connected with natural sensorimotor training; instead of traditional sensory feedback being supplied, however, continuous information such as tactile and proprioceptive cues to simulate touch or physical sensations, intracortical microstimulation to trigger the somatosensory cortex, and most commonly, visual feedback, is sent to the brain via sophisticated technologies, equipping it to adapt to the interface.[20] BMIs such as those that enable users to control computer cursors most often utilize outgoing efferent signals to coordinate movements and are effective despite the lack of incoming afferent signals supplying sensory feedback thanks to the brain's effective adaptation to the BMI.[21] Through continuous practice, users of BMIs can improve execution of motor skills even after initial difficulties operating the interface.[22] This practice is what makes it possible for humans to experience brain remapping and thereby regard actuators as extensions of the body rather than foreign objects.[23]

Neuralink

Famed entrepreneur and tech enthusiast Elon Musk has made significant headway in this field through his company Neuralink.[24] Unlike other brain implants, those created by Musk's company consist of thousands of electrodes attached to threads that are precisely inserted into the brain and, remarkably, are wireless.[25] This surpasses other implants in that many cannot detect such specific neuron groupings and require external wires to function. It is no wonder then that Neuralink has seemed to revolutionize the world of brain-machine interfaces, even sparking competition that has led Chinese scientists to develop a similar, smaller wireless implant that may well prove superior once it moves beyond its early stages.[26] For those who experience physical disabilities that inhibit motor functioning, BMIs such as Neuralink have promised hope in being able to re-engage with society through digital communication and to participate in pleasurable activities such as chess or video games.[27]

At the same time, Musk proves overly concerned with technological progress for the sake of progress itself. While BMIs for those in whom disability impairs physical functioning seem considerably altruistic, Musk has also endeavored to engineer devices that push the limits of human-machine relations.[28] He has championed technologically progressive aspirations such as enhanced communication efficiency between people with the goal of creating a "symbiosis with artificial intelligence."[29] Even more, he has insinuated that humans must merge with machines if we do not wish to succumb to the inevitable threat of domination that AI poses.[30] It is in this sense that Musk could be considered a technological messianist, or one for whom technology appears salvific. To a person of that mindset, technology is not simply a tool to be used at the discretion of the person but a foreseeable extension of the self that must be embraced if we are to avoid the collapse of humanity. Without engaging with technology such as BMIs critically, however, one is at risk of overlooking severe ethical problems. What is further troubling, then, is that the negative aspects of BMIs are commonly brushed aside, minimizing the troublesome dimensions of the technology.[32]

Physical Risks

Only recently having been implanted into humans, invasive brain-machine interfaces such as those created by Neuralink pose an abundance of ethical conundrums.[33] As previously noted, the very act of placing an invasive BMI into the human brain puts people at risk, potentially leading to severe injuries.[34] This means that the benefits of the technology must be carefully weighed against possible physical risks. It also means that there must be consensus about what the technology is intended for exactly, whether it is being used for restoration or for enhancement.

Beyond the initial insertion process, the interconnection between the brain and a BMI calls into question the autonomy of the individual housing the implant due to the powerful cognitive shaping it stimulates.[35] If a human's neural pathways are being continuously shaped by the presence of the device, how can others be sure that the thoughts, feelings, and behaviors of said person are truly his or her own? While respect for autonomy is often a major consideration in the formulation of neurotechnologies like BMIs, there is simultaneously a weighty threat to a person's autonomy as the device

alters physiological mechanisms within the brain, rendering autonomy uncertain.[36] Not only are human social/relational engagements potentially compromised through these physical alterations, but informed consent is as well.[37]

The gravity of these risks requires considerable grappling with when considering the use of BMIs as a restorative tool. Given the assuring possibilities of BMI usage for individuals who lack the ability to communicate verbally or physically, there is a case to be made for permitting certain risks associated with the device. Subjecting individuals to these risks for the sake of enhancement, however, warrants censure. Matters such as brain-to-brain interactions and cognitive enhancement are ethically problematic to begin with, even before factoring in these physical risks.

Brain-to-Brain Interactions

The same technology that would allow for brain-to-brain interactions—what Musk so desperately yearns for—would be deleterious to individuality and authenticity.[38] The merging of human thought between individuals would threaten to eliminate dissent and uniqueness, both of which are fundamental to a progressing society. Having access to another person's innermost thoughts erodes the fundamental privacy humans have possessed since creation.[39] Neil Messer touches on this concern in his evaluation of brain reading, or the technique of using "electro-encephalography (EEG) or functional magnetic resonance imaging (fMRI) to gain knowledge of subjects' mental states or thoughts."[40] Not only does this technique reduce the human mind to mere biological mechanisms, but it is prone to errors and does not account for differences between and within individuals' brain activity.[41] Applications of brain reading are remarkable: It can be used in conjunction with brain-computer interfaces and to detect consciousness in individuals diagnosed with Unresponsive Wakefulness Syndrome (UWS), in addition to neuromarketing strategies and lie detection.[42] Though Messer addresses brain reading primarily in the context of the latter two situations, his argument regarding privacy holds true in the context of brain-to-brain interactions, such as those envisioned by Musk. Under the assumption that we all have a moral right to privacy, Messer, quoting Mark Tunick, concludes that losing our innermost form of privacy opens the door for manipulation and indignity as a result of "'being exposed or accessed by others without one's consent.'"[43] Moreover, the popular use of BMIs capable of brain-to-brain interaction would place humans on a trajectory toward a mental monoculture devoid of cognitive diversity and filled with fearful vulnerability.[44] Scientific progress would come at the cost of privacy and individuality, essential aspects of our humanity. In this way, the application of BMIs for brain-to-brain interactions suppresses human flourishing not only by deteriorating virtue but by cultivating vice.

Cognitive Enhancement

Another contentious aspect of BMIs is the prospect of cognitive enhancement.[45] The improvement of memory, attention, and mood beyond the realm of "normal" functioning is a thrilling prospect to those who see the physical human body as an obstacle to be conquered rather than a form of embodiment for the intrinsically valuable human being.[46] The quest for excellence can be seen as characteristic of our human nature.[47] Nevertheless, the definition of excellence itself and the means of reaching it are subject to questioning. How we determine excellence is contextually dependent; what could be considered excellent in one situation may not be in another. When these ever-changing criteria become the standard of living, those who fall outside the standard may face ridicule, as evidenced in discriminatory eugenic practices spanning over a century.[48] Furthermore, if the means to achieve this precarious definition of excellence require the use of bioenhancement, we have erroneously outsourced the matter to the realm of biotechnology.[49] Technologically altering human nature is not the solution to defining or cultivating a cognitively and morally "excellent" society. Rather, it disallows the conditions necessary to develop the very virtues that allow us to thrive.

Loving Our Neighbors Well

Here, we can turn to a Christian ethic to help navigate these troubling quandaries. Keeping in mind the risks brain-machine interfaces pose, there arises immediately the matter of disregarding the welfare of one's neighbor in favor of technological innovation (Mark 12:31). Allowing the lure of progress to obfuscate or supersede the good of the person, even those whom the technology is being created to help, inevitably leads to the abandonment of ethical standards that are integral to the cultivation of human flourishing in a biotech world. It is true that technologies developed with the goal of neurorehabilitation have proven to be more effective than standard care in terms of patient outcomes; however, the eagerness of developers to disperse these technologies appears to be outpacing the ethical and legal valuations necessary to ensure they are not at risk of compromising patients' rights.[50] Particularly in cases of invasive BMIs, which require an elaborate interconnection between a computer and a human brain, there must be more scrupulous ethical consideration, not less.

Being called to love one's neighbor as oneself compels us to consider the benefit and detriment posed by advanced technologies such as BMIs. Letting excessive technological wariness close off a potential route to improved flourishing could be said to be just as mistaken as abandoning ethical evaluations of technologies that carry such a great risk of harm physically, cognitively, and even existentially. In cases of severe disability, such as locked-in syndrome, the risk of surgical implantation may indeed be acceptable should it provide the possibility of increased engagement.[51] The improved communication achieved through this means aligns with our God-given design to be in community with one another, consequently contributing to greater flourishing (Gen 2:18).[52] At the same time, its application may prove unacceptable if shown to perpetuate societal inequities significantly by limiting access, or to threaten the privacy of the individual reliant on the device, particularly in cases where ethical assessment prior to and in conjunction with implementation has proven inadequate. Christians should consequently work to understand comprehensively the nature of emerging technologies such as BMIs so as to recognize both their potential role in serving the needs of neighbors as well as their unnecessary risk, altogether avoiding advocating for technologies that disproportionately threaten an individual's wellbeing or the wellbeing of society at large. It is then crucial for Christians to be prepared to help bear the suffering of individuals who may feel abandoned when promising technology proves ineffective, undesirable,

or dangerous and come alongside them in Christ-like community regardless of their physical, mental, or spiritual state (1 Thes 5:14; Gal 6:2).

Stewardship

Infatuation with technological advancement at the expense of sound ethics not only results in the neglect of our neighbors' wellbeing but of our role as stewards of that which God has given us (Gen 2:15; Deut 8:17–18; John 3:27).[53] The choices we make regarding how to create and implement technologies must be "informed by our values," not the other way around.[54] Ienca et al. suggest that "ethical values should be proactively incorporated at the level of design" rather than being disregarded until the technology is nearly complete, then used in ongoing evaluation while the technology is in use.[55] Without a Christian moral framework to guide us, we will inevitably become absorbed in earthly endeavors that fail to glorify God. Consequently, instead of stewarding what we have created, we risk wrongfully worshiping it and abusing it, a scenario seen clearly in Genesis 11 through the construction of the Tower of Babel.[56] Human creativity is not in itself wicked; in fact, our creativity resembles the creative nature of God himself (Gen 1:27).[57] This passage in Genesis warns of the hubris of humans who worshiped their own creation instead of their Creator, ultimately leading to their downfall. Humans have natural limitations that prevent us from ever reaching a state of equality with God.[58] Our sinfulness presupposes that attempting to remove power over nature from God's hands and ascribe it to humans inevitably results in disaster.[59] This in mind, we must not let the thrill of human capabilities diminish our recognition of God's sovereignty or make us lose sight of our obligation to honor him through the creativity he has gifted us with (Prov 3:9).

Fully Known and Fully Loved

Regarding the prospect of brain-to-brain interactions embraced by Elon Musk, it is crucial to remember that only God can fully know our minds (Ps 139:23–24; 1 Cor 13:12). Indeed, this is partly what makes the gift of salvation so miraculous (Rom 5:8). To regard the knowledge we could have of other persons through brain-to-brain interactions facilitated by BMIs as "God-like" or on par with the way in which God knows us is unarguably mistaken.[60] Endeavoring to invade the privacy of and alter the human mind through means of BMIs not only reduces humans to our biological mechanisms but attempts out of hubris to elevate human capacities. In fact, any knowledge we might obtain about somebody through this technology would be merely a distortion of how we ought to know and be known.[61] In our fallen world, we may very well be persuaded to inflate, diminish, or conceal aspects of ourselves if our mental privacy were stripped; similarly, we might be tempted to do the same to others depending on how it best served the matter at hand, altering the moral foundation of society.[62] We would appear to be uncomfortably close to a posture of divine judgement, albeit without the incomprehensible mercy we all desperately need (Rom 6:23; 1 Cor 4:5).[63] God knows us *fully;* he knows us outside of the limits of time and in the context of his salvation and justification, enabling him to judge us righteously (Gal 3:24).[64] Even the most sophisticated BMI lacks the capacity to rival the all-good omnipotence and omniscience of God. The reality of human depravity means that "biomedical enhancements, being part of culture, work to transmit the destructive effects of sin and have the potential to magnify human depravity."[65] As such, striving for a technology that seeks to imitate God in this way remains morally problematic; and, in the case that this kind of technology is normalized, holding to these truths of Scripture will be all the more important.

Image of God vs. Transhumanist Visions

Furthermore, Scripture makes abundantly clear that God created mankind in his image (Gen 1:26, 9:6; Col 3:10). The cognitive enhancement of human beings directly flies in the face of a sound theological anthropology. Champions of enhancement are eager to transcend the supposedly inconvenient limits of the human body, but our bodies have been declared good by God and are therefore not meant to be viewed as obstacles to a better life but as living sacrifices through which we serve God and others as exemplified in the life, death, and resurrection of Jesus incarnate (Gen 1:31; Rom 12:1; 1 Tim 3:16). Intervening in already healthy persons in order to cognitively enhance the mind denies the goodness of God's creation while simultaneously disregarding the inherent value of human beings regardless of ability (Matt 10:29–31).[66] Cognitive enhancement through BMIs promotes a transhumanist agenda that challenges the fundamentally sacred design of human beings and opts instead for an artificially manufactured society deprived of authenticity and diversity. This puts those who fall outside of the margins of the new "normal" in peril of being seen as lesser humans, or at worst, not human at all. Enhancements of the human mind are not a pathway to better humans but one leading to dehumanization. [67]

Conclusion

In summary, brain-machine interfaces are still an emerging technology that is subject to great praise and in need of greater scrutiny. While there seem to be genuine benefits to those with disabilities, there remain significant ethical predicaments that need to be grappled with seriously and intentionally: physical risk at the point of installation, uncertainty regarding privacy and autonomy, the dangers of cognitive enhancement, and struggles to carry out the Christian calling to love one's neighbor, to steward well the creativity we have, to avoid unrighteous judgement and distrust, and to preserve the dignity of all humans created in God's image. Is the answer, then, to abandon the technology of BMIs altogether? Fabrice Jotterand and James Giordano would say "no"; rather, more research must be conducted to assess appropriately the ethical applications of the technology.[68] There may indeed be a place for BMIs to assist in flourishing as restorative interventions if proper ethical boundaries are established. To do so, it is imperative a biblical ethical framework be consulted to determine how God intends humans to flourish. BMIs are just one of many technologies that, if developed and applied ethically, offer tremendous hope to persons facing suffering in our fallen world. Until BMIs are better developed and regulated, however, they will continue to be a morally precarious technology laden with unavoidable harms that Christians in particular should remain wary of, making certain to maintain a proper understanding of God's design for humanity so as not to lose sight of our calling to love the Lord with all of our heart, soul, and mind, and to love our neighbor as ourself, even in a biotech world (Matt 22:37–39).

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8

Homo Prostheticus: Theological and Ethical Implications of Brain-Computer Interface Technology

William P. Cheshire, Jr., MD, MA | Guest Contributor

Introduction—Sounds of the Future

"You sound like a glockenspiel!" These were the first words spoken by my daughter Ashley, in response to my words, "I love you," moments after her cochlear implant was activated, restoring the hearing she had gradually lost in her twenties as she became deaf. The technology of her implant is truly amazing, even if the quality of electronically simulated speech is unlike natural hearing. A tiny microprocessor behind her ear translates sound waves into electrical impulses and relays them to her brain by a wire threaded through her skull and deep into the inner ear, where it stimulates the auditory nerve. Restoring her hearing has changed her life. It has allowed her again to flourish, both socially and professionally. Through technology, a father whose words are music is now delighted to have what she whimsically refers to as a cyborg daughter.

Technologies that unite brain networks with computer circuitry continue to advance and astonish. Noland Arbaugh is a young man of the same generation as my daughter. At age twenty-two, he sustained a severe spinal cord injury from a swimming accident and became permanently quadriplegic, with complete paralysis and loss of sensation in his limbs. When he learned that Elon Musk was seeking volunteers for an investigational brain-computer interface (BCI), he applied, placing his trust in the entrepreneur famous for pushing the boundaries of technology. "The dude's done so many amazing things," he remarked in an interview.[1] In January 2024, Arbaugh became the first human to be implanted with Musk's Neuralink device. "It's always cool to be the first at anything," said Arbaugh, who is now enabled to move a computer cursor by thought.

Problematic Questions Arise

Even a cursory look at the implications of BCI technologies is to peer into a Pandora's box of problems. Questions arise not only for medicine, neuroscience, and computer engineering, but also for ethics, law, sociology, philosophy, and theology. The questions are too numerous to address comprehensively here, but in order to orient the reader to the complexity of the topic, a few deserve mention. What are the bioengineering possibilities? What additional neurological deficits might future technologies overcome? What are the acceptable and unacceptable risks to health? As the technology advances, who should have access to it? Should there be boundaries around acceptable use, and who decides? Should BCI use be limited to restoring health, or should we also permit use for enhancing human capabilities beyond what is possible naturally? Which human capacities should we value? Should we embark on radical projects to redesign humanity? How far should this technology go, and to what ends?

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If these questions make your head spin, you are not alone. In order to address them, more than an understanding of technological feasibility is needed. We must take a step back and ask, what is the brain in relation to the mind, and what does it mean to connect it with technology? Only then can answers to some of the ethical questions begin to come into focus, even as more questions inevitably will come. This essay The discoveries of neuroscience have not proven the brain to be essentially a computer, and to regard it as such would be tragic.

What Is the Human Brain?

We often hear of the brain described as analogous to a computer, defined functionally by its electrochemical activity in the same way that a computer consists of an assembly of electrical chips and circuit boards. Computers, so goes the narrative, are silicon-based replicas of what the brain happens to do with carbon-based molecules. Along this line of thinking, a fictional concrete-thinking neurosurgeon in the 2006 television drama *3 Lbs*[2] quipped that the brain is just "wires in a box."[3]

However, to think of the brain only in terms of its electrical activity is to greatly oversimplify its structure and function and to mistake its nature. The human brain is far more complex than any computer. It consists of a hundred billion neurons, each of which has, on average, some three thousand synaptic connections with other neurons—some as many as one hundred and fifty thousand connections. The brain is not reducible to cellular "wires." Within its inner recesses flow precise chemical exchanges of neurotransmitters and neuropeptides. Its synaptic connections are endowed with dynamic plasticity that selectively modifies their strength of communication. The mathematical implications of such rich connectivity are staggering. The number of synapses in the brain exceeds a hundred trillion. Thus, the number of functionally unique possible brain states is many orders of magnitude more than the number of elementary particles in all the universe.

There is much that neuroscience does not understand and cannot explain about the human brain. This is especially true regarding the nature of consciousness and nondeterministic behavior such as personal agency or free will.

The Brain and the Technical Grid

Whereas conventional technologies, such as electroencephalography (EEG), detect patterns of the brain's electromagnetic activity by recording from the scalp surface, Neuralink penetrates further into the cerebral cortex. The technology is quite remarkable. First, the skin is sliced open, and a hole is drilled into the skull. Then, a coin-sized electronic hub with more than a thousand electrodes is inserted and placed over the cerebral cortex. Projecting from it are sixty-four tiny flexible threads, each containing a bundle of minuscule wires, which are sewn into the cerebral cortex by a robot with tiny mechanical fingers in order to avoid puncturing arteries, so intricate is the procedure. The result is more than three thousand electrodes that record signals within a small slice of brain—for Arbaugh, in the motor cortex corresponding to intentional hand movement.

BCI research is actively pursuing functional limb prostheses and targeting still other brain regions with exciting prospects for restoration of lost function. Recent efforts to decode the neural activity underlying language have led to early yet ground-breaking developments in computers' ability to detect intended speech, offering hope to patients who, as the result of stroke or neuromuscular paralysis, are locked in.[4]

For patients who are minimally conscious, a language neuroprosthesis that bypasses the motor apparatus of audible speech would be a welcome clinical tool, enabling those who have lost the capacity for communication again to relate to others and to interact with their environment.[5] Innovative research is taking place also in technology to restore sight to the blind.[6] A subretinal photovoltaic implant has been developed to treat macular degeneration.[7] A bionic vision system that captures images and transmits signals directly to the brain's visual cortex has entered into human clinical trials in Australia.[8] Image resolution is low but is expected to improve with further developments.[9]

The brain's highly complex interconnectedness means that a thought is not just one discrete unit that can be captured by an electronic sensor. A word or phrase in the brain's language network is dynamically associated with other thoughts. Words may be associated with visual memories, influenced by the imagination, shaped by reason, guided by forethought, driven by desire, hindered by anxiety, arrested by fear, or inspired by hope. Whether a feasible BCI of the future might tap into multiple interrelated brain processes simultaneously is uncertain, but it should be kept in mind that increasing the number of contacts would multiply the invasiveness of the surgical procedure.

Presented with such revolutionary medical applications, it may be easy to overlook the inherent surgical risks. BCIs are not just another type of cool wearable device. They are invasive machines surgically implanted through a craniotomy. The potential risks of brain surgery are numerous and can include infection, hemorrhage, inflammatory reactions such as foreign body response, tissue heating, stroke, seizures, headaches, lead migration, lead disconnection, attenuation of effect over time, and unwanted effects of stimulation on targeted or adjacent brain tissue, including altered mental states. Currently, the device-related complication rate for deep brain stimulation by one or two electrodes is 2.7–3.4%.[10]

Rodolfo Llinás, an academic neuroscientist, proposes threading an array of nanoscale wire electrodes into the intricately arborizing cerebrovascular network in order to gain access to large numbers of neurons deep within the brain.[11] Such a procedure would avoid the need to drill a hole through the skull but could substitute other surgical risks. To be safe, these innumerable "wiretaps" penetrating into the brain must be biocompatible.[12] The long-term risks, which might include vascular perforation causing hemorrhage into the brain, are nontrivial and largely unknown.[13]

In bridging technical barriers, projects intended to fuse the human with his artifact probe the conceptual distinction between man and machine. At the single nerve level is the cochlear implant, which utilizes a multichannel microprocessor to extract sounds from the environment. The device detects pressure waves carried by air and converts them into digital signals that are conveyed as electrical pulses to the auditory nerve. The brain must then relearn to hear as it interprets environmental sounds in a new way. The sounds are qualitatively different, something like a musical piece played on a new

type of musical instrument, but meaning is preserved. Building on that technology, BCIs tap into other brain functions. Whereas the cochlear implant sends auditory stimuli to be received by the brain passively, the Neuralink device taps into voluntary motor output. Thus, more advanced future BCIs as mediators of intentional motor output could potentially render determinations of causal agency ambiguous. It might be unclear whether it was the person or the computer initiating the action. "The computer made me do it" could become a catch phase.

BCIs are quite a remarkable accomplishment, given the staggering complexity of brain signals, which a team of biomedical engineers has described as a "nearly impenetrable coding jungle."[14] Representing brain function within the circuitry of a digital prosthesis is like modeling a small slice of a three-dimensional structure in only two dimensions. Notably, the output is incomplete. Digital computers are deaf to the brain's higher-order analog processes and blind to its abstract concepts. There are domains of human thought experienced in the first person that are utterly undetectable and forever indecipherable by computational machine technologies.

Even more fantastic technologies are emerging. A novel research paradigm implants cerebral organoids[15] into damaged brains of laboratory animals with the goal of enhancing connectivity via organoid-brain-computer interfaces.[16] More than technical expertise about feasibility and safety is needed to evaluate such biotechnology. In order to calibrate our moral compasses in this bold new world of challenging questions, a valid philosophical framework is needed. For that framework to lead to blessings rather than curses, I submit that it should be informed by theological principles informed by the Bible.

Theological Considerations

Does demonstration that a human brain can be functionally connected to a computer mean that our brains likewise are just computers, our minds just molecules, our patients just physical bodies—rather than embodied souls? Are human persons a body-soul unity according to the traditional Christian account, or has science dispelled the myth of the immaterial by offering a convincing assessment of humans as fully reducible to their physical bodies? Regardless of how one answers this question, linking metal to mind tends to reframe our plausibility structures of human nature reductionistically in terms of matter and energy. The BCI is a physical device, and if it is used in ways that touch on personal identity or moral agency, then it matters whether humans are more than physical entities. Thus, in assessing BCI technology, healthcare professionals should consider not only the science but also the nature of patients under our care.

For the Christian, the doctrine of the *imago Dei* is an enduring theological north star. The book of Genesis describes the creation of human beings differently than that of the "creeping things and beasts of the earth" (Gen 1:24, ESV) and declares that God created humankind uniquely "in his own image" (Gen 1:27a). Nowhere does Scripture apply this label to any other living creature, nor to any humanly crafted artifact. This means that the most important conclusions to be drawn about the appropriate use of BCIs in humans extend beyond what can be learned from animal models or technology.

Efforts to define precisely the *imago Dei,* which all humans bear and which sets humans apart from all other animals, have not identified a universally recognized biomarker. Among the traits that distinguish humans from other animals are abstract reasoning, planning for the future, intentional decision-making, symbolic language, wearing of clothing, altruism, and spirituality. Some argue that rudimentary evidence of these traits can be found in some animal species, one example being vocal labeling by dolphins, elephants, and monkeys as an elementary form of symbolic language. Others argue that, as measured by abstract intelligence, humans stand apart not only in degree but in kind. To the extent that these traits are definable by physical criteria, increasingly they have been replicated by computational machines. The thoroughgoing materialist would be mistaken, however, in attempting to explain the significance of the *imago Dei* in purely physical terms within reach of and, potentially, manipulation by BCIs.

The *imago Dei* is not a physical, but rather a theological concept relevant to the creation, fall, redemption, and sanctification of humankind. The Bible does not define the *imago Dei* in terms of attributes, capacities, traits, or abilities, which differ in degree among individual members of the human species. Rather, the Christian tradition has long understood the *imago Dei* as the basis for being in relationship with God. Theologian John Kilner offers an elevated definition of the *imago Dei,* asserting that it "has to do with being created to conform to who Christ is as the image of God."[17]

Competing Models of Human Nature

What is man, that God is mindful of him, and his brain, that his electronic tools might interconnect with him? Analogous to the boundary between person and machine that BCIs in some sense bridge is the philosophical debate over competing models of human nature. One perspective is what philosopher J. P. Moreland and ethicist Scott Rae define as "substance dualism," which is "the view that the soul—I, self, mind—is an immaterial substance different from the body to which it is related."[18] "Immaterial" refers to that which exists but is not physical matter. An example of something that is real but not material is abstract mathematics; equations and geometric shapes exist in the mind as meaningful ideas but are not physical things that one can touch. "Substance" refers to a thing that exists, in contrast to a "property," which is an attribute that a substance may have. Regarding the human person, Moreland and Rae distinguish substance, which they define as "a continuant that remains the same through change," from a property-thing (i.e., an assembly of properties), which "does not sustain absolute identity through change of properties or parts."[19] If the human soul were a property-thing, they argue, then personal identity over time would not be possible because bodily cells normally undergo replacement over a lifetime. You might not now be the same person your parents brought into the world!

Dualists recognize that our bodies, to which BCIs and electronic wearables attach, is also, in some way, constitutive of our identity. In defining substance dualism, Moreland writes that "the human person is comprised of a soul (a fundamental, immaterial/spiritual substance) and a physical body, capable of existing without a body, but not without his/her soul, and the mental life of which is possessed and unified by his/her soul."[20] Philosopher Matthew Owen writes that it is the body that distinguishes contemporary

views of dualism from Cartesian dualism: "a human person is a hylomorphic object consisting of soul and body. Furthermore, the body is essential to a human person."[21]

By contrast, philosopher-theologian Nancey Murphy, psychologist Malcolm Jeeves, and philosopher Warren Brown hold that persons are purely physical entities. They appeal to science, which they believe has explained the soul away by providing physical explanations of mental processes. Whereas these physicalists recognize the starkly atheistic implications of an anthropology that radically reduces humans to matter, yet as Christians, they maintain that humans, though having no immaterial nature, are nonetheless more than the sum of their parts. In an effort to reconcile physicalism with Christian theology, they advance a "nonreductive physicalism" model, which proposes that higher-level physical properties emerge from complex lower-level interactions of cellular matter.[22] These emergent properties of mind, they reason, are what science compels us to believe define humanity in physical terms, in contrast to what used to be understood as the soul. But is this truly a scientific conclusion, or is it a philosophical assertion?

Body-Soul Dualism Is a Long-Held Model

Moreland points out that substance dualism accords with the common experience of freedom and personal identity and has withstood the test of time. He writes, "the overwhelming majority of educated and uneducated Christians throughout history have been dualists" who believe in the immaterial soul.[23] Belief in the soul is not just an academic question. It "has implications for the practice of medicine," writes theologian Todd Daly, "where virtues like faith, fortitude, hope, patience, and love (ideally) inform and uphold this most sacred enterprise."[24]

A medical ethos that would regard humans as bodies without souls sends shudders down the spine. The historian Richard Weikart reminds us that the history of medical ethics is a series of lessons in the tragic consequences of relinquishing belief in the soul and regarding human beings as simply physical objects. Weikart draws our attention to the ethicist Joseph Fletcher, who holds to a functionalist view, asserting that "human beings are not persons from the moment of conception or even the moment of birth; rather, they gradually develop into persons. By that view," writes Fletcher, "some humans are persons, and others are not."[25] Having defined personhood by physical criteria, Fletcher promotes euthanasia, and by similar reasoning ethicist Peter Singer justifies the option of infanticide.[26]

Has Neuroscience Disproven the Soul?

BCI technology draws from neuroscience, which supposedly has rendered the soul implausible. Detailed physical descriptions of brain states correlating with human thought have become the prevailing account of human mental processes previously attributed to an immaterial soul.[27] Jeeves writes of the "ever tightening links between mind and brain"[28] signaling a paradigm shift, such that "theological affirmations about the human person cannot ignore the findings of science."[29] Likewise, molecular biologist Francis Crick asserts that "You, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact *no more than* the behaviour of a vast assembly of nerve cells and their associated molecules."[30] Confidently, philosopher Patricia Churchland concludes that "the weight of evidence now implies that it is the *brain,* rather than some nonphysical stuff, that feels, thinks, and decides. That means there is no soul."[31] Is the question of the soul truly settled, or should we, with Moreland, lament this shift to reductionism?[32]

We must be careful not to confuse correlation with causation. Moreland and Rae explain that "the brain and the mind/soul are two different things or substances: the brain is a physical thing that has physical properties, and the mind or soul is a mental substance that has mental properties."[33] Accordingly, scientific investigation of physical properties of the brain can tell us much about neurochemistry, but it cannot directly detect an immaterial mind/soul.[34]

Literary scholar C. S. Lewis cuts through the philosophical fog with clarity by affirming the reality of an immaterial mind in his "argument from reason." The mind that reasons "must be able cognitively to stand apart from nature to comprehend nature. If mental processes were dictated solely by a deterministic chain of causation," he writes, then we "could have no reason to believe that scientific insights into nature are true and trustworthy rather than just a reflection of the way the brain's molecules happen to interact."[35] On this basis, physicalism is self-refuting, "because it undermines the validity of reasoning, on which all possible knowledge depends."[36]

Incomplete Knowledge through Reductionism

The scientific portrait of human nature, though detailed, is incomplete, and to appreciate fully the nature of humanity, one needs sources of knowledge beyond the reach of science. Returning to Crick's blunt assertion, when he claims that personal identity reduces to so many molecules, his words "no more than" betray a prejudice that, from the onset, excludes any consideration of the nonphysical. This prejudice is not an empirical fact that can be demonstrated scientifically; it is a philosophical presupposition. Crick's thoroughly reductive physicalism, in the words of physicist John Polkinghorne, "destroys rationality. Thought is replaced by electro-chemical neural events. . . . The very assertions of the reductionist himself are nothing but blips in the neural network of his brain."[37]

Moreland rejects reductionistic assertions as "irrelevant" to the evaluation of immaterial substance.[38] If the mind/soul is immaterial, then science (its method being limited to the physical) can neither access nor exclude it.[39] With philosopher William Lane Craig, Moreland reminds us that science is not the exclusive source of all knowledge. Abstract reason, wisdom gained through reflection, and divine revelation in Scripture also are sources of valid knowledge that present truths undetectable by empirical methods and that are, therefore, unassailable by technological innovations.[40]

Moreover, human knowledge is limited. Science awaits additional discoveries, and faith in an infinite God acknowledges further depths of knowledge (Isa 55:9). Ethicist C. Ben Mitchell and colleagues contend that, when scientists argue for a purely physical anthropology, they are "imposing their view of the world on their work and drawing metaphysical conclusions that simply cannot be drawn from their field of expertise."[41] Philosopher David Aiken agrees: "Settling metaphysical disputes by appeal to the latest scientific data . . . confuses the explanatory

categories of the sciences with those of philosophy."[42] Thus, exclusion of dualism is not a scientific verdict; it is a philosophical assertion.

In place of evidence, physicalists propose a curious model. Conceding that a radically reductionist account of human nature is incomplete, Christian physicalists seek to rescue human nature by introducing a higher functional property layer. Murphy agrees with dualists that the eliminative materialist philosophy of Crick and Churchland, grounded in atheism, "is utterly unacceptable to the Christian."[43] In place of the immaterial soul, Murphy proposes a nonreductive physicalism, which theorizes a higher-level property—mind—that emerges from the complexity of the physical brain and causally influences the brain in a "top-down" manner, in contrast to deterministic "bottom-up" chains of causation at the levels of atoms and neurons.[44]

Even nonreductive physicalists acknowledge the metaphysical to a point but, in the end, settle on empirical neuroscience and the prestige it confers. Jeeves concedes that "there are certainly great scientific benefits in the reductionistic approach as a methodological stance, but not as a metaphysical one."[45] Murphy agrees that "no amount of evidence from the neurosciences can ever prove dualism to be false or physicalism true."[46] At first glance, these statements seem to agree with substance dualists that science is unqualified to answer metaphysical questions about the soul. Elsewhere, however, these same scholars appeal to science as definitive support for their metaphysical stance. Jeeves writes that "dualisms of parts or substances will not do. There is no scientific evidence for them."[47] In refrain, Murphy writes, "if we take nonreductive physicalism to be not merely a philosophical thesis, but also the hard core of a scientific research program, there is ample scientific evidence for it."[48] Having cracked open the door to the metaphysical, physicalists have then drawn it shut, allowing in only science.

Physicalists' inconsistent statements relating science to metaphysics expose a weakness in their model. The claim that science validates nonreductive physicalism because it has not shown it to be false is logically fallacious.[49] Absence of evidence for a soul is not evidence of absence.[50]

Note the philosophical sleight of hand. Having asserted that science is the ultimate authority by which to understand human nature, these scholars then conjure from the physical an emergent mind, but this mind is not a scientifically defined property that can be objectively detected and verified; it is a rationalized philosophical construct.

Does nonreductive physicalism as a philosophical principle succeed in rescuing human nature from the reductionism of the physical sciences? And is it ethically sufficient for the healing professions? The physicalist account, though nonreductive, is still physical, and it falls under the spell of "scientism," which is the mistaken view that the exact sciences supply "the only genuine knowledge of reality."[51] Moreland calls nonreductive physicalism "weak scientism" in that it "acknowledges truths apart from science, granting them some minimal rational status," but when one gets right down to it, regards science as "by far the most authoritative sector of human knowledge."[52] Thus, weak versus strong scientism is a distinction without a difference. Philosopher Gordon E. Carkner sums up why weak scientism fails: it is essentially "a metaphysical claim about the impossibility of metaphysics."[53]

The physicalist view is also ethically suspect because its embrace of scientism renders value judgments meaningless. Physical descriptions might show how the brain reasons, but they cannot establish how it should reason. "Nor can a scientific description limited to factual knowledge about the brain inspire the care of the sick or resolve difficult dilemmas in medical ethics," wrote this author, adding that "a materialistic appraisal of human nature would thus impoverish medicine. The obligations to love one's neighbor (Lev 19:18; Mark 12:31) and serve one another (Gal 5:13) would make little sense if the ethos of healthcare were based on the lonely view that patients are essentially churning aggregations of molecules."[54]

Physicalists slip into a philosophical category error by explaining consciousness not as a substance but as a property derived from other properties. For example, Brown explains consciousness as "emergent in a sense from our brain function," adding that "patterns of electrical activity modulating over the surface or in the cerebral cortex . . . give us that moment of consciousness."[55] Paying close attention to his language, who is the "our" and the "us" that possesses this consciousness, if not the soul as the bearer of mind and identity?

Personal Identity Through Time

By denying substance, which remains the same through physical change, physicalism invalidates the central Christian doctrine of a bodily resurrection, in which the person who is resurrected in Christ is the same person who died. Theologian Scott Smith writes that, if we are "just a bundle, or set, or physical properties," then when Jesus' body died on the cross, *"Jesus the human person also died* (i.e., ceased to exist). Now, if humans are physical things, then the Jesus who died is not identical with the Jesus who was raised, for their respective bodies had different properties. That implies that Jesus did not survive his death on the cross."[56] Smith continues: "for it seems [that according to physicalism] we too cannot survive our deaths and be resurrected."[57] Similarly, the Apostle Paul writes that, "if there is no resurrection of the dead, then not even Christ has been raised" (1 Cor 15:13).

Aspects of personal identity essential to Christian theology include the capacities for belief, free will, and moral responsibility. An unresolved problem for physicalism, writes Aiken, is "whether responsible agency and the capacity for moral self-transcendence can be adequately understood as emerging from the material conditions under which they operate."[58]

Murphy acknowledges that personal identity over time is a difficult question if there is no soul,[59] while affirming the "reassembly view."[60] Here, "the entire person simply disintegrates at death, to be recreated by God at the general resurrection."[61]Moreland, however, challenges Murphy's claim of mereological essentialism as just an assertion for which she provides no justification.[62] If the person is no more than "a mereological aggregate" (a system comprising parts), then it loses identity when its parts are altered and has a different identity if its parts are reassembled.[63] The dualist view, by contrast, holds that the person is an essence that endures despite accidental changes to its physical features[64] Referring to the resurrection, Paul writes of the mystery that not a reassembled body but "this mortal body must put on immortality" (1 Cor 15:53). In this life, physicians minister

not to aggregates of molecules but to people who, though they will die, yet shall live (John 11:25).

Implications for BCIs

The astute reader will notice that the three strands of discussion thus far, the technical, the philosophical, and the theological, are complementary. They converge at questions of how to think about linking computers to the brains of human beings who are constituted by bodies, minds, and souls. Viewing humans holistically, scientific data cannot tell us all we need to know to make good decisions about BCI applications. Viewed through a technological lens, the line distinguishing persons from computers blurs. If technology alone is in focus, then persons may seem to be downgraded to the status of machines.

It bears emphasizing that persons are not simply aggregates of matter with brains that can intertwine with electrodes and seamlessly integrate with computers. If persons are more than their physical brain states, then there are immaterial aspects of humanity intangible to BCIs, which detect and interact with only the brain's electrical signatures. It follows that a BCI might probe or even manipulate neuronal function, but it cannot directly tap into or alter the *essential* identity of the immaterial mind or soul. As a corollary, if the mind is not an epiphenomenon of a nonreductive physicalist process, then we should not expect computers that have reached a certain level of complexity to thereby become conscious beings.

BCIs do, however, have the potential to alter a person's *accidental* identity, which is contingent on physical influences on the brain or body that, while not changing one's essential identity, can influence perceptions of the world, desires, or beliefs. In this sense, BCIs are like psychopharmaceuticals[65] or transcranial magnetic stimulation,[66]although they are more directly invasive. The full potential of BCIs is, therefore, difficult to forecast.

Human beings are more than molecules. They are embodied souls. For physicians entrusted with life-or-death matters in the care of suffering souls, physicalism offers no adequate ethical basis for compassion, empathy, and concern for those whom we should love as Jesus does. Regardless of the language used to describe persons, we are called to love our neighbors (Matt 22:39), not as material aggregates, and not as plug-in modules, but as fellow persons. By restoring lost language or mobility, a BCI might enable someone to express love better, but it can never be the source of love. If a BCI alters one's accidental identity, the aim should be to restore or preserve one's essential identity.

A Proposed Ethical Framework

To help navigate difficult questions about the use of technology, ethicist Michael Sleasman proposes an ethical framework consisting of four categories.[67] One prefers a world with less technology. Another likes technology too much. A third seeks a just-right balance but overlooks the values needed to know where that balance should lie. The fourth is the way of wisdom and responsibility. In unpacking them below, note that each draws from different presuppositions about what it means to be human and leads to different conclusions about BCI applications.

Technological Sentimentalism

The technological sentimentalist instinctively resists technological innovation. Neuralink, bionic eyes, and cochlear implants seem to be a further step along a path that is already fragmenting human communication as we attach ourselves more and more to smartphones and find it difficult to unplug from electronic connectivity. They are attentive to how current communication technologies seem to erode kindness in how we treat others, as if people were machines. They worry that connecting more directly with computers might mean disconnecting from people. They are nostalgic about what is remembered as a more natural way of inhabiting the world. Of course, someone in need of an implant to restore lost function is unlikely to be a pure sentimentalist.

Technological Messianism

Technological messianism is the opposite of sentimentalism. This perspective regards all technology as intrinsically good and desirable. It applauds the prospect of restoring communication and mobility to a quadriplegic to improve his quality of life. The optimism of technological messianism traces to the European Enlightenment, which elevated reason as the supreme means by which we can understand the universe and obtain progress. Unless guardrails are imposed, technological messianism tends to assess technology uncritically, overlooking unintended bad consequences and conceding to a form of fatalism that says if it can be done, it is inevitable that it will be done, and therefore it might as well, or even should be, done.

As an example, an electronics engineer writes of BCIs: "Inspired by its benefits, the society needs to seize the available opportunities that the technology advocates."[68] The phrasing "technology advocates" suggests a technological imperative, as if the BCI device had personal agency of its own. Consider also this comment by a neurosurgeon: "No neuron is safe from a neurosurgeon. We can really go anywhere in the brain with considerable safety. We can either drive a circuit, or we can suppress pathologic activity within circuits."[69]

Technological messianism opens a door to the philosophical movement known as transhumanism, which looks to technologies such as BCIs as the means to re-engineer humanity in order to overcome existing human limitations and enter into a radically different posthuman future.[70] To the Enlightenment project, the given human body is an obstacle to the will to power. If one believes that human nature is the product of an undirected evolutionary process whereby chance mutations favorable to survival prevailed, then there would seem to be no reason we should not take control of human evolution if technology gives us the powers to do so, or so the argument goes. A 2002 manifesto on *Converging Technologies* published by the National Science Foundation explicitly recommends technology as "an important next step in human evolution."[71] One of its authors writes, "we may not have yet reached our final evolutionary form. Since we are still evolving, the inescapable conclusion is that nanotechnology can help drive our evolution."[72] Another writes, "What will human-like intelligence evolve into if it is freed from the limits of the human meat-machine, and humans can change and improve their own hardware? It's hard to say. . . . No death. You back yourself up. You get new hardware as needed."[73]

It would be easy to dismiss such preposterous assertions as bizarre, fringe, or sci-fi dreaming if they were not published by mainstream (and well-funded) experts. Elon Musk, the tech billionaire who cofounded the company that produced Neuralink, confides that "the long-term aspiration with

Neuralink would be to achieve a symbiosis with artificial intelligence."[74] How far from humanity as we know it is transhumanism poised to go? Julian Savulescu, a neuroethicist, predicts that "Humans may become extinct. . . . We might have reason to save or create such vastly superior lives, rather than continue the human line."[75]

We must be discerning, scientifically and theologically. As Christians, we know who the Messiah is (John 10:27). When he returns, retaining the human nature that he took upon himself as the incarnate Son of God, what version of humanity will he find on earth (John 1:14; Phil 2:6–10)?

Technological Pragmatism

The pragmatic perspective, which is the prevailing attitude among secular ethicists today, looks to usefulness as the ultimate measure of right and wrong. A pragmatic approach to BCIs calculates how much benefit is possible for how many people and balances that against how much harm might occur. The answer is a risk-assessment calculation. In ethical theory, pragmatism is a form of utilitarianism, and it has certain blind spots of which we should be aware. Pragmatism is appealing because it seems objective, but it presupposes that empirically verifiable physical facts are the only valid knowledge. This is an illusion, for it omits value assessment and the immaterial. How should we measure good? How do we define better? Is it to maximize pleasure, speed, or relationships? Is it right to implement a technology that causes a small minority to suffer harm if, on the balance, a greater number benefit? Adrift from any shared concept of values, pragmatism tends to descend into moral relativism. To live as a secular pragmatist is to live as though there is no God. But, as Solomon reminds us, pleasure ultimately is meaningless (Eccl 2:1), and higher purpose may be found in the wise but not always pragmatic, approach of fearing God and keeping his commandments (Eccl 12:13; Prov 1:7). Biblical wisdom towers over our expedient plans.

Technological Responsibilism

The responsibilism approach to ethics recognizes that technology is not neutral, as is commonly assumed, but is laden with the values of its human designers and implementers. The applications of technologies such as BCIs may also be shaped by—or shape—the values of its users. In promoting human flourishing, it matters therefore what one believes it means to be human. For the Christian considering whether to implant or to receive a BCI, an attitude of biblically informed responsibilism usually does not provide simple yes or no answers but prompts questions of discernment. As the human is not reducible to his or her material constituents, the person receiving a BCI is not a material extension of a technological apparatus but an embodied soul bearing the image of God. For this reason, ethical decisions about the use of BCIs must be made after careful reflection, with great care, and with reverence for the *imago Dei*.

If you were to receive a brain chip, would its functions enable you to do justice, love kindness, and walk humbly with your God (Mic 6:8)? Would your new capabilities ennoble your character? Would you have the option of switching off a BCI that enhanced sensory information from your environment? Would a BCI that piped streams of information introduce noise to distract from your prayer life? If a BCI connected to artificial intelligence were to anticipate your thoughts or mediate your actions, could you be certain they were your own?

Future direct brain-to-brain electronic connections might render some of one's private thoughts transparent, just as, before a word is spoken, Psalm 139:4 tells us that God knows it altogether. But would removing the veil of privacy truly enhance human communication? Would you feel comfortable letting someone else browse your most personal thoughts if the implant took away your ability to filter them? Elon Musk has said that he wants to use Neuralink to speed up the rate of communication between people by a factor of a thousand.[76] Scripture, on the other hand, cautions Christians to be "slow to speak, slow to anger" (Jas 1:19; also Prov 14:17).

Looking forward, technology that taps into memories and fears might one day cure posttraumatic stress disorder or panic disorder, which would be welcome developments. However, the same technology might also be used by authoritarian regimes to monitor and control political or religious thought or to provoke targeted panic. Could such applications be prevented, were the technology to be developed? Could attainment of such power be trusted?

Christian responsibilism appreciates the reality of human sin and recognizes the potential perils of allowing BCI technology to drift in whatever way it may. Unless one has a valid moral compass, downhill descents are more probable than heavenly ascent. Responsibilism also guards against what may be the greatest danger of BCIs: hubris. If we are to address the numerous ethical questions raised by BCIs in a way that pleases God, promotes rather than obstructs the Holy Spirit's formation of Christlike character in our minds, and helps us to serve our neighbors, we require less hubris and more humility. That cannot be achieved by turning a knob on a device but only through intentional thought, reasoned reflection, compassionate engagement, and prayer.

Conclusion

Mr. Musk is correct that humankind needs an implant, but not the kind he thinks. BCI technologies represent one of the finest examples of what the Apostle Paul in 1 Corinthians called the "wisdom of this age or of the rulers of this age" (1 Cor 2:6), which in time will pass away. In contrast, believers in Christ have access to the "hidden wisdom of God" (1 Cor 2:7), so that "we might understand the things freely given us by God" (1 Cor 2:12). God has given us not a machine to insert into our heads but, through his Spirit, insofar as we abide in Christ (John 15:3-5), we have access to "the mind of Christ" (1 Cor 2:16). This is a wonderful mystery. Lesser substitutes will inevitably disappoint.

One aspect of having the mind of Christ, as Scripture reminds us over and over again, is that we should not fear. Rather than just compute what is digitizable, calculable, feasible, and monetizable, we are commended to think on whatever is true, honorable, just, pure, lovely, commendable, and worthy of praise (Phil 4:8).

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17

Brain-Computer Interface Technology's Impact on Human Personhood, Identity, and Dignity

Fazale "Fuz" Rana, PhD | Guest Contributor

In 2021, a research team from the Howard Hughes Medical Institute reported a significant advance with exciting potential for people with locked-in syndrome—a condition caused by brain injury, stroke, or diseases such as amyotrophic lateral sclerosis (ALS) that render patients unable to speak.[1] The research team surgically implanted an array of electrodes in the motor cortex of a 65-year-old male who was paralyzed from the neck down due to a spinal cord injury. Using a machine-learning algorithm, the researchers trained the device to convert patterns of neural activity into letters by asking the patient to imagine writing letters. With the device, the patient could "write" 90 characters per minute (between 8 and 18 words) with an error rate of around 5%. (The average smartphone user can type about 115 characters per minute.) With an autocorrect feature, the error rate dropped to 2%.

In 2023, the same team extended their work by developing a speech-to-text device implanted in the brain of a patient with ALS who could no longer speak. A neuroprosthesis consisting of two microelectrode arrays was implanted in a small area of the ventral premotor cortex and a small part of Broca's area. This brain region, located in the left frontal lobe, serves a crucial role in speech and language production by coordinating motor functions for speech, helping articulate words, and forming sentences. The researchers trained a recurrent neural network to convert brain activity into text at 62 words per minute.[2] Normal human speech produces about 160 words per minute. Using a general English vocabulary of 125,000 words, the patient produced text with an error rate of 23.8%. For a smaller word set of 50 words, the error rate was 9.1%.

The researchers improved their neuroprosthesis in 2024 by designing one that required microelectrode arrays to be implanted only in the left ventral precentral gyrus of the brain's frontal lobe.[3] This new device, which converted neuronal activity into text and text into speech via a voice synthesizer that mimicked the patient's pre-ALS voice, achieved an accuracy rate of 99.6% for a 50-word vocabulary and a 90.2% accuracy for a vocabulary of 125,000 words. With further training, the neuroprosthesis helped the user attain a 97.5% accuracy for the larger vocabulary. By the end of the study, the patient could carry out conversations at a rate of 32 words per minute.

These neuroscientists hope that their work will lead to clinical devices that help people with locked-in syndrome regain the ability for rapid communication, stave off isolation and depression, and improve their quality of life. Access to these neuroprostheses could even shape end-of-life care for such patients.

Reports like these have become commonplace in the technical literature, and they highlight the remarkable advances that have taken place with brain-computer interface (BCI) technology. BCIs may revolutionize clinical treatments not only for people with locked-in syndrome but also

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for amputees and people with paraplegia and quadriplegia. Beyond medical use, some technologists are eyeing BCI technology for nonmedical applications (such as education and gaming). Others recognize this technology's potential to provide cognitive enhancements for healthy individuals. Some bioengineers are even exploring BCIs to tether human brains together.

All of these applications—medical and nonmedical—raise a host of ethical questions. For Christians, BCIs also present theological questions. For example, how does BCI technology affect human personhood, identity, and dignity? This paper makes the case that BCI technology can have a positive impact on personhood, as it is defined in relationship to the image of God, and consequently human dignity. I assert that personhood arises out of God's image. I maintain that the image of God entails aspects of ontological, functional, and relational qualities, and all human beings exist in the image of God. Yet, those functional aspects evidenced by the call to advance human flourishing and steward the Earth (Gen 1:28) can be aided by advances in BCIs. However, some of the cutting-edge applications of such technology raise significant ethical concerns, many of which also intersect with questions about personhood, identity, and human dignity. Thus, the technical complexity of this advancing form of technology renders it difficult to generalize its impact. It must be assessed on a case-by-case basis.

For a Christian perspective to impact our culture regarding this exciting and, at times, frightening emerging biotechnology, it is critical to engage the actual state-of-the-art technology and not a caricature of it. Unfortunately, it is not uncommon for people to react to the hype surrounding BCIs instead of engaging the actual work that is being performed by bioengineers. Furthermore, as Sun and Ye point out, people sometimes discuss ethical issues from a general standpoint that neglects specific features and applications of BCI technologies.[4]In short, to effectively engage ethical and theological issues, a Christian must possess an informed understanding of BCI technology.

Introduction to BCI Technology

One of the most significant milestones in BCI technology came in 1973, when Jacques Vidal, a computer scientist from UCLA, proposed the idea that the brain's electrical activity could be used to control external devices.[5] However, due to the requirement for real-time processing of vast amounts of data, bioengineers made little progress toward fulfilling Vidal's pioneering ideas and vision for BCI technology. In the last several years, BCI research has moved into the mainstream with an explosion of research publications and breakthroughs.[6] Two factors help explain this dramatic change. One is the increased power and decreased cost of computer hardware and software along with growing insight into brain signaling. It is now possible for researchers to reliably direct brain electrical activity into external hardware. The second factor is sociological; BCI technology is now viewed positively. According to Nicolas-Alonso and Gomez-Gil, "The chances of using BCIs as auxiliary technology that might serve severely disabled people has increased social acceptance in this field and the need to accelerate its progress."[7] As a result, BCI technology is beginning to transition from the lab to clinical settings.

The key conceptual principle behind this technology relies on the discovery that the activity within networks of neurons located in human brains constitutes actual information of the same character as that transmitted between machines. Accordingly, this neurological information functions as a control system for humans in the same way that control systems use information to regulate machines' activities. For this reason, information can flow from a biological system to a machine, directing the machine's operation. In turn, information can flow from a machine to human brains, providing feedback about the external world.[8] The discovery of electrical activity in animal and human brains and the invention and clinical use of EEG technology affirm this key principle.

Types of BCIs

Several excellent reviews describing BCI technology in detail have been published.[9] For convenience, this paper will summarize key features relevant to this study. Researchers use different schemes to classify BCI technology. One of the most useful categories describes the invasiveness of the technology.

Noninvasive BCIs

This type of system usually involves fitting a modified EEG cap on the patient's head with electrodes that contact the scalp. These contacts pick up electrical activity in the brain. An obvious advantage of this BCI is that it does not require surgery to install. Unfortunately, it suffers from poor resolution and signal strength.

Semi-Invasive BCIs

To overcome the limitations of noninvasive BCIs, bioengineers have explored placing electrodes directly on the brain surface. This approach eliminates the signal loss that occurs when the electrical activity from the brain passes through the skull and scalp. However, it requires surgery to position the BCI on the brain surface. Earlier versions required wires to pass through the skull and scalp. This issue has largely been resolved with Bluetooth® technology, but the technique still suffers from poor resolution.

Invasive BCIs

Some biomedical researchers have sought to improve the resolution by directly implanting these systems into the brain. This approach allows researchers to stimulate and record the average electrical activity of thousands of neurons in specific regions of the brain. Unfortunately, this improvement comes at a cost. The process of inserting electrodes into the brain can damage tissue, lead to scar formation, and trigger an immune response. Over time, glial cells in the brain migrate to the electrodes and coat them, which leads to loss of function.

Neuralink has developed a BCI that improves upon the limitations of invasive systems.[10] Instead of using rigid, fixed geometry microelectrodes, Neuralink's technology relies on more flexible gold filaments that are coated with a biocompatible polyimide polymer. These two features prevent bleeding and damage to brain tissue when the microelectrodes are inserted. They also reduce the brain's immune response. Neuralink has also developed a microsurgical robot capable of inserting

6 threads per minute, which allows each thread to be inserted into the brain with exacting microscopic precision. This process permits the BCI to be implanted into specific brain regions while avoiding blood vessels.

Work in BCI technology focuses on creating efficient channels for the information flow between the human brain and the machine. There are five sequential stages to this information flow: (1) signal acquisition, (2) preprocessing or signal enhancement, (3) feature extraction, (4) classification, and (5) the control interface.[11] These five stages capture the brain's electrical activity for mathematical processing in a way that renders it usable for controlling external devices.

The goal involves converting these patterns into signals that communicate the patient's intentions to the external device and, in doing so, provide the user with the means to control an external device. The most common means of converting intention into action is referred to as active BCI, by which the user trains with the BCI to either learn to modulate their brain activity (by imagining they are moving their arm, for example) or to train the BCI system using machine-learning algorithms to decipher user intent.

Coupling Artificial Intelligence and BCI Technology

One of the most significant advances in BCI technology involves coupling it with AI. This pairing improves the accuracy and reliability of these systems.[12] AI systems are adept at recognizing patterns in complex data, making them ideal for processing the electrical information coming from neural tissue and deciphering user intent, particularly for more sophisticated and complex applications. AI-driven BCI systems are also adaptable, and they process information instantly, whereas traditional BCI systems can take up to several seconds to complete this step.

Combining AI with BCI technology does have drawbacks. For example, using these two technologies together requires vast amounts of training data, which is time-consuming to generate. The training data must be high-quality. If not, it will compromise the performance of the AI-powered BCI system.

Medical Uses of BCI Technology

Biomedical researchers continue to explore an ever-expanding range of medical uses for BCI technology.[13] In addition to helping people with locked-in syndrome to communicate, this technology can be employed by people with amputations and quadriplegia to control robotic limbs. People with quadriplegia and paraplegia can use the technology to gain mobility through the control of exoskeletons. Also, BCIs may help stroke patients recover lost motor function.

BCI technology can also be used to electrically stimulate different brain areas in patients with neurological disorders such as Alzheimer's, Parkinson's, and Huntington's diseases, Tourette's syndrome, dystonia, and essential tremor. Biomedical researchers are also exploring ways that passive, noninvasive systems may diagnose mental illness and sleep disorders. Electrical stimulation may play a role in treating addiction, depression, anxiety, anorexia, obsessive-compulsive disorder, and schizophrenia. It may also help treat insomnia.

Nonmedical Applications of BCI Technology

While the primary interest in BCI technology has resided in the clinical arena, interest is now growing for nonmedical applications.[14] For now, nonmedical use primarily centers around noninvasive technology.[15] Apart from educational uses, most nonmedical applications are intended for healthy users.

Education

The prospects of using BCI technology in education have received significant attention.[16] Researchers think that these systems can provide students with immersive learning experiences and may help students improve focus and memory. Passive, noninvasive BCIs might even help diagnose and assist students with learning disorders.

Gaming and VR

One nonmedical application of BCI technology that currently receives significant attention is gaming. Current noninvasive BCI equipment is slower, less accurate, and has lower bandwidth than conventional interfaces. Current touchless alternatives, such as voice and gesture control, are superior to BCIs for gaming purposes. It appears that the motivation to use BCI technology for gaming may have more to do with the experience and novelty than anything else. Some technologists are exploring this technology for virtual reality systems. While performance is currently substandard, it does allow for input that goes beyond the use of limbs. Allison et al. refer to this condition as an "induced disability"—a condition in which fully mobile individuals do not have full use of their limbs because their hands are busy.[17] For example, surgeons, mechanics, soldiers, and pilots may find themselves in situations where both hands are busy. BCI technology may allow them to control devices that enable them to complete their work.[18]

Art

One of the more interesting uses of BCI technology is for creating and experiencing art.[19] For example, artists have used the technology to control robotic limbs that paint based on the artist's brain waves. BCIs have also been used at interactive displays in art galleries, where the artist's brain activity creates a unique visual display.

Sports

BCI technology may have a place in sports psychology by helping players improve and perform well under pressure. Through neurofeedback, athletes can learn to manage stress and performance anxiety. They can also learn to achieve better concentration and focus, allowing them to find the "zone" and remain in it.

Brain-to-Brain Interface Technology

One provocative advance in BCI technology involves tethering brains together, referred to as brain-to-brain interfaces (BBIs). The feasibility of BBI technology was demonstrated by Yoo et al. in 2013.[20] Using a noninvasive system, a human test subject caused the tail of an anesthetized rat to twitch. With an EEG cap, the human subject initiated an ultrasound burst that focused on the motor area of the rat's brain that controlled tail movement. The time delay from thought to tail movement was about 1.5 seconds.

In 2014, a research team from the University

of Washington described the first human-to-human BBI.[21] They designed a noninvasive BBI that used an EEG to record the brain activity of the "sender" and transcranial magnetic stimulation (TMS) to deliver the information to the motor area of a "receiver's" brain. The researchers designed an experiment in which the two test subjects, located remotely from one another, had to cooperate to play a computer game. With this configuration, the sender transmitted information over the internet, which caused the receiver to press a touchpad at the desired time.

In 2019, the same research team reported on a multi-person BBI, which they dubbed the BrainNet.[22] This BBI involved three human subjects: two senders who transmitted brain signals via the internet using EEG, and one receiver whose occipital cortex was stimulated using TMS. The receiver was unable to see the computer screen and had to decide to rotate a block or keep it in the same orientation, based entirely on the information transmitted to his brain by the two senders who *could* see the computer screen. Using EEG, the receiver's decision was transmitted to the computer system. The average accuracy of completing the task for five sets of three distinct test subjects was just over 80%.

Cognitive Enhancement with BCI Technology

Researchers have a great deal of interest in using BCI technology for cognitive enhancement. These applications involve both medical and nonmedical uses, and often the line between the two is not distinct. Cognitive enhancement is defined as improvement in acquiring and generating knowledge and understanding of the world, which requires the user to gain enhanced capability to focus attention, form knowledge, store and retrieve memories, exercise judgment, and perform evaluations.[23] Preliminary work indicates that noninvasive BCIs can be used to improve cognition in patients with Alzheimer's disease and other forms of dementia by helping them to regain memory, focus, and executive function.[24] Other researchers are exploring how BCI systems might improve cognition in healthy elderly people with mild cognitive decline.[25] Both research programs show promise.

Noninvasive, passive technology has helped neuroscientists better understand the brain areas and processes that underlie cognition, a first step in using BCI technology to improve cognition in compromised and healthy individuals. Use of noninvasive systems shows promise for improving memory and performance for numerous tasks, including complex problem solving.[26] With this initial success, it is not difficult to envision commercially available, wearable, noninvasive equipment routinely used by healthy people to improve their cognitive skills.

Some bioengineers are exploring the use of collaborative, noncommunicable BCIs for cognitive enhancement.[27] Unlike multi-user BBIs, the brains of users do not communicate. Instead, the BCIs feed information from each user, process it, integrate it, and then execute a single action. This multi-user BCI technology has been used to control robots and play video games.

Finally, bioengineers hope multi-user BBIs will facilitate cognitive enhancement. In this case, multiple people collaborate through direct brain connections to engage in cooperative problem-solving. Jiang et al. regard multi-person BBIs as "a social network of connected brains."[28] Multi-user BBIs are ideal for work that requires sustained alertness and attention that may include continuous monitoring of instruments and other information sources, processing that information, and executing an action in response to the information.[29] Examples of these jobs include aircraft pilots, power plant workers, and surgeons.

Ethical Concerns

Despite the promising medical and nonmedical applications, BCIs raises various safety, ethical, and societal concerns. It is critical to be aware of the types of ethical concerns associated with this technology, because many of them interdigitate with interest in understanding the impact of this technology on personhood and protecting human dignity. To identify and understand the range of these issues, Burwell et al. carried out a scoping review of the medical literature using PubMed as a bibliographic database.[30] Their review was published in 2017. Because of rapid advances in BCI technology, Coin et al. recognized the need to update the work, systematically reviewing the academic literature for ethical concerns from 2016 to 2020.[31] In 2024, a third group performed a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) study of the academic literature published from 2018 to 2023, seeking to identify the ethical themes that appeared regarding BCI technology.[32]

All three studies identified the same safety, ethical, and societal concerns. Coin et al. added concerns about animal welfare, and Livanis et al. added concerns about use of BCI technology for human enhancements. Based on the three studies, the safety, ethical, and societal concerns can be grouped using these 10 criteria: (1) user safety, (2) humanity and personhood, (3) autonomy, (4) stigma and normality, (5) privacy and security, (6) research ethics and informed consent, (7) responsibility and regulation, (8) justice, (9) animal welfare, and (10) human enhancement.

Though these analyses have been conducted from a secular framework, Christians will undoubtedly share many of these qualms. Some have a theological dimension and raise questions about personhood, identity, and human dignity. A brief survey of these issues lays the groundwork for a theological analysis of BCI technology.

User Safety

Perhaps the most common concern is user safety, and it is most pressing for invasive and semi-invasive systems. Damage to the brain during electrode insertion is a grave concern. So is the scarring of the neural tissue triggered by the glial cell response to the electrodes. Additionally, postsurgical complications raise worries. Bioengineers and ethicists have also expressed misgivings about the short- and long-term health effects of BCI technology. For example, what are the effects of repeatedly stimulating the brain with electrical impulses?

Humanity and Personhood

Several questions arise when it comes to humanity and personhood. When machinery becomes integrated into the human body, does that lead to a loss of humanity? How do BCI technologies impact users' perceptions of themselves and their place in society? Does this technology compromise the user's authenticity?

Also, a BCI that stimulates the brain changes people. It alters their cognition. It can alter their behavior and personality. Will people who use these systems lose themselves? Conversely, BCIs may enable people with locked-in syndrome to communicate. They may also grant people with quadriplegia and paraplegia the mobility and self-sufficiency that helps them recover a sense of humanity and personhood.

Autonomy

The capacity for self-determination is important in and of itself, but it also impacts other ethical issues such as informed consent. Many people working with BCIs worry that the technology undermines users' autonomy, particularly for applications that involve coupling the BCI with machine-learning algorithms and AI. These mathematical tools are necessary for extracting user intent from complex brain activity. But is the action that results directed by the user, by a collaboration of the user and the BCI, or by the BCI itself?[33]

Behavioral and personality changes associated with some applications are also concerning. If the patient's personality has changed, how can we be sure that the user's decisions are the same as they would have been before receiving the BCI?

On a positive note, technology that helps users communicate helps recover their autonomy, allowing them to express their desires with nuance. This capacity is particularly important for people who are locked in who often can only signal their desires with a simple "yes" or "no."

Stigma and Normality

For some people, disability is a stigma. Will social pressure influence disabled people to seek BCI technology when they otherwise would not? Of course, BCIs may help remove the stigma associated with disability and help patients recover a sense of normalcy.

What if people view others who use BCI systems as "cyborgs"? This unfortunate label would be mitigated if BCI use becomes prominent among healthy people and the technology is viewed as normal.

Privacy and Security

We take for granted that our thoughts are private, but BCIs could change that freedom. BCIs extract information from our brains. The existence of that information (outside the human brain) represents a potential loss of privacy for the BCI user. In principle, once the information about a patient's mental states, psychology, and private thoughts is public, it can be sold to third parties. More maliciously, the user could be blackmailed under the threat that their private thoughts will be made public. The loss of privacy is exacerbated in the case of BBI systems in which multiple users have their brains tethered together.

Brainjacking (unauthorized control) also causes uneasiness because this technology increasingly uses wireless technology and relies on access to the internet for other uses. Both make the user vulnerable to bad actors who could force them to engage in unintended actions.

Research Ethics and Informed Consent

Can a BCI user really give informed consent? If a person with locked-in syndrome consents to participate in pre-clinical studies, they might be able to indicate "yes" or "no," but can they communicate their exact wishes? The technology and its effects on the brain are complex. Because they suffer from locked-in syndrome that results from impaired brain function, can investigators be sure that these patients fully understand what they are giving assent to or rejecting?

Some treatments alter behavior and personality. If so, once a patient's brain is stimulated with a BCI, is the decision to continue with the study truly what the patient would have wished prior to the treatment? For patients with locked-in syndrome or quadriplegia or paraplegia, some ethicists and technologists worry that participants' involvement in studies may stem from desperation and not truly be a voluntary act.

Also, what happens to the patient when the study comes to an end? Or the company goes out of business, and the device is no longer supported? It seems cruel to give a person with locked-in syndrome the capacity to communicate and then take it away because the study is complete and funding is no longer available. Gilbert et al. interviewed patients who had their BCI systems removed and learned that they felt a deep sense of loss. This loss made them question whether taking away access to BCI technology constitutes a violation of patients' human rights.[34]

Responsibility and Regulation

If a BCI user causes harm, who is at fault? The user? The BCI? The people who developed and installed the technology? For more sophisticated applications, machine learning algorithms or AI are paired with BCI technology. As a result, it is not clear if an action is strictly due to user intention or some combination of user intention coupled with the BCI's influence. These systems also make mistakes—they are not 100 percent accurate in deciphering user intent. When mistakes happen, the action is unintended. But who is responsible?

Concern about responsibility only becomes amplified for BBIs.[35] Who is responsible for an action? Is it the sender? Is it the receiver? Is it both?

Justice

Will everyone who could medically benefit from BCI technology have access to it? And what about nonmedical applications? Healthy users who have access to this technology will have advantages that could be regarded as unfair, particularly if the systems are expensive. This disparity gives wealthy individuals an advantage that could widen the socioeconomic gap.

Animal Welfare

Many advances in BCI technology have been achieved thanks to animal studies that help establish feasibility and serve as the basis for developing and refining the technology. Nevertheless, using animals (particularly nonhuman primates, which are regarded as highly sentient) as test subjects raises concerns about animal welfare and cruelty.

Human Enhancements

Advances in BCI technology legitimize the transhumanist movement and place theoretical ideas about human enhancement within reach. BCIs can be used, at least in principle, to enhance human cognition beyond natural biological limits. They can also be used to enhance users' strength by empowering exoskeletons or robotic

prosthetic limbs. These enhancements threaten human identity. They also raise ethical questions about experimenting on healthy people to develop technology for enhancement purposes.

Personhood and the Protection of Human Dignity

With an understanding of the state of the art of BCI technology and an appreciation of ethical issues raised by ethicists and investigators working in the field, it is next necessary to define personhood and describe human identity and human nature from a Christian perspective, before reflecting about the impact of BCI technology on personhood, human identity, and human dignity.

A Definition of Personhood

By no means is the task of defining personhood straightforward, in part because secular and Christian views fundamentally diverge. Most secular perspectives take a strictly functional view of personhood, which can be ambiguous. Persons are afforded dignity and respect and are granted human rights if they are sentient and display certain cognitive capacities.[36]

A Christian worldview regards personhood in ontological terms as an essential aspect of human nature. The basis for human personhood resides with the image of God. Because all human beings are "in Adam," they bear God's image and have personhood independent of functional capacities.[37]

If the basis for human personhood rests on the image of God, then it is important to define the concept. As conceptualized here, conservative and evangelical scholars generally hold to one of three views: (1) the resemblance view (also called the substantive view or the structural view), which emphasizes how human nature and attributes resemble God's nature; (2) the representative view (also called the functional view), which emphasizes human responsibility to rule and steward creation; and (3) the relational view, which emphasizes the unique relationship that humans have with God.[38] These three views are not mutually exclusive. The best way to understand the image-of-God concept is a combination of the three, with each one reflecting a facet of what it means for human beings to reflect God's image. Yet, the resemblance view seems to be preeminent because it incorporates the other two perspectives.[39] In contrast to other creatures, if image bearers have the responsibility to uniquely care for the creation or uniquely form a relationship with the Godhead, then these two features require that humans have unique qualities compared to other animals. For that reason, the resemblance view will be the primary perspective of God's image used to assess the impact of BCI technology on human dignity, though other aspects, such as the relational view, will be considered as well.

But what about people who do not possess distinct qualities that define the image of God due to their stage of development (human embryos and fetuses)? How about those who never developed these capabilities because of a developmental disorder, or who lost them due to a neurological disease or brain injury? Is the image of God absent in them? These questions stand as the primary objection to the resemblance view.[40]

In the face of this challenge, it is critical to keep in mind that every human being bears God's image because they are "in Adam."[41]Human dignity and value stem from our ontological status in Adam, with the unique qualities that define human beings flowing out of our essential nature. If the brain has not fully developed or is damaged from injury or disease, the image of God cannot be fully expressed, but it is not absent. In this sense, human personhood has an ontological basis that gives rise to unique functional qualities that are generally observable for most human beings. Unlike the secular view of personhood, functionality doesn't define personhood in a Christian perspective. It consequentially arises.

This idea presupposes a duality in human beings consisting of both material and immaterial natures. Because some BCIs are embedded in the brain (for invasive systems) and can alter a patient's cognitive skills, behavior, and personality, it is necessary to pose a model for the relationship between our material and immaterial natures as part of the process of defining personhood.

Human beings are a composite of material and immaterial natures. We are body and soul. The image of God does not merely reside in our immaterial self. Human beings in their entirety are made in God's image.[42] Our material and immaterial natures are integrated yet can be separated. Upon death, the soul goes to be with God. In this condition, as a bodyless soul, we are not in our natural state. With our resurrected bodies, both immaterial and material natures will once again be reunited.

This integration of material and immaterial natures that can be separated has been called holistic dualism.[43] In this model, our brain becomes an instrument for the expression of our immaterial nature, which echoes the idea that the ontological foundation of the image of God finds functional expression through the human brain. Accordingly, a dynamic interaction takes place between our brain (body) and our soul (mind and spirit), with changes in our brain influencing our mind and spirit.[44] In turn, our mind and spirit can influence our brain.

In summary, in this study, the definition of personhood used to assess the impact of BCI technology on human identity and dignity, rests on the image of God, with the image of God regarded as a composite of the resemblance, representative, and relational views. While these three perspectives focus on distinct features, they are not mutually exclusive. Still, the resemblance view encompasses the other two perspectives. To uniquely serve as God's representative or to have the unique capacity to relate to God requires qualities that only human beings possess. Moreover, the model used in this study is shaped by the concept of mutualistic dualism, recognizing an interplay between the immaterial and material natures of human beings, with the fullest expression of the image of God requiring a healthy brain.

BCI's Impact on Personhood, Identity, and Human Dignity

Assessing how BCIs affect human personhood, identity, and dignity is not straightforward. It involves a complex interplay between science, technology, ethics, and theology.

Positive Considerations

Despite the complexity of this undertaking, it is clear that BCI technology has the potential to uphold human personhood, identity, and dignity, particularly for people with locked-in syndrome or quadriplegia or paraplegia. BCI systems help patients previously unable to do so to communicate thoughts, ideas, and emotions. Some BCI users will be able to compose music, direct musicians, and create artwork.[45] The technology provides mobility to immobile patients by controlling robotic limbs and exoskeletons so users can regain some self-sufficiency. Without question, BCI technology promotes human flourishing in these patients and should be pursued with vigor.

Ontologically, these people have inherent worth and dignity because they bear God's image, whether or not they can communicate, move about, or care for themselves. For these individuals, this technology offers a way to *express* the image of God. In interviews, patients using BCI systems reported that the technology makes them feel human again. It changes the way they perceive themselves. It enhances their sense of self-worth.[46] Patients also expressed gratitude that they had the opportunity to socialize with others again, and they valued the chance to participate in activities. They also felt proud that they could contribute to medical advance. This gratitude reflects the relational aspect of the image of God, by which humans have the capability of relating to God and others. As part of the image of God (according to the resemblance view), human beings were created as social beings.

Improving cognition in patients with neurological disorders—or helping elderly patients regain lost cognitive skills—promotes human flourishing by restoring self-worth and dignity and regaining the capacity to express God's image.

Using BCIs to help diagnose and treat mental health disorders or to promote relaxation is beneficial and does not compromise human identity. And for mental health patients who have an addiction or live with depression or severe mental health disorders such as schizophrenia, helping them manage these diseases helps them recover lost dignity and self-worth. It also helps them to fully express God's image.

While still in the pilot stage, another use of BCI technology that has the potential to deliver positive results can be found in the educational arena. Currently, this technology is costly and may not be widely available to students from lower socioeconomic strata and it may require specialized training to implement it. So, equitable access to the technology becomes a concern. Still, BCIs could improve educational outcomes, and exploration of these types of applications should be welcomed. BCI technology may help students better realize their potential and use their giftedness to contribute to society and serve the church. Again, this application could possibly promote human flourishing and allows a more complete expression of God's image.

Theological Uneasiness

Human dignity—the inherent worth each human possesses because they are persons who bear God's image—includes autonomy and accountability. Each person's autonomy is a reflection of their capacity for free will and self-direction, which enables moral choices. As part of the image of God according to the resemblance view, human beings possess an inherent understanding of right and wrong and a desire for justice. As image bearers, human beings are accountable for their actions and moral choices. Denying a person autonomy and accountability for their actions undermines their personhood. One ethical issue with BCI technology is the potential loss of autonomy, especially for applications that involve machine-learning algorithms and AI. Uncertainty about who makes decisions (the user, the user in collaboration with the BCI, or the BCI itself) is problematic. These systems make errors when deciphering user intent. This uncertainty not only raises questions about autonomy but also about responsibility for the action. In both cases, the user's personhood and dignity are undermined. For example, in an interview with a patient equipped with a BCI powered by AI, researchers learned that this person eventually gave up autonomy. She stopped listening to her instincts and ceded her decisions to the BCI system. She eventually let the system instigate her decisions.[47]

Another autonomy-related concern involves the effect that brain stimulation has on personality. Using BCI systems to stimulate the subthalmic nucleus and the globus pallidus interna—brain structures involved in motor control—can help control the motor symptoms of Parkinson's disease, but they also render the patient less risk-averse.[48] This change raises a question about consent for subsequent treatments with BCI technology. Would the patient have granted consent if their personality did not change? This potential loss of autonomy compromises the patient's dignity and undermines their agency.

BBI systems are in their infancy as a technology, yet they raise various concerns about privacy, autonomy, and responsibility, all three of which impact human dignity. In multi-user BBI systems, it is not clear who initiates the action and who should be responsible for its outcome. Human beings often collaborate. Group decisions often involve deliberations before plans are executed. In these partnerships, each person's identity is retained. Anyone can withdraw if the group is about to engage in a collective action with which he or she is uncomfortable. But it is unclear if this possibility exists for contributors to multi-user BBIs. If not, then the technology threatens participants' autonomy and forces them to assume responsibility for actions they would otherwise have opposed.

Human dignity entails privacy, and it is a right afforded to those with personhood status. Humans have an identity rooted in God's image, which includes private thoughts, emotions, and experiences that if shared could be unjustly exploited to cause harm to themselves or others. Privacy prevents dehumanization, with protected information shared within trusted relationships. One of the most sacrosanct aspects of privacy is the privilege of having your own thoughts and the freedom to choose to whom one discloses those thoughts. Having private thoughts publicly exposed is a direct assault on an individual's dignity. Thus, if BCI and BBI systems lead to a loss of privacy, then they threaten human dignity.

Do BCI and BBI technologies threaten human identity? In principle, they could if the user's brain is significantly modified through the technology. Noninvasive

technology should not be viewed as a threat. Even though some noninvasive BCI applications, such as brain stimulation, may alter personality and behavior, it does not fundamentally change human identity. On the other hand, invasive systems pose a concern.

However, current uses of invasive BCI technology, even when coupled with machine-learning algorithms and AI, do not seem to pose much of a threat. Based on interviews with people equipped with invasive systems, the opposite seems to be the case.[49] These people report feeling *more* human. They quickly integrate with the BCI and external devices controlled by the system. They say that the BCI feels as if it is a natural part of them and that they have not changed. They are the same person.

Greater anxiety exists for BBI technology. Of course, collaboration is very much a part of human experience and is how God made us as image bearers. Though we are individuals, we are social beings. We are created to be in relationship with one another. One aspect of our nature that makes us exceptional is our capacity to create and live within complex hierarchical social structures. We seek out one another to work together. As members of the church, we are described analogically as part of a body, with each person possessing unique giftings that harmonize with others' talents to accomplish the church's mission.

BBI technology *seems* like a natural extension of the collaborative, social aspect of our nature. Tethering brains together may even make collaborations more potent and effective. So, depending on the specific design of the BBI system and the application, tethering brains together into a momentary collective may not pose a threat to human identity. Other applications in which the collaboration is permanent would be problematic. Each person would lose their identity as a unique and valuable individual as they meld into the collective. They would also be stripped of individuality and mistreated in ways that are incompatible with the dignity they possess.

What about more radical, futuristic applications of BCI technology? If they require more extensive modifications to the brain, BCIs could fundamentally alter human identity. This concern particularly applies to technologies designed to enhance human beings beyond our natural biological limits. In those cases, they transcend the boundaries God instituted when he created us.

Conclusion

Christians should regard BCI technology, at least for the current state of the art, as a positive advance. Many medical and nonmedical applications can potentially restore a lost sense of personhood, identity, and human dignity. BCIs can help people who live with severe medical conditions. While the image of God is inherent to every human being, it must be expressed, and in some instances this technology enables the expression of the image of God and allows people to exercise their full giftedness. Yet this technology raises vexing ethical and theological issues. By recognizing these concerns, it should be possible to mitigate them, at least for now.

Given the scientific and technical complexity of BCI technology and its range of applications, Christians cannot generalize when engaging this emerging biotechnology. We must take advances on a case-by-case basis and pay close attention to users' experiences. Their firsthand accounts will inform us as we navigate ethical and theological issues. We also must keep an open mind. It is conceivable that some applications that appear to undermine human personhood, identity, and dignity may ultimately be of little concern. Likewise, others that seem nonproblematic may, in practice, become deeply concerning.

With an eye toward the future and the development of advanced applications, Christians must continue to ponder what it means to be made in the image of God. We need to develop more complete anthropological models that emphasize the dynamic interaction of our material and immaterial natures. These efforts will require interdisciplinary collaboration among theologians, philosophers, neuroscientists, engineers, technologists, and others. Such collaboration entails that Christians stand at the forefront of the technological breakthroughs with the detailed knowledge and wise counsel to drive ethical conversations.

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26

Living in the Biotech Century: 2025 Conference Recap

Bryan A. Just, MA | Operations & Events Manager

Throughout the 1990s writers and thinkers explored visions for what would come at the turn of the millennium. They made predictions, warned of new threats to human life and dignity, and explored opportunities for growth and development. The year 2025 marked one quarter of the way into what has been dubbed the Biotech Century. Thus, for CBHD's 32nd annual summer conference, *Living in the Biotech Century: The First 25 Years*, we sought to use this time to assess where we now stand. Looking back, how accurate were the predictions, threats, and opportunities that were identified back in the 90s? What issues have arisen that were simply not on the radar then? Looking forward, how can we use this knowledge to prepare ourselves to think ethically about the developments throughout the rest of the Biotech Century?

The conference opened on Thursday evening with CBHD's 3rd annual Virtue Ethics Lecture, delivered by Brent Waters, entitled "In Praise of Mundane Healthcare."[1] Waters' address sought to answer a seemingly simple question: "When and why did contemporary healthcare take a wrong turn?" Waters was straightforward with his answer: Medicine's wrong turn occurred "when it tried to become exciting, even extraordinary, at the expense of discounting the ordinary and commonplace."

For much of history, medicine was mundane. Doctors cared for everyday aches and pains, but they lacked the knowledge and ability to treat or cure most severe illnesses. The twentieth century brought about astounding advances in our knowledge of the human body, and with it, the ability to cure illnesses that were never before treatable. Much suffering has been alleviated, and many lives have been saved. But this is also where medicine's wrong turn began.

Medicine has evolved to focus solely on the body and to deny or at least ignore any immaterial aspect of the person. And now, medicine is pushing past the limitations of the body, which "is no longer seen as an object of care, but as a problem to be solved." Even aging itself, long seen as a natural part of the human lifespan, is being treated as a disease to be cured. While Christians hold no hope that medicine can ultimately be successful in overcoming humanity's finite nature, it nonetheless offers a higher degree of control over our health and our bodies than has ever before been realized.

Control leads to a loss of attentiveness to ordinary needs. This is a problem, because "giving the mundane its due is vital to human flourishing." God has created us with very basic, mundane needs, and we ignore these at our peril. And yet medicine increasingly ignores the ordinary—the headaches, the colds, the high blood pressure—and instead focuses on the extraordinary, on the quest to gain complete control over the body. We see this in the rise of genetic screening, fetal testing, therapeutic abortion, assisted suicide, and euthanasia.

To counteract medicine's newfound focus on the extraordinary, Waters recommended a recovery of virtue for both healthcare

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providers and patients. Virtues are habituated—they start as how we act, but when consistently practiced, they transform who we are. To counteract medicine's wrong turn, Waters drew our attention to the virtues of prudence—doing the right thing for the right reason with the benefit of wise counsel—and love of neighbor. These in turn lead to the virtue of humility. Healthcare providers must come to recognize that every disease cannot be prevented, our performance should not be enhanced, life cannot be extended indefinitely, and not all suffering can be avoided. Likewise, patients must learn that they are finite creatures, not consumers who can demand whatever they want from healthcare, and that not everything can be treated. We must all come to terms with the fact that while we are embodied creatures, our bodies will eventually fail.

When we have internalized these virtues, we will learn yet another—that of gratitude. As Waters concluded, "gratitude expresses . . . the habituation of prudence and neighbor-love. These virtues should exemplify the provision and reception of medical care and again, more broadly, be foundational to the common callings and ordinary virtues of our life together with neighbors."

Friday morning began with a presentation by Maureen Condic on "The Science and Ethics of Emerging Biotechnologies."[2] Condic focused on three main technologies that have been developing in the first quarter of the Biotech Century: stem cell research, CRISPR gene editing, and synthetic embryos. Religious individuals frequently fall into one of two errors when they approach contemporary science. Because science can be arcane and intimidating, there is the temptation for some to simply leave science to the scientists (despite their poor track record of exercising moral judgment). Others take an opposite approach, condemning all scientific advances as immoral or at least questionable. Condic advocated instead for the middle path of virtue—to both understand scientific technology and make our own informed moral judgments on it.

Condic began by defining some of the different types of stem cells and what they can do. She then explored the success stories of treatments using embryonic stem cells, concluding that they have accomplished very little. There have been one or two treatments with very modest success (and a slew of negative side effects), but despite their being hailed as a miracle cure, the effectiveness of embryonic stem cells in clinical trials has "consistently been unimpressive." In contrast, studies with adult stem cells have been far more successful, and these have the added benefit of not needing to destroy nascent human life. Stem cells have the potential to save lives and reduce human suffering, but while multiple treatments utilizing adult stem cells have been approved and are in use, embryonic stem cell use remains immoral and has failed to live up to its own hype.

Condic then transitioned to discussing CRISPR gene editing, giving a detailed breakdown of how the process works and how it is transforming the way genetic research can be conducted. There are several reasons one might want to edit genomes, such as being better able to conduct basic science, eliminating certain diseases, and modifying a species. That said, this technology also raises some serious ethical questions: Can this be done safely and without unintended side effects? Can the problems of chimerism (where not every gene is modified) be overcome so that patients are not left immunosuppressed? Can the current research, which immorally utilizes embryos, be done in an ethical fashion? Can the treatments resulting from CRISPR be made available cheaply and equitably? Will we be able to avoid the commodification of human beings as this technique becomes more widely practiced? As scientists use this technique to modify crops or non-human species, how are we dealing with concerns regarding species elimination, environmental impacts, and unintended consequences? And considering that this technique has already begun being used in humans, what are the potential long-term and unintended consequences of modifying the human germline?

The final topic Condic addressed was synthetic embryos. It is currently a point of debate whether synthetic embryos should be considered human, as they do not produce a full human developmental sequence. But according to Condic, there is no reason why they should not be. Though the way they are created is unique, and the way they develop is defective, "they're made out of human cells, they contain human DNA, and they're replicating human development." This is concerning, as scientists are quite eager to experiment on these embryos to perfect artificial reproductive technologies, to intentionally create embryos with genetic defects in order to study them, to test the effects of poisons, and to use them in drug development and testing. If synthetic embryos are not human, this would not be a problem, but as it is, billions of humans could be produced and destroyed every year by the pharmaceutical industry. Ethical guidelines currently lag far behind the technology, and while human synthetic embryos have not progressed as far as animal models, the research is ongoing. As Condic concluded, "we are facing a truly horrific era of human experimentation and exploitation."

For Friday afternoon's session, Nigel M. de S. Cameron, one of the founders of CBHD, returned to talk about "Biotech Promises, and Biotech Perils: A Quarter-Time Report."[3] His goal was to look back at how things have gone in bioethics over the past 25 years to give some direction for the future. At the beginning of the Biotech Century, there was enormous optimism. Cameron recounted how, in testimony before a House appropriations committee, one scientist claimed that with enough money, they could cure cancer by 2010. There was a general thought that advances in biotechnology, bioinformatics, and nanotechnology would transform medicine as we know it. While it is true that rates of cancer have dropped, this has had much more to do with declines in smoking and better early detection, and much less with radical new technologies. This is a cautionary tale—none of these technologies has brought about the radical changes that were anticipated.

In looking at the various policy debates over bioethics that have dominated the early 21st century, Cameron identified two major themes that emerged. The first was that progress in these areas required Christians and those in the pro-life movement to become interested in topics beyond abortion. According to him, "the issues of research cloning and the patenting of human embryos have served to bridge the divide between abortion and the moral and policy significance of biotechnology. Both have brought the pro-life movement into energetic engagement in questions that are only analogically related to abortion and are not part of the struggle over *Roe v Wade*. With whatever caveats the pro-life movement has

crossed the bridge, there will be no going back." He gave as an example of this bridging work an article he participated in creating, "The Sanctity of Life in a Brave New World: A Manifesto on Biotechnology and Human Dignity," which dealt with cloning, inheritable genetic modification, genetic discrimination, and patenting human genes.

Cameron's second theme is the necessity of pro-lifers becoming willing to work with those with whom they have disagreements, especially on the issue of abortion. From the 1970s–90s Evangelicals and Catholics learned to set aside their theological differences because of their agreement on abortion. Now, both must learn to work with those who might be in favor of abortion but are in agreement on ways in which advances in technology pose threats to human freedom. Quoting from an early article, Cameron shared that

> we have seen the beginnings of cooperation between those divided by the question of abortion. They have discovered that once abortion itself is taken off the table, a surprising degree of agreement emerges on matters as varied as cloning, whether for research or to produce a live-born baby, genetic discrimination, the patenting of embryos and genes, the prospect of designer babies, and broader issues affecting the integrity of the human condition, including the potential significance of new technology such as nanotechnology and cybernetics to enhance and thereby demean human dignity. The spectre of a new eugenics hangs ineluctably over this new century, powered by technologies of vastly greater power for blessing and bane than the primitive barbarities of eugenic sterilization, widely practiced in the US during the early 20th century (and in fact still in the mid-20th century in some states) and in the more consequent hands of the Nazis with their eugenic killing.

Cameron discussed numerous ways in which new coalitions between unlikely partners have formed in order to address some of the most pressing bioethical questions of the day. While not every venture was a success, building relationships among groups that are usually polarized will be key if we are to successfully address the bioethical issues that we face over the rest of the Biotech Century.

Friday's final presentation was given by members of CBHD's Chinese Bioethics Initiative (CBI).[4] The CBI was started nearly 10 years ago by John Kilner and Curtis Chang in order to train a small group of Chinese-speaking Christian doctors in bioethics so that they could in turn pass their training along to others in Hong Kong, Taiwan, etc., and eventually in mainland China as well. Funds were generously donated in order to help the initial cohort obtain an MA in bioethics at Trinity Graduate School, and many in the cohort were so excited that they offered to pay some of their own costs so that there would be funds for even more to join.

Six members of the CBI were able to speak and give updates on their work: Drs. Curtis Chang, Vivian Lee, Chun-Wai Chan, Juliana Tze-Wah Kao, Benjamin Kuo, and Grace Chang. Though each came from different backgrounds and medical specialties, they shared how their participation in the CBI influenced their lives and ministries and turned their attention to the ways in which their biblical beliefs and convictions could be brought into their medical contexts. Following their training, nearly all of the participants have had opportunities to teach bioethics and pass on what they learned to a new generation of bioethicists in Chinese-speaking countries. Their testimonies were a great encouragement to those in attendance about the work God is doing in bioethics in other parts of the world, and CBHD is honored to have been able to facilitate this program.

Friday evening ended with a casual pizza party—a time for sharing a meal together, chatting, and catching up with one another. Friday dinners have become a tradition at CBHD conferences and are a great opportunity for meeting new people, catching up with old friends, and hearing more about bioethics in a more casual environment.

Saturday morning opened with a presentation by Canadian physician Ewan Goligher titled "How Should We Then Die? A Christian Response to Physician-Assisted Death."[5] It has been ten years since physician-assisted death was legalized in Canada, and during that time, it has both become normalized throughout society and expanded in scope. While Canadian law initially only allowed euthanasia in cases where death was "reasonably foreseeable," it was later amended to include those with physical disabilities and mental illnesses (although the implementation of the latter revisions has been delayed). There is ongoing discussion about further expansions, such as allowing for euthanasia by advance directive or opening it up for mature minors.

Goligher argued that physician-assisted death has been embraced because it "fit with the moral intuitions of society." Therefore, to address physician-assisted death as Christians, we need "absolute moral clarity" as well as to understand "the underlying cultural, philosophical, and theological drivers that make this intuitive for people." Goligher gave three issues that we must have moral clarity on. First, we must recognize that physician-assisted death undermines human value. Both proponents and opponents of euthanasia claim to value human life and human dignity. But, euthanasia treats people as if they have only extrinsic value—when they tell their physician they want to die, they are saying their life no longer matters or has value. Rather than remind them of the intrinsic value they have as human beings created in the image of God, a society that approves of PAS tells them they are correct—their life has lost meaning, and there is therefore nothing wrong with ending it.

Second, euthanasia denies the value of the body. The process of euthanasia involves injecting a series of drugs that attack consciousness, breathing, and heart rate. Rather than treating the body as something with inherent value, it is seen as something the person uses for a time and then discards when it is no longer wanted. Finally, assisted death is "profoundly, foolishly presumptuous." In making the decision to die, a patient weighs the pros and cons of being alive or dead and chooses to be dead. The problem is neither the patient nor his or her doctors knows anything about being dead or whether that is actually the better state. Assisted death is therefore "essentially an experimental therapy practiced upon patients with no possibility of follow-up to ascertain outcome. It's quackery, and it has no place in the rational ethical practice of medicine."

Goligher acknowledged that many, if not most, people no longer hold these moral convictions. Thus, if we are to change people's perspective on physician-assisted death, we must remind them of key philosophical

and theological truths that seem to have been forgotten. The first of these is that we have lost a sense of human sacredness and instead see human persons as something to be manipulated. We must recover a view of the sacredness of humanity; only then will people understand that assisted death is "an act of desecration." Second, we have become forgetful of the body. We deny our embodiment, and the concomitant truth that we are dependent, vulnerable, and finite. We are incomplete in ourselves and require others for our full flourishing. When we recover a robust view of our embodiment, we see that life is not about autonomy (the primary value of those who promote assisted death) but rather communion, interdependence, and giving. When we have a healthy view of the body, "assisted death makes no sense because it's literally a way of cutting people off from the world."

Finally, we have forgotten how to suffer, and so the response to suffering is to attempt to take control. Physical suffering is not the primary reason people seek assisted death, but rather fear of losing abilities, being a burden, etc. Assisted death becomes a way of taking back control over one's life in the face of suffering. Thus, we need to equip people to face suffering and do so even before they are facing life-and-death decisions. As Christians, one of the best ways to do this is to point people to the Gospel, which offers meaning and hope in the face of suffering and the fear of death. The Gospel helps us to make sense of suffering, and the Christian church must recover its role of being a moral exemplar in teaching people to deal with the realities of suffering in a fallen world. As Goligher concludes, "It's inside the church that we can make euthanasia and assisted death utterly unthinkable."

The final plenary session of the conference, "Ethical Challenges in Family Medicine: Past, Present and Future," was presented by Paul Dassow and James Heid from the American College of Family Medicine.[6] One of the developments of the biotech century is an increase in organizations seeking to help physicians live out their ethical convictions, and so Drs. Dassow and Heid spoke about some of the issues they are seeing and the ways in which their organization is working to support physicians in the field of family medicine. Family medicine is the broadest medical field and covers patients from conception to death. Its largest professional organization is the American Academy of Family Physicians (AAFP), but there have been numerous developments within this body over the past decades that are worrying for pro-life physicians.[7]

It is no surprise that there has been an increase in ethical issues facing medical students. While once abortion was one of the sole techniques a student might object to performing, the list has been expanding to include such modern practices as physician-assisted suicide and the prescription of puberty blockers and cross-sex hormones. This is part of a larger shift in medicine away from the traditional Hippocratic ethic of "First, do no harm" and a move toward a utilitarian ethic that prioritizes patient autonomy. Unfortunately, the AAFP has done very little to promote rights of conscience for either medical students or doctors, and in fact has put forward numerous policy statements directly at odds with a Hippocratic, pro-life practice of medicine.

Dassow and Heid, along with several of their colleagues, via recorded video messages, gave numerous examples of this shift. They recounted the ways that language in medicine is breaking down, and basic terms like *family* or *gender* are being redefined. Likewise, many practices are being relabeled to obscure what is actually taking place, such as the push to call physician-assisted suicide "medical aid in dying" or referring to abortion as "reproductive health." Numerous AAFP policy statements are likewise concerning to physicians seeking to uphold the Hippocratic Oath. For example, there are AAFP policies that

- say if a woman faces an unintended pregnancy she should be given non-biased counseling about all options, including abortion, or referred to a physician who will provide such counseling.
- encourage all physicians to train in providing abortions
- encourage physicians to practice across state lines to perform abortions or prescribe abortive pills even if they are illegal in the state
- advocate for insurance to cover abortions and fertility treatments
- support offering and expanding access to physician-assisted suicide.

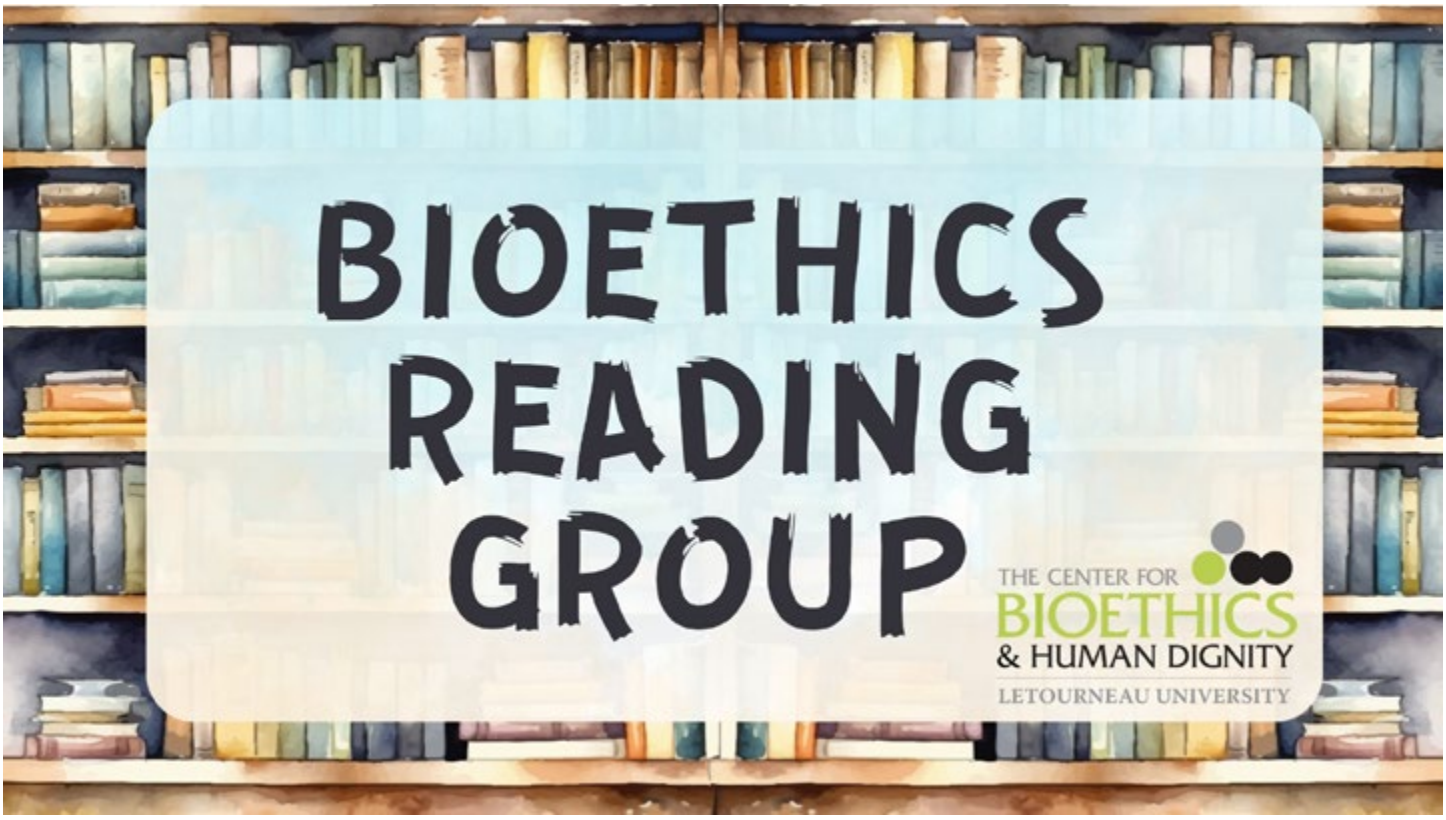
These shifts are not limited to the AAFP. Medical schools have also moved away from the principles of the Hippocratic Oath and from the sanctity of human life. This leaves many medical students feeling homeless, as their convictions are not shared by their fellow students, by their faculty, or by the professional organizations they will one day join.

In order to counteract these shifts within medicine and professional organizations as well as support medical students who wish to uphold traditional medical values, Dassow, Heid, and others formed the American College of Family Medicine. Their mission "is to preserve and defend the principles and practice of Hippocratic family medicine. These principles include protecting the vulnerable at the beginning and end of life, seeking the ultimate good for the patient with compassion and moral integrity, and providing healthcare with the highest standards of excellence based on medical science." This is one way of pushing back against the ethical laxness of the Biotech Century and preserving the traditional practice of medicine for the decades to come.

Perhaps fittingly given *Living in the Biotech Century's* goals of looking both backward and forward, this was the final conference to be held on the campus of Trinity International University in Deerfield, IL. Due to Trinity's impending merger with Trinity Western University, CBHD, with TIU's blessing, has found a new institutional home at LeTourneau University in Longview, TX. We at the Center are so thankful to all of those who have attended the annual conference each year in Deerfield, as well as for TIU and its hospitality throughout CBHD's history. We will be forever grateful for our first home at TIU. Preparations are now underway for CBHD's 2026 conference, *Polytechnic Bioethics,* which will be held on LeTourneau's campus. While the location might be different, our conference will continue to be a leading venue for Christians to explore and discuss the ethical implications of developments in our MedTech world. We hope to see you there!

References

1. Brent Waters, "In Praise of Mundane Healthcare" (plenary address, The Center for Bioethics & Human Dignity's 32nd Annual Conference, *Living in the Biotech Century: The First 25 Years*, Deerfield, IL, June 26, 2025), https://www.youtube.com/live/5SlIldxkkfs.
2. Maureen Condic, "The Science and Ethics of Emerging Biotechnologies" (plenary address, *Living in the Biotech Century*, June 27, 2025), https://www.youtube.com/live/X_WhqTy6ZM4.
3. Nigel Cameron, "Biotech Promises, and Biotech Perils: A Quarter-Time Report" (plenary address, *Living in the Biotech Century*, June 27, 2025), https://www.youtube.com/live/Fxxo578xkBE.
4. "From Vision to Chinese Outreach: The CBI Team's Journey in Bioethics Ministry and Transformative Impact" (plenary address, *Living in the Biotech Century*, June 28, 2025), https://www.youtube.com/watch?v=n_8BJ-sbLik.
5. Ewan Goligher, "How Should We Then Die? A Christian Response to Physician-Assisted Death" (plenary address, *Living in the Biotech Century*, June 28, 2025), https://www.youtube.com/live/XdJa0L5VWjA.
6. Paul Dassow and Jim Heid, "Ethical Challenges in Family Medicine: Past, Present and Future" (plenary address, *Living in the Biotech Century*, June 28, 2025), https://www.youtube.com/live/WoKuK7y-zjA.
7. The AAFP has provided CBHD's CME certification for the past several years.



In April 2026, we are launching a series of online book discussions that will span a full calendar year. The aim of these discussions is to reflect deeply on current and emerging medical and bioethics trends that are currently relevant to daily life or likely to become more relevant within a generation. Participants will be encouraged to engage in online written discussions and teleconferences to consider what is going on, why (or whether) it should be going on, and how Christians should live in light of these developments.

The four books we will read and discuss together are:

- David VanDrunen, *Bioethics and the Christian Life: A Guide to Making Difficult Decisions*
- Ewan Goligher, *How Should We Then Die? A Christian Response to Physician-Assisted Death*
- Paul Ramsey, *Fabricated Man: The Ethics of Genetic Control*
- TBA

Join us for one book or, even better, join us for all four. More details coming soon. Join the CBHD email list to be the first to know: https://bit.ly/cbhd-email

31

BOOK REVIEW

The Immortal Mind

Michael Egnor and Denise O'Leary, *The Immortal Mind: A Neurosurgeon's Case for the Existence of the Soul.* Hachette Nashville, 2025. ISBN 978-1-5460-0637-4 (ePub).

Rick Townsend, PhD | Guest Contributor

In *The Immortal Mind*, neurosurgeon Michael Egnor offers a thoughtful analysis regarding one of the most fundamental questions in bioethics: "What is this thing we call consciousness?" The answer to that question is fundamental to a related question, "What does it mean to be human?" Drawing on forty years of clinical practice, Egnor and O'Leary challenge the naturalism-only assumption that the brain can fully generate consciousness. Instead, they suggest that human beings possess an immaterial dimension that grounds reason, moral agency, and personal identity. For readers concerned with the philosophical and theological foundations of human dignity, the work provides a treatment that is both stimulating and compelling.

Clinical Observations That Resist Reduction

A distinctive strength of the book is its reliance on clinical experience. The authors build a case on experience rather than theory alone. They introduce cases in which patients experience severe neurological injury or loss of portions of their brains due to tumors and other abnormalities. In many of these cases, the patients retain their personality, temperament, and memory. Egnor and O'Leary consider split-brain surgery, contending that the unified subjective self remains intact, even when the left and right hemispheres of the brain are separated, disrupting normal communication channels. Surgeons perform this separation of the hemispheres in cases of severe epileptic seizures, in which electrical signals on one side of the brain increase in strength as they are transmitted to the other. A back-and-forth cyclic increase in the signals results in seizures in severe cases. In some of these surgeries, the corpus callosum, the "massive bundle of millions of nerve fibers that connects the two hemispheres of the brain," is completely severed (p. 13). The result often calms the seizures' intensity and frequency, but it never severs the conscious unity of the individual.

The volume contains enough medical-grade diagrams to demonstrate the expertise of Dr. Egnor yet expresses medical complexity in terms that allow non-physician readers to grasp the significance of the argument. Such comprehensibility may result from the work of the co-author, accomplished science writer and journalist Denyse O'Leary. However the work progressed, the collaboration works well. The complexities described add credibility without leaving readers with little foundational medical knowledge in the dust.

Early chapters address the lack of predictable correlation between brain abnormalities and the functioning intellect of patients afflicted with the various conditions described above. The human experience of working through life is, indeed, sometimes profoundly influenced by physical or mental handicaps that stem from such abnormalities. But in many

Rick Townsend, "Review of The Immortal Mind" *Dignitas* 32, no. 3-4 (2025): 31-32.

more cases than one might expect, the intellect remains unaffected or minimally impacted. And in every documented case, the consciousness of the individual is always a unified single entity. Egnor and O'Leary make the case that this lack of connection to the physical condition is due to the immaterial (or as they contend, the immortal) nature of the conscious essence of humanity.

The authors also consider episodes of near-death experience and unexpected lucidity in deep coma. These are phenomena that, while not conclusive in themselves, raise legitimate questions about the sufficiency of materialist accounts of mind.

The case made in this work does not overstate documented medical results but instead uses case studies that serve to reveal aspects of human consciousness for which neuroscientists have at best incomplete theories. For the authors, such cases invite humility about what brain science can explain and remind us that purely physical descriptions cannot adequately explain the complexity of human experience. A materialist approach is insufficient to account for the described phenomena.

The Classical Framework: Intellect and the Immaterial

Egnor has shared in lectures that he has studied the philosophy of Thomas Aquinas and holds a Thomistic interpretation of human nature. He and O'Leary cite classical thinkers' work showing that human capacity for abstract reasoning cannot arise solely from matter. Humans' intellectual ability to contemplate abstract ideas and comprehend immaterial realities suggests a spiritual dimension that transcends neurological causes.

While readers may differ on how best to describe this immaterial aspect, the book's treatment underscores an important bioethical point: Human dignity is not reducible to functional capacity or neurobiological performance. Rather, the ontological reality of the person as an embodied yet transcendent being is grounded in deeper spiritual levels than materialism can provide.

The Unity of Consciousness

The authors also address the unity of consciousness—our coherent, continuous, universal personal experience of consciousness. Alternate theories often resort to explanations that fail to fully account for the human experience of the world through their minds. Egnor and O'Leary contend that the most compelling account is that human consciousness arises from a unified personal spirit-mind-soul nature, not from a combination of physical components. They point out that these alternate theories are often simply proposed explanations lacking empirical grounding.

This insight carries significant implications. If the person is fundamentally unified and not merely an assembly of physical capacities, then human dignity remains intact even in conditions of severe cognitive impairment, dementia, or brain injury. In such situations, the metaphysical grounding of dignity becomes especially important for bioethical deliberation and compassionate care.

Freedom, Responsibility, and the Moral Life

The authors' reflections on free will further support their understanding of the physical and spiritual dimensions of human experience. Moral awareness and sensitivity cannot be explained by deterministic processes. Egnor argues instead that genuine choice is both philosophically defensible and consistent with the lived experience of patients and practitioners. Physiology and biochemistry have no causal ability related to human decision-making. Instead, evidence suggests that deliberation and intentional action involve a dimension not strictly confined to biomedical factors.

For Christians concerned with bioethics, this view resonates with long-standing theological affirmations of human responsibility, moral discernment, and the sanctity of the moral life.

Assessment

The Immortal Mind does not claim to settle every debate, nor does it dismiss legitimate insights from neuroscience. Rather, the book's contribution lies in calling attention to the limits of strictly materialistic accounts and inviting a richer, more thorough understanding of the human person. The writing style encourages humility related to the mystery of consciousness and openness to philosophical traditions that affirm the spiritual dimension of humanity.

For a field like bioethics—where decisions often hinge on how we define personhood, agency, and human worth—the work provides a timely reminder that scientific description, while indispensable, cannot by itself answer the deepest questions about what it means to be human.

The Immortal Mind will not persuade all readers, but it offers thoughtful analysis, a wealth of clinical insight, and a framework for reflection that aligns with a robust, dignity-affirming perspective regarding what it means to be human. As such, it merits careful attention from scholars, clinicians, theologians, and all who are committed to upholding the sanctity of human life in an age increasingly tempted to reduce the person to the measurable and the material.

BIOETHICS NEWS STORIES

July–December 2025

Heather Zeiger, MS, MA | Research Analyst

"ChatGPT Turns 3"

Rest of World, November 26, 2025

Three years ago, on November 30, 2022, OpenAI launched ChatGPT. Hot on the heels of its viral image generator DALL-E, the Sam Altman-helmed company's chatbot quickly attracted millions of visitors and was heralded as a transformative technology.

After ChatGPT's launch in 2022, the shimmer has since dulled as people are less enthusiastic about Large Language Models. The interactive chatbots have led to inappropriate interactions with teens that would be considered illegal in human-to-human interactions, including enabling suicide ideation. Furthermore, families and therapists have reported loved ones falling into so-called "AI psychosis." MIT Technology Review published an article in December entitled "The Great AI Hype Correction of 2025" that reported on how AI failed to deliver in some of its business promises, and in November the Wall Street Journal reported that "AI Is Making Us Rich and Unhappy."

AI has damaged marriages, given bad medical advice, upended education, plagiarized writers, and stressed the power grid. Here is a sampling of the AI headlines from the second half of 2025.

AI RELATIONSHIPS

"Teens Say They Are Turning to AI for Friendship"

by Jocelyn Gecker, Associated Press, July 23, 2025

"Everyone uses AI for everything now. It's really taking over," said Chege, who wonders how AI tools will affect her generation. "I think kids use AI to get out of thinking."

"What am I falling in love with? Human-AI Relationships Are No Longer Just Science Fiction"

by Salvador Rodriguez, CNBC, August 1, 2025

Until recently, stories of human-AI companionship were mostly confined to the realms of Hollywood and science fiction. But the launch of ChatGPT in late 2022 and the generative AI boom that quickly followed ushered in a new era of chatbots that have proven to be smart, quick-witted, argumentative, helpful and sometimes aggressively romantic.

"It's Surprisingly Easy to Stumble into a Relationship with an AI Chatbot"

by Rhiannon Williams, MIT Technology Review, September 24, 2025

Members stressed repeatedly that their AI relationships developed unintentionally. Only 6.5% of them said they'd deliberately sought out an AI companion.

"1 in 5 High Schoolers Has Had a Romantic AI Relationship, or Knows Someone Who Has"

by Lee V. Gaines, NPR, October 8, 2025

Students who attend schools that use AI a lot were also more likely to report that they or a friend had used AI for mental health support, as a companion, as a way to escape reality and to have a romantic relationship.

"AI Relationships Are on the Rise. A Divorce Boom Could Be Next"

by Jason Pahram, Wired, November 13, 2025

Love has never been easy, but spouses who have unmet emotional needs are "the most vulnerable to the influences and behaviors of AI," Palmer says. "And particularly if a marriage is already struggling."

AI AND PUBLIC POLICY

"Trump Signs Executive Order to Curtail State AI Laws"

by Alyssa Lukpat and Natalie Andrews, Wall Street Journal, December 11, 2025

The order would allow the Justice Department to punish states with rules deemed restrictive for AI, in a move to bring the U.S. under one federal standard. Silicon Valley executives had been lobbying the president to ban state AI laws that they said could cause the U.S. to lose the AI race to China.

AI AND MENTAL HEALTH

"'I Feel Like I'm Going Crazy': ChatGPT Fuels Delusional Spirals"

by Sam Schechner and Sam Kessler, Wall Street Journal, August 7, 2025

The chats shed light on an emerging phenomenon, dubbed AI psychosis or AI delusion by doctors and victims' advocates, in which users come under the influence of delusional or false statements by chatbots that claim to be supernatural or sentient or discovering a new mathematical or scientific advance.

"AI Psychosis Is Rarely Psychosis at All"

by Robert Hart, Wired, September 18, 2025

With the focus so squarely on distorted beliefs, MacCabe's verdict is blunt: "AI psychosis is a misnomer. AI delusional disorder would be a better term."

"People Who Say They're Experiencing AI Psychosis Beg the FTC for Help"

by Caroline Haskins, Wired, October 22, 2025

The Federal Trade Commission received 200 complaints mentioning ChatGPT between November 2022 and August 2025. Several attributed delusions, paranoia, and spiritual crises to the chatbot.

"What OpenAI Did When ChatGPT Users Lost Touch with Reality"

by Kashmir Hill and Jennifer Valentino-DeVries, New York Times, November 23, 2025

It sounds like science fiction: A company turns a dial on a product used by hundreds of millions of people and inadvertently destabilizes some of their minds. But that is essentially what happened at OpenAI this year.

"Her Daughter Was Unraveling, and She Didn't Know Why. Then She Found the AI Chat Logs"

by Caitlin Gibson, Washington Post, December 23, 2025

H was convinced that she must be reading the words of an adult predator, hiding behind anonymous screen names and sexually grooming her pre-pubescent child.

AI AND MEDICINE

"Dr. ChatGPT Will See You Now"

by Ryan Flinn Wired, July 10, 2025

Several studies have shown that AI is capable in certain circumstances of providing accurate medical advice and diagnoses, but it's when these tools get put in people's hands—whether they're doctors or patients—that accuracy often falls.

"The Doctors Are Real, But the Sales Pitches Are Frauds"

by Steven Lee Myers, Alice Callahan, and Teddy Rosenbluth, New York Times, September 5, 2025

Scammers are using A.I. tools to make it look as if medical professionals are promoting dubious health care products.

"Empathetic, Available, Cheap: When A.I. Offers What Doctors Don't"

by Teddy Rosenbluth and Maggie Astor, New York Times, November 17, 2025

Frustrated by the medical system, some patients are turning to chatbots for help. At what cost?

REPRODUCTIVE ETHICS

"Healthy Babies Born in Britain After Scientists Used DNA from Three People to Avoid Genetic Disease"

by Maria Cheng and Laura Ungar, Associated Press, July 16, 2025

Eight healthy babies were born in Britain with the help of an experimental technique that uses DNA from three people to help mothers avoid passing devastating rare diseases to their children, researchers reported Wednesday [July 16].

The U.K. and Australia are the only places that allow the technique, which uses the mother's egg, the father's sperm, and donor mitochondrial DNA. Britain had to change a 2016 law to allow the technique to be done. Results of this latest study show an inefficient technique—8 pregnancies out of 22 women—and it may not have worked in all cases. One of the 8 babies had higher than expected levels of abnormal mitochondria. One of the biggest criticisms for "three-person IVF" is that no one knows the long-term impact on future generations, or even on the child who was born through this technique.

"Sperm Donor with Cancer-Causing Gene Fathered Nearly 200 Children Across Europe, Investigation Finds"

by Haley Ott, CBS News, December 10, 2025

Some children conceived using the sperm have already died from cancer, and the vast majority of those who inherited the gene will develop cancer in their lifetimes, geneticists said.

While mitochondrial replacement (i.e., "three-person IVF") is not permitted in the US or other parts of Europe, the lack of regulations in assisted reproduction has caused problems. In part of Europe, there is a limit to how many women can be impregnated with donor sperm, but that does not stop companies and individuals from using mail-order sperm ["'They treat men like vending machines': Inside the Hidden World of Social Media Sperm Selling"]. However, this can result in some devastating unintended consequences. As reported in December, a man with a genetic mutation that results in cancer has fathered at least 200 children across Europe, most of whom will get cancer at some point.

"Genetically Engineered Babies Are Banned. Tech Titans Are Trying to Make One Anyway"

by Emily Glazer, Katherine Long, and Amy Dockser Marcus, Wall Street Journal, November 8, 2025

Backed by OpenAI chief executive Sam Altman and his husband, along with Coinbase co-founder and CEO Brian Armstrong, the startup—called Preventive—has been quietly preparing what would amount to a biological first. They are working toward creating a child born from an embryo edited to prevent a hereditary disease.

San Francisco-based Preventative has been quietly working on a project that is supposed to be banned in the US—making genetically engineered children. The company has been working in countries where experimentation with embryo editing is allowed. Other Silicon Valley companies, such as Orchid, use embryo screening techniques to select embryos for desired traits. A recurring theme in Silicon Valley is the belief that there is a technological solution to the human condition, a belief that is hardly cutting edge.

PHYSICIAN-ASSISTED SUICIDE

"New York Is Set to Legalize Medically Assisted Suicide with 'Guardrails,' Governor Says"

by Anthony Izaguirre and Michael Hill, Associated Press, December 17, 2025

Democratic Gov. Kathy Hochul plans to sign the proposal next year after pushing to add a series of "guardrails" in the bill, she announced in an op-ed in the Albany Times Union.

Hochul, a Catholic, said she came to the decision after hearing from New Yorkers in the "throes of pain and suffering," as well as their children, while also considering opposition from "individuals of many faiths who believe that deliberately shortening one's life violates the sanctity of life."

"Gov. Pritzker Signs Bill Making Illinois 12th State to Allow Physician-Assisted Suicide"

by Andy Koval, WGN9, December 12, 2025

The bill, named the End-of-Life Options for Terminally Ill Patients Act (SB 1950), is also known as "Deb's Law."

Both Illinois and New York have been added to the list of US states that permit physician-assisted suicide in December. Both bills have guardrails and are intended for people who have six months or less to live. Meanwhile, Switzerland is seeing an increase in suicides among people ages 65 to 85 ["Suicides in Switzerland Quadruple Among Older People"], and an article in The Atlantic says "Canada Is Killing Itself" because so many people have used its medical assistance in dying law. Canada's MAiD has expanded so quickly that it has "proved to be a case study in momentum," according to The Atlantic. Canadian journalist Stephanie Nolan wrote a long-form article on the expansion of euthanasia laws globally for the New York Times, "Should You Be Able to Ask a Doctor to Help You Die?" The article is worth reading to gain an overview of how euthanasia laws tend to begin as only for the terminally ill but always expand to other groups.

OTHER NEWS

"Huntington's Disease Successfully Treated for First Time"

by James Gallagher, BBC, September 24, 2025

An emotional research team became tearful as they described how data shows the disease was slowed by 75% in patients. 'It means the decline you would normally expect in one year would take four years after treatment, giving patients decades of "good quality life"', Prof Sarah Tabrizi told BBC News.

A new treatment for Huntington's disease has shown remarkable ability to slow down the progression of the disease. This treatment is a gene therapy (AMT-130) that reduces levels of rogue protein that kills neurons. The therapy is administered as a single dose in a 12–18-hour brain surgery. The trial involved 29 patients; results have not been published but were released by the company. The treatment is lifelong since brain cells do not renew like other cells.

"After Years of Anger Directed at C.D.C., Shooting Manifests Worst Fears"

by Apoorva Mandavilli, New York Times, August 9, 2025

The investigation into the shooting and the gunman's potential motives was still in early stages on Saturday [August 9]. But law enforcement officials said that the suspect identified in the shooting had become fixated with the coronavirus vaccine, believing that it was the cause of his physical ailments.

In August, a man opened fire at the CDC, killing a police officer and damaging the property. Many people see this as the result of misinformation and part of a pattern against healthcare workers and civil servants.

GLOBAL HEALTH TIMELINE

July–December 2025

Heather Zeiger, MS, MA | CBHD Title

JULY 2025

July 2: "Ann Merriman, 'Mother of Palliative Care' in Uganda, Dies at 90" (New York Times)

July 8: "First Malaria Treatment for Babies Approved for Use" (BBC)

July 9: "The World Bank Set Out to Transform Health Care for the Poor in Africa. It Drove Patients Deeper into Poverty" (ICIJ)

July 11: "Burkina Faso's Only Eye Doctor for Children Sees the Trauma of Both Play and Conflict" (AP)

July 11: "In the Country with the World's Lowest Birth Rate, Fertility Clinics Are Booming" [South Korea] (BBC)

July 15: "Israel and Iran Usher in New Era of Psychological Warfare" (New York Times)

July 15: "Big Brother Gets New Powers in China with Digital ID System (Washington Post)

July 16: "WHO, UNICEF Say More than 14 Million Infants Worldwide Remain Unvaccinated" (Medical Xpress)

July 23: "'We Faced Hunger Before, But Never Like This': Skeletal Children Fill Hospital Wards as Starvation Grips Gaza" (The Guardian)

July 25: "Weak Regulation Causing Deaths Due to Contaminated Medicines, WHO Says" [Global] (Reuters)

July 29: "Famine Is Unfolding in Gaza, U.N.-Backed Group Says" (Wall Street Journal)

July 30: "Google Failed to Warn 10 Million of Turkey Earthquake Severity" (BBC)

AUGUST 2025

August 8: "The World Nearly Beat Polio. But Fake Records, an Imperfect Vaccine and Missteps Aided Its Comeback" (AP)

August 8: "China Has Declared War on the Chikungunya Virus. How Much of a Threat Is It?" (NPR)

August 13: "'Our Children Are Dying'—Rare Footage Shows Plight of Civilians in Besieged Sudan City" (BBC)

August 15: "This Virus Seems Like It's No Longer a Problem. It's Still a Threat" [Africa] (NPR)

August 19: "One Neurosurgeon, 8 Million Patients" [Sierra Leone] (NPR)

August 22: "Famine Is Now Gripping Parts of Gaza, Says Global Body" (Wall Street Journal)

August 22: "Revealed: Israeli Military's Own Data Indicates Civilian Death Rate of 83% in Gaza War" (The Guardian)

August 27: "Pregnancy Has Become a Nightmare for Many Women in Nigeria's Conflict-Hit North" (AP)

SEPTEMBER 2025

September 1: "Latam-GPT: Meet the Open Source AI of Latin America" (Wired)

September 2: "Critical Medical Supplies Run Out as Cases of Rare Syndrome Rise in Gaza, WHO Says" (Reuters)

September 3: "An Ancient Disease Makes Yet Another Comeback" [Africa] (NPR)

September 5: "WHO Adds GLP-1 Weight Loss Drugs to List of the World's Essential Medicines for the First Time" (Quartz)

September 11: "$10 Million in Contraceptives Have Been Destroyed on Orders from Trump Officials" (New York Times)

September 22: "This Country's Government Vowed to Eliminate TB by the End of 2025. It's Not Going Well" [India] (CNN)

September 25: "Philanthropies Strike a Promising Deal to Turn Back H.I.V." [Global] (New York Times)

OCTOBER 2025

October 6: "Bad Practice: How Doctors Jump Borders to Leave Troubling Pasts Behind" [Global] (National Post)

October 10: "Iran Lures Transgender Foreigners for Surgery But Forces Operations on Locals" (New York Times)

October 14: "W.H.O. Warns of Sharp Increase in Drug-Resistant Infections" [Global] (New York Times)

October 15: "Good News About Christian Hospitals in Africa" (CT)

October 22: "'I Fear We Are Sitting on a Time Bomb.' Scientists Debate Mass Distribution of Antibiotics in Africa" (Science)

October 24: "This Nation Has the Fastest Rising Rate of Cancer Cases—and Deaths—in the World" [Lebanon] (NPR)

October 24: "In a Regional First, Uruguay Passes a Law Allowing Euthanasia" (AP via MSN)

October 29: "Hundreds Killed in Massacre at Sudanese Hospital, W.H.O. Warns" (New York Times)

NOVEMBER 2025

November 7: "AI Steps in to Detect the World's Deadliest Infectious Diseases" [Global] (Wired)

November 13: "New Malaria Drug Could Be a Life-Saver as the Standard Drug Shows Signs of Weakness" [Africa] (NPR)

November 24: "Bad Drugs or No Drugs: Cancer Patients Face Scary Reality Tied to Foreign Supply Chain" [United States] (The National News Desk)

November 24: "Unesco Adopts Global Standards on 'Wild West' Field of Neurotechnology (The Guardian)

DECEMBER 2025

December 1: "WHO Warning Over Shortage of Obesity Jabs" [Global] (BBC)

December 2: "These Zika Mothers Went to Battle—And Their Cry Was Heard" [Brazil] (NPR)

December 15: "They Answered an Ad for Surrogates, and Found Themselves in a Nightmare" [Global] (New York Times)

December 16: "The Biggest Mosquito-Borne Disease in the World Has a Cure. There's Just One Problem" [Global] (Vox)

December 24: "The Quiet Violence of Surveillance Developmentalism" [India] (The Hedgehog Review)

December 31: "A Deadly, Drug-Resistant Fungus Threatens People Around the World, Scientists Warn" (Gizmodo)

BIOENGAGEMENT

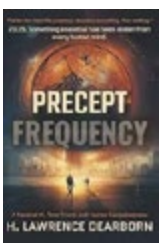
Readers are cautioned that these resources are highlighted because they raise bioethical issues. Given the complexities of the issues, the resources represent a wide spectrum of perspectives, genres, and content, and they may contain material that is not appropriate for all audiences, including material that may bring up difficult experiences for some. Thus, both the content and the perspectives represented therein are not necessarily endorsed by CBHD. Readers are encouraged to further research each resource before engaging.

If you have a suggestion for us to include, send us a note at research@cbhd.org.

BIOFICTION

Gone Before Goodbye
(Harlan Coben and Reese Witherspoon, 2025)
Griefbots, Radical Life Extension, Organ Transplantation

Emergence: The Belt Series Book 6
(Gerald M. Kilby, 2022)
Public vs. Individual Moral Obligation, Ethics of Emerging Technology, Artificial Intelligence



Precept Frequency: A Novel of AI, Time Travel and Human Consciousness
(H. Lawrence Dearborn, 2025)
Artificial Intelligence, Uploading Human Consciousness, What It Means to Be Human

PRIMETIME BIOETHICS

Pluribus
(Apple TV+, 2025)
Informed Consent, What It Means to be Human, Pandemic Ethics, AI

The Eternaut
(Netflix, 2025)
Pandemic Ethics, Individual Autonomy vs. Public Health, Grief and Loss

Doc
(Fox Entertainment, 2025)
Memory and Identity, Medical Ethics, Grief and Loss

BIOETHICS AT THE BOX OFFICE

Brainstare
(Steve Balderson, 2025)
Use of AI in Creative Content, Ethics of Technology and Privacy, Brain-Computer Interfaces
First AI/Human Feature-Length Film: https://www.youtube.com/watch?v=-lt-G7YMk324.

Thunderbolts
(Walt Disney Studios, 2025)
Informed Consent, Human Enhancement, Moral Injury

Frankenstein
(Netflix, 2025)
Ethical Use of Technology, Human Enhancement, Moral Status of Created Beings

UPDATES & ACTIVITIES

CBHD Events:

Other Events and Activities

- CBHD officially signed contracts in November to join LeTourneau University in Longview, TX. January 2nd launched the beginning of this new partnership. Staff of the Center are elated at joining "*The* Christian Polytechnic University" and the alignment in vision and mission shared between the Center and the school.
- The Member's Roundtable Discussion, led by Research Scholar Anna Vollema, explored the application of themes from Mary Shelley's Frankenstein to modern day ethics and discussed Guillermo del Toro's film adaptation. The event was offered online and held in early December.
- December's Roundtable Book Discussion with TEDS faculty, staff and students was also led by Anna Vollema on C. S. Lewis' *That Hideous Strength*. We're grateful for the rich discussion that occurred within each of these events.
- The Center hosted yet another successful cohort. Executive Director Matthew Eppinette led the 5-week "Ethics of Life and Death Cohort" across the months of September and October, with a phenomenal turnout and interaction from participants.

Staff Bioethical Engagement:

Matthew Eppinette

- Almost all of my time and energy went toward finding a new home for The Center for Bioethics & Human Dignity. We are all grateful for the Lord's provision in bringing us to LeTourneau University.
- Taught "The Ethics of Life and Death" for Fuller Theological Seminary's School of Psychology & Marriage and Family Therapy, June–September.
- Led a 5-week online cohort, "The Ethics of Life and Death," in conjunction with Trinity Evangelical Divinity School in September and October.
- Was a guest on *Just Common Sense Radio* in November.

Bryan Just

- Published "Suicide by Default: Dr. Death's New Killing Device Is Even Worse Than Its Predecessors," *Salvo* 74 (Fall 2025): https://salvomag.com/article/salvo74/suicide-by-default.
- Published "Dr. Who? The AI 'Doctor' Is (Not) In," *Salvo* 75 (Winter 2025): https://salvomag.com/article/salvo75/dr-who.
- Taught a 4-week Sunday School series on "Dying as a Christian" at The Orchard, Arlington Heights, IL.
- Presented "Coverage of Bioethics in Early Issues of Christianity Today" at The Evangelical Theological Society 77th Annual Meeting, Boston, MA, November 18–20, 2025.
- Was awarded a Paul Ramsey Fellowship with the Center for Bioethics & Culture.

Anna Vollema

- Led the roundtable discussion for CBHD members on Guillermo Del Toro's film adaptation of *Frankenstein*.
- Led the roundtable discussion on C. S. Lewis' *That Hideous Strength* for faculty, staff, and students of Trinity Evangelical Divinity School.
- Published "Bryan Johnson vs. Bill Furlong: Renew the Mind, Don't Worship the Body," *Intersections*, November 18, 2025, https://www.cbhd.org/intersections/bryan-johnson-vs-bill-furlong-renew-the-mind-dont-worship-the-body.
- Published "Emmanuel: The Word Made Flesh," *Intersections*, December 1, 2025, https://www.cbhd.org/intersections/emmanuel-the-word-made-flesh.

Heather Zeiger

- Started a new teaching job as a high school physics and chemistry teacher at a Classical Christian school in Dallas, where she helped advise students who are doing their thesis project on bioethics topics.
- Talked about bioethics and science headlines on Faith Radio's *The Reconnect* with Carmen LeBurge.

Social Connection with CBHD

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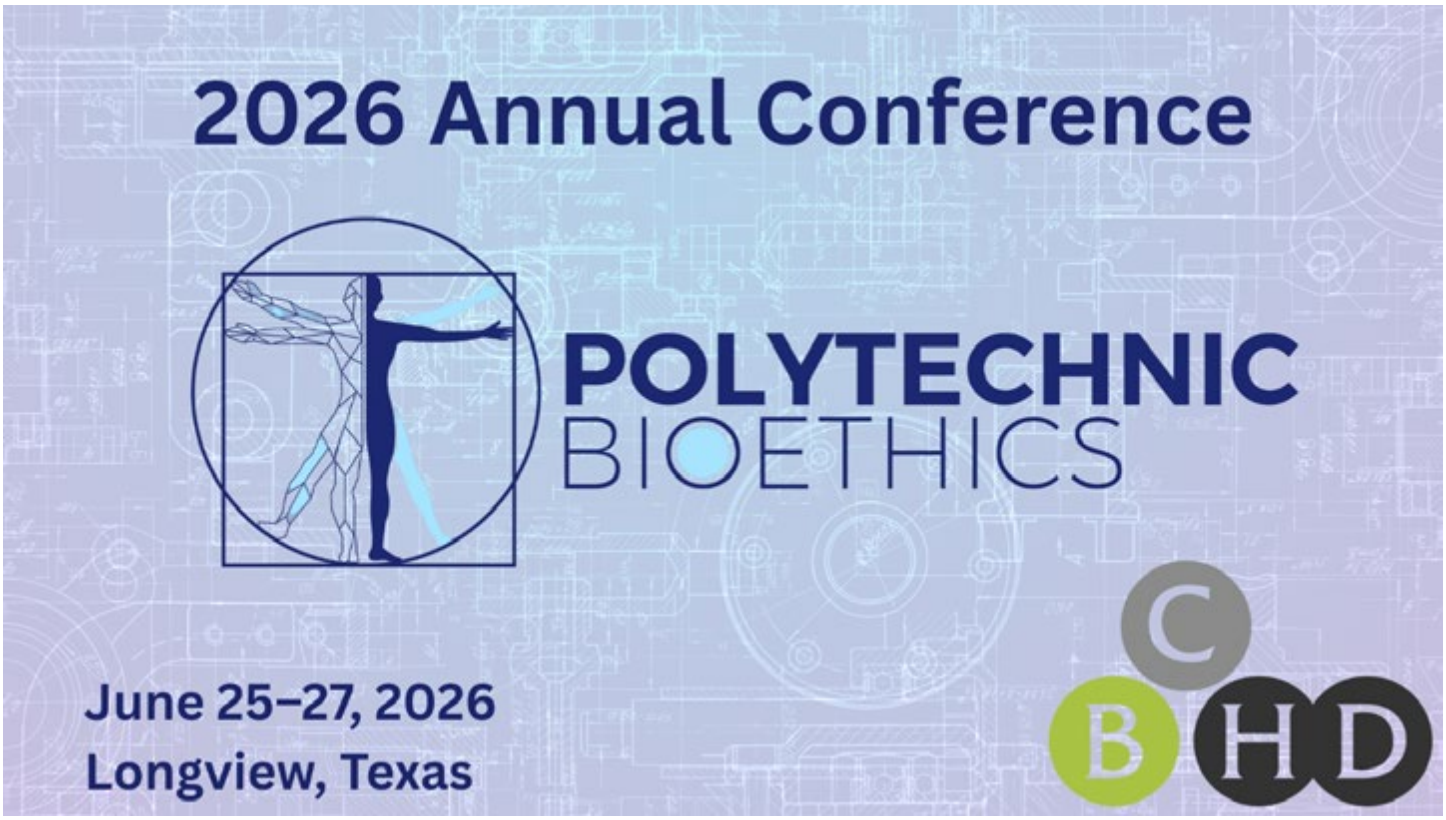

CBHD's new location at LeTourneau University, known as The Christian Polytechnic University, prompts us to reflect on the term "polytechnic" and how bioethics is a polytechnic field. At its root, polytechnic simply means "many arts," and more specifically, combining the liberal arts with the technical, or "practical," arts. Bioethics has always been multidisciplinary, drawing from Medicine, Theology, Philosophy, Law, and many other fields. Ethics is applied philosophy, and bioethics specifically combines the technical with the philosophical. It goes beyond asking an abstract question, like "What does it mean to be a human living in community?" to "What will we do with this patient right here before us?" Bioethics, it seems, is very much a polytechnic field.

And just as CBHD has championed a distinctly *Christian* view of bioethics for the last thirty years, LeTourneau University takes a distinctly *Christian* view of the polytechnic.

Our 2026 Summer Conference, then, will focus on the polytechnic nature of bioethics, including the various fields from which the discipline draws; the many issues raised that are immensely practical, technical, and temporal; and the deeply human and timeless questions that bioethics raises, like what we will or will not pursue when it comes to matters of life and death.

We invite you to join us at LeTourneau University in Longview, Texas, June 25–27, 2026, for The Center for Bioethics & Human Dignity's 33rd Annual Conference, *Polytechnic Bioethics*.

https://www.cbhd.org/conference-2026

The Center for Bioethics and Human Dignity (CBHD) is a Christian academic research center at LeTourneau University that conducts, disseminates, and advances biblically informed, theologically rich research, analysis, and reflection on the complex and pressing ethical issues in medicine, science, and technology.

Dignitas is the quarterly publication of the Center and is a vehicle for the scholarly discussion of bioethical issues from a Judeo-Christian Hippocratic worldview, updates in the fields of bioethics, medicine, and technology, and information regarding the Center's ongoing activities.