The Brain and the Making of the Modern Mind

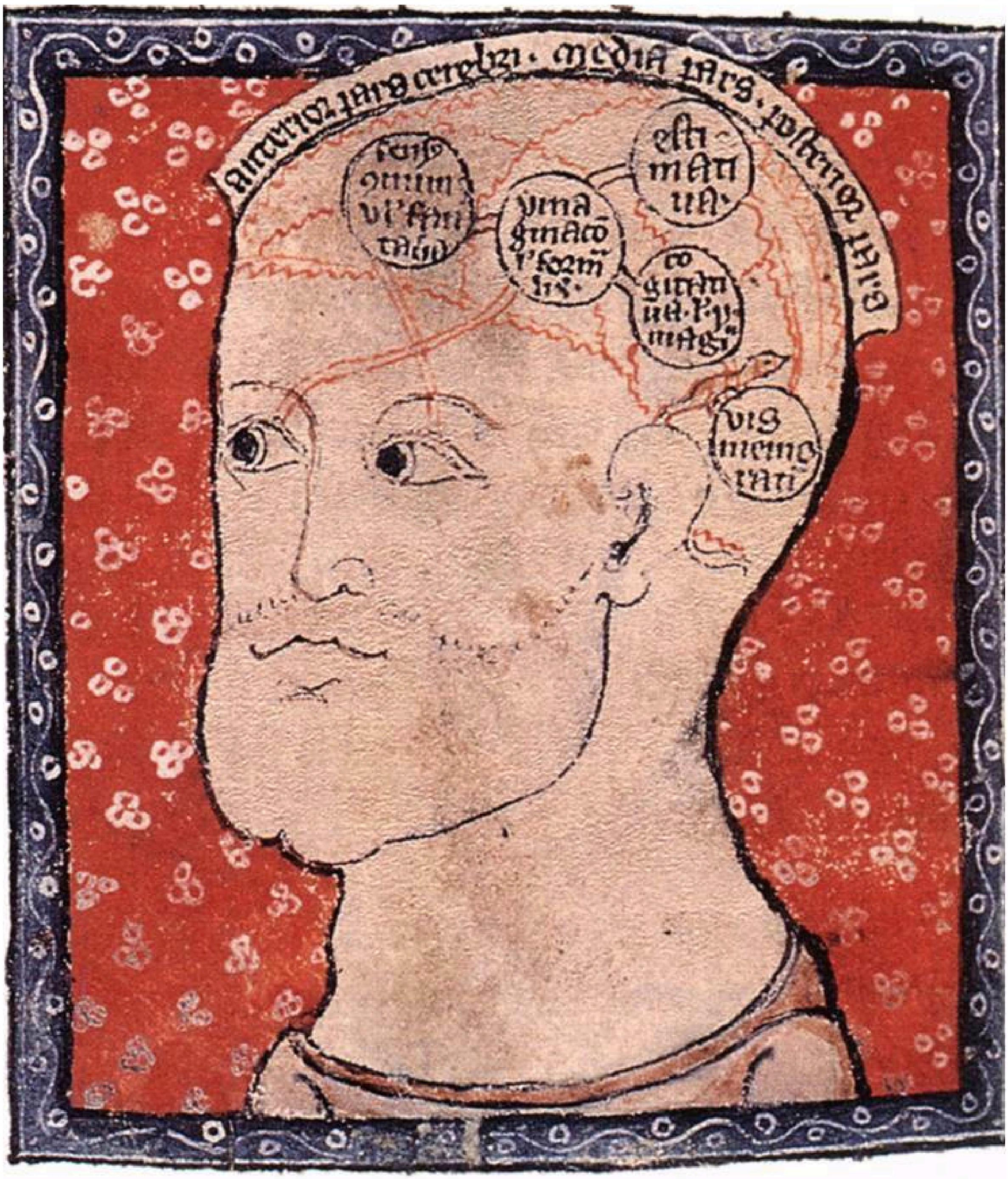


Diagram of the brain, ca. 1300, unknown artist

Few today would deny that the brain holds a preeminent place in the scientific imagination. In modern science, the brain is often seen as the organ of consciousness, thought, and identity. This view, rooted in neuroscience, psychology, and cognitive science, suggests that who we are —our emotions, memories, imagination, and even sense of free will—is fundamentally tied to and determined by the brain's structure and function. With the rise of brain imaging (e.g., functional MRI and electroencephalograms), neuroplasticity research, and artificial intelligence (AI), the brain has become a new frontier for exploration. Neuroscientific breakthroughs have fueled speculation about everything from mind uploading to brain-machine interfaces, reinforcing the brain's essential role in discussions about human potential and limitations.

Yet as Matthew Cobb's illuminating *The Idea of the Brain: The Past and Future of Neuroscience* demonstrates, despite centuries of scientific inquiry, our understanding of the brain remains remarkably limited.[1] The more we learn, the more the brain's complexity defies reductive explanations. While we have built a solid foundation in neurophysiology, we still lack a clear understanding of how neurons—whether billions, millions, or thousands—interact to generate brain activity.[2] To be sure, we know that the brain interacts with the world and the body, processing stimuli through both innate and learned neural networks. It predicts changes in stimuli to prepare appropriate responses and coordinates bodily actions through intricate neuronal connections and chemical signaling. Yet when it comes to truly grasping how neural networks operate at a cellular level or accurately predicting the effects of changes in their activity, we are still in the early days of neuroscience. For instance, while scientists can artificially induce visual perception in a mouse by replicating a specific pattern of neuronal activity, they do not yet fully understand how and why visual perception generates that pattern in the first place.[3]

How are we able to discuss so extensively an organ whose operations we scarcely understand? Cobb provides an accurate account when he argues that a persistent challenge in neuroscience is the tendency to impose external analogies and metaphors onto the brain, a tendency that reflects a *representationalist* approach to its study. From Descartes's hydraulic model inspired by garden fountains to contemporary metaphors drawn from computing and AI, such approaches often obfuscate rather than illuminate our understanding of the brain. A representationalist approach to understanding the brain assumes that the brain functions primarily as a system that creates and manipulates internal representations of the external world. In this view, the brain is like a mirror or model builder that forms symbolic or computational representations of reality rather than directly engaging with it.

While metaphors like these may be unavoidable, an overreliance on them can constrain our thinking about the brain itself. For example, many scientists now recognize that to view the brain as a computer that passively processes inputs is to overlook its active role as an organ embedded in the body, constantly interacting with its environment. More importantly, these models are external projections onto the brain rather than direct insights into its actual workings.

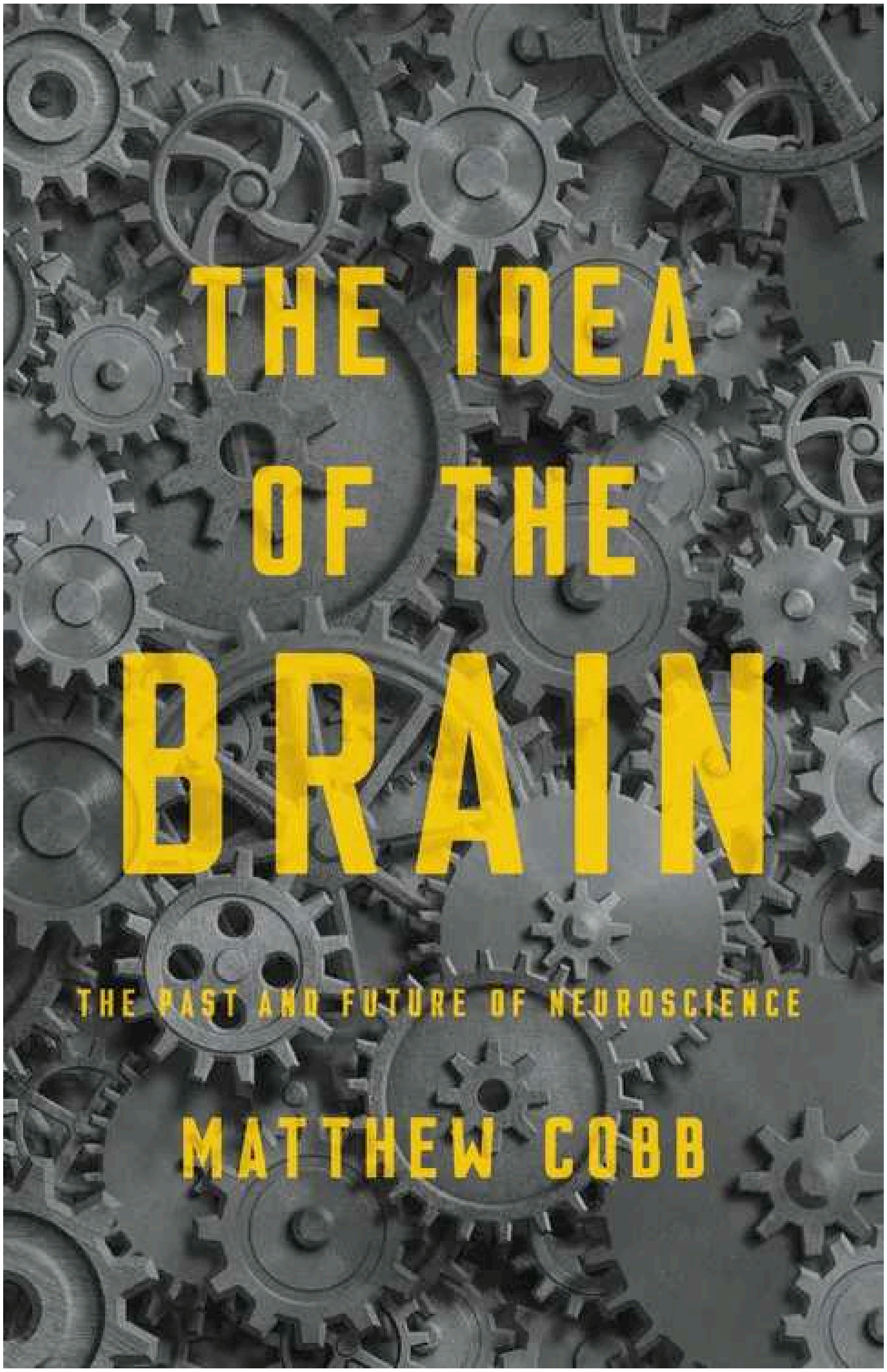
Similarly, the prevailing scientific view is that thought arises, though by mechanisms we do not yet fully understand, from the activity of billions of neurons within the human brain. Surprisingly, however, this focus on the brain is a relatively recent development. Throughout most of history (with some exceptions), human beings have regarded the heart, rather than the brain, as the primary locus of perception and emotion. The influence of this ancient perspective persists in our everyday language. For instance, English expressions like *learn by heart, heartbroken,* and *heartfelt* (with parallels in many other languages) reflect a worldview that modern science has largely superseded. Yet these phrases carry a deep emotional resonance, something that becomes clear if one attempts to substitute *brain* for *heart* and considers the result (e.g., "brainbroken").

In any event, similar to other elements in our scientific paradigm, the mechanistic view of the brain goes back to the proponents of the new empirical science in the seventeenth century. Thus, Nicolaus Steno, who was influenced by Descartes, describes the project of neuroscience in the following way:

> The brain being indeed a machine, we must not hope to find its artifice through other ways than those which are used to find the artifice of the other machines. It thus remains to do what we would do for any other machine; I mean to dismantle it piece by piece and to consider what these can do separately and together.[4]

This passage highlights a scientific and mechanical approach to studying the brain. The idea is that since the brain can be understood as a kind of "machine," we should study it in the same way that we would any other complex machine. We must "dismantle" the brain in order to study its individual components, such as neurons, synapses, and various biochemical processes, so that we can understand their separate and collective functions. By doing this, we may hope to uncover how the brain works in much the same way as the mechanics of any other machine.

However, such mechanistic views of the brain—and, by extension, of the human being as a whole—inevitably raise ethical concerns, particularly in the context of human relationships, where complex emotions are at play. Indeed, comparisons between humans and machines were widely considered deeply immoral since they were seen as threatening the notion of free will. The prevailing argument held that if human choices were merely the result of material processes rather than guided by the spirit, the foundation of morality would be at risk. Many critics even feared that materialists would exploit the machine analogy to lure naive young people into unchecked sexual indulgence. According to one John Witty, the crafty scheme of the materialists would be "*first*, to Argue themselves into mere Machin[e]s; and afterwards in Letters to the Ladys; to persuade 'em, for what ends 'tis not difficult to determin[e], out of their *Immaterial* and *Immortal Souls*."[5] This amusing suspicion expressed in the 1700s actually shows an awareness of a holistic understanding of the human being that contemporary brain science still lacks.



What Brain Science Cannot Tell Us

One of the most striking claims in *The Idea of the Brain* is that despite extraordinary technological and experimental advances in neuroscience over the past fifty years, there has been no fundamental shift in our conceptual understanding of how the brain functions.[6] As Cobb says:

> In reality, no major conceptual innovation has been made in our overall understanding of how the brain works for over half a century. This period has seen immense, Nobel Prize winning discoveries—astonishing new techniques have given researchers an amazing degree of precision and control of brain activity, massive computer simulations capture the activity of millions of neurons and we now appreciate the role of chemistry in controlling the activity of neural networks. All of this gives us a far richer understanding of what is happening where in the brain, compared with past generations, but we still think about brains in the way our scientific grandparents did.[7]

Cobb's observation seems to resonate with many other neuroscientists as well. For instance, French neuroscientist Yves Frégnac criticizes the current trend of gathering enormous amounts of data through costly, large-scale projects. He argues that this trend reflects the industrialization of brain research, by which funding bodies and researchers believe that "using the most advanced tools and harnessing the power of numbers" will lead to groundbreaking discoveries. These kinds of projects are happening globally, from the US (the BRAIN Initiative and the Human Connectome Project, among others), to China (the China Brain Project), to Europe (the Human Brain Project, among others), Australia, and Japan. Ironically, the flood of data being produced by these initiatives is creating significant bottlenecks in progress because, as Frégnac succinctly puts it, "big data is not knowledge." Moreover, "each overcoming of technological barriers," he goes on to say, "opens a Pandora's box by revealing hidden variables, mechanisms, and nonlinearities, adding new levels of complexity."[8]

Thus, our current understanding of the brain appears to be highly incomplete. The absence of a precise understanding of the brain's fundamental nature affects various approaches to treating mental health disorders, where such knowledge is crucial. Consequently, it is not surprising that, despite a significant increase in public awareness of mental health, substantial research funding, and a growing number of scientists and physicians dedicated to identifying the causes of and solutions for mental health conditions, the overall impact of neuroscience on alleviating patient distress has remained limited. Thomas Insel, who directed the National Institute of Mental Health (NIMH) from 2002 to 2015, recently acknowledged this reality:

> I spent 13 years at NIMH really pushing on the neuroscience and genetics of mental disorders, and when I look back on that I realize that while I think I succeeded at getting lots of really cool papers published by cool scientists at fairly large costs—I think $20 billion—I don't think we moved the needle in reducing suicide, reducing hospitalizations, improving recovery for the tens of millions of people who have mental illness.[9]

All of these issues lead us back to the question of representationalism and its limitations. Cobb is at his best when he argues that representationalist models, while they have provided useful heuristics, have imposed conceptual hurdles. The tendency to compare the brain to contemporary technology often leads researchers and experts to *mistake the metaphor for the mechanism*, assuming that the brain *must* operate in ways analogous to these external systems, rather than as an evolved biological organ with its own principles of function. For instance, in the *early computational models of the brain*, scientists assumed that cognition was essentially a form of *symbolic processing*, akin to a Turing machine's manipulation of internal representations. This perspective led to early forms of AI built on rule-based systems and symbolic logic, but it failed to account for the brain's adaptability, embodied cognition, and nonlinear dynamics. Later, neural network models attempted to move beyond rigid symbolic processing, but they, too, often retained the assumption that the brain is a representational system.[10]

Given these challenges, one must ask: What would an alternative, non-representationalist approach to neuroscience entail? Cobb's study invites new ways of thinking about the brain—ones that go beyond simplistic metaphors and strive for a deeper, more nuanced understanding of neural function. Although I do not necessarily share his materialistic presuppositions about the mind and brain relationship, I find his arguments to challenge how we study the brain and conceptualize consciousness thought-provoking. The shortcomings of past metaphors suggest that a paradigm shift is long overdue, one that moves beyond representationalism and embraces interconnectedness, embodiment, and complexity.

Islamic Thought and the Brain

To move beyond the limitations of representationalism, which reduces human subjectivity to scientific models, a comparative history of the brain across cultures is essential, as it reveals fundamentally different ways of conceiving the relationship between mind, body, and world. So, in *The Idea of the Brain*, Cobb also aims to provide a global history of the scientific understanding of the brain, but one deficiency of the book is its limited treatment of the brain's comparative history across different cultures. As alluded to earlier, the brain has not always been regarded as the central organ of thought, feeling, or identity, as it is in modern scientific discourse. Cobb's treatment of these diverse cultural perspectives is rather superficial. For instance, his discussion of Avicenna (Ibn Sīnā) and Islamic medicine can be criticized for being cursory, as it overlooks the significant contributions that Muslim scientists made to the understanding of the brain and the development of medical thought during the classical and postclassical periods.[11] Avicenna, one of the most influential philosophers and physicians in the Islamic world, made important contributions to explaining the brain's role in both physiological and psychological processes. His *Canon of Medicine* (*Al-Qānūn fī al-tibb*) was a key medical text in both the Islamic world and Europe for several centuries, and it significantly shaped medieval and early modern understandings of human physiology.[12] Avicenna's approach to neurology was pathbreaking, as he systematically synthesized and expanded upon the works of Galen, Aristotle, and earlier Islamic scholars while also incorporating his own empirical observations.

A central aspect of Avicenna's neurophysiology was his theory of the *internal senses* (*al-hawāss al-bātinah*), a concept that profoundly influenced later medical and philosophical thought. He identified five internal faculties located in different parts of the brain, each responsible for distinct cognitive and perceptual processes. These faculties, Avicenna argued, were functionally localized within the brain, and he described how damage to different parts of the brain could lead to specific cognitive and sensory impairments. This framework anticipated later developments in cognitive psychology and neuroscience, particularly theories of mental representation and functional specialization in the brain.

Furthermore, Avicenna made significant contributions to the understanding of neurological disorders. He provided some of the earliest detailed discussions of conditions such as stroke, epilepsy, migraines, and depression, offering insights into their causes, symptoms, and potential treatments. Unlike many of his predecessors, Avicenna recognized that these conditions were not purely supernatural or humoral in origin but could arise from disruptions in the brain's structure or function. His discussions of mental health also included sophisticated theories of psychosomatic illness that emphasized the interactions among the brain, emotions, and bodily health—a holistic approach that has a parallel in modern psychosomatic medicine.[13]

Additionally, Avicenna argued that the brain was not merely a passive receiver of sensory impressions but an active participant in perceptual acts. In his view, the soul is intimately connected to the brain, yet he maintained a robust distinction between the intellect and the material organ without resorting to a Cartesian dualism. His integration of empirical medical knowledge with a rigorous philosophical framework helped lay the foundation for later Islamic and European medical thought.

Despite the significance of Avicenna's contributions, Cobb's treatment of Islamic medicine fails to fully engage with the complexity of the former's neurological theories, limiting itself to a broad mention of his influence without delving into the specifics of his medical and psychological innovations. A more nuanced treatment would recognize Avicenna's pivotal role in the global history of neuroscience and his enduring legacy in shaping conceptions of the brain's function in both Islamic and European medical traditions.[14] Such a historically and cross-culturally grounded understanding is crucial for challenging the assumptions of representationalism, as it opens up alternative models of mind and brain that are rooted in different epistemologies and ontologies.

Cobb's survey also overlooks the wealth of knowledge preserved and expanded upon in the Islamic world, where scholars not only translated Greek and Roman medical texts but also made significant original contributions. Contrary to popular belief, Islamic science did not disappear in the thirteenth century. The works of later scholars, including Mullā Ṣadrā, Shāh Walī Allāh, Aḥmad al-Damanhūrī, and many others, demonstrate striking similarities with the ideas of Descartes, Steno, Herman Boerhaave, and Albrecht von Haller regarding concepts like animal spirits (*spiritus animalis*), even though Muslim philosophers did not embrace a mechanistic framework.[15]

Another neglected area in Cobb's book is its lack of a detailed discussion of the heart as the key organ of perception in most nonmodern cultures. In Islamic thought, the heart, which is closely intertwined with the intellect, holds a central position. As al-Ghazālī explains, the Arabic word *qalb* (heart) has two distinct meanings. The first refers to the physical heart, the organ located on the left side of the chest. The second meaning, however, is far more profound. It denotes a spiritual subtlety (*latīfah*) that is intimately connected to the physical heart yet not identical to it. This sense of *qalb* represents the true self or essence of a person, as it is the faculty responsible for thought, understanding, and emotional experience. In this sense, the heart is regarded as the seat of the intellect.[16]

Moreover, the heart is not merely a passive receptacle but an active agent, as it governs actions, receives guidance, and is held accountable. Closely related to *qalb* is the term *rūh* (spirit), which also carries dual meanings. The first refers to a subtle, invisible substance emanating from the physical heart and circulating through the body via the arteries. Physicians have historically used *rūh* in this sense, describing it as a fine vapor produced by the heat of the heart. The second meaning of *rūh*, however, relates to consciousness and awareness, aligning with one of the definitions of *qalb*. This interpretation finds resonance in the Qur'anic verse "Say: the spirit is my Lord's command" (17:85).

As mentioned earlier, the dominant scientific paradigm has located cognition, emotion, and consciousness exclusively within the brain. However, this view was significantly challenged in the latter half of the twentieth century by research demonstrating the crucial role of the parasympathetic nervous system and the presence of neural clusters throughout the body, particularly in the heart and the gut. Far from being merely a mechanical pump, the heart possesses its own "little brain" of approximately forty thousand neurons, which not only regulates cardiac rhythm but also engages in bidirectional communication with the brain.[17] Beyond its neural network, the heart actively secretes key neurochemicals such as noradrenaline, oxytocin, and dopamine, which influence various cognitive and emotional processes in the brain. This intricate relationship between the heart and the brain manifests in numerous ways, with each organ influencing the other's function. One of the most striking examples of this connection is takotsubo cardiomyopathy, commonly known as broken heart syndrome, in which intense emotional distress can lead to acute heart failure.[18] Conversely, research on heart surgery patients has revealed that interventions affecting the heart can lead to notable changes in cognition, sensory perception (including alterations in taste and smell), memory, and overall cognitive performance. Furthermore, studies have demonstrated a causal link between cardiovascular disease and depression, underscoring the deep interconnection between psychological and physiological health.[19]

These findings challenge the conventional, brain-centric model of cognition and suggest a more distributed and embodied understanding of human consciousness and emotional experience. Rather than existing in isolation, mental and emotional processes appear to emerge from complex, dynamic interactions between multiple organs in the body, with the heart playing a particularly significant role in shaping our psychological and physiological well-being. Within the framework of Islamic thought, these discoveries reflect the deep interrelation between the spiritual and physical dimensions of the heart. In the Islamic tradition, the physical heart is not merely a biological organ but serves as a reflection, instrument, or conduit of the spiritual heart. As a result, the dynamics of the spiritual heart exert an influence on the physical heart, shaping its function and experiences.[20] In light of these considerations, Cobb's *The Idea* *of the Brain* lacks a truly global and historically nuanced account of the scientific understanding of the brain. His limited engagement with non-Western traditions, particularly Islamic medicine, results in a missed opportunity to highlight the rich and multifaceted contributions of philosophers like Avicenna, whose theories of neurophysiology, cognition, and psychosomatic health anticipated many later developments in neuroscience. Attending to such diverse intellectual traditions is not simply a matter of inclusivity; rather it is essential for disrupting the narrow confines of representationalism and for reimagining the brain-mind relationship through alternative conceptual frameworks.

Endnotes

- 1 Matthew Cobb, *The Idea of the Brain: The Past and Future of Neuroscience* (New York: Basic Books, 2020).
- 2 Although some recent studies have begun to make progress in ameliorating this situation, see The MICrONS Consortium, "Functional Connectomics Spanning Multiple Areas of Mouse Visual Cortex," *Nature* 640 (2025): 435–47, https://doi.org/10.1038/s41586-025-08790-w.
- 3 Cobb, 3.
- 4 Nicolaus Steno, *The Discourse on the Anatomy of the Brain*, in *Nicolaus Steno: Biography and Original Papers of a 17th Century Scientist*, ed. and trans. Troels Kardel and Paul Maquet (Berlin: Springer, 2013), 516.
- 5 John Witty*, The First Principles of Modern Deism Confuted* (London: John Wyat, 1707), v.
- 6 This is partly reflected in the Hodgkin-Huxley model—the most widely used model for nerve impulses—which overlooks nonelectrical manifestations, such as mechanical, thermal, and optical effects, that have been found to accompany nerve impulse propagation. For more information, see Muhammad U. Faruque, *Sculpting the Self: Islam, Selfhood, and Human Flourishing* (Ann Arbor: University of Michigan Press, 2021), 163–65.

- 7 Cobb, *Idea of the Brain*, 203.
- 8 Yves Frégnac, "Big Data and the Industrialization of Neuroscience: A Safe Roadmap for Understanding the Brain?," *Science* 358, no. 6362 (October 2017): 470–77, https://doi.org/10.1126/science.aan8866, cited in Cobb, *Idea of the Brain*, 370. Cf. John Ioannidis, "Correction: Why Most Published Research Findings Are False," *PLOS Medicine* 19, no. 8 (2022): e1004085, https://doi.org/10.1371/journal.pmed.1004085.
- 9 Adam Rogers, "Star Neuroscientist Tom Insel Leaves the Google-Spawned Verily for… a Startup?, *Wired*, May 11, 2017, https://www.wired.com/2017/05/star-neuroscientist-tom-insel-leaves-google-spawned-verily-startup/.
- 10 When Warren McCulloch and Walter Pitts were developing their mathematical model of a neural network, John von Neumann "recognised that neurons were not truly digital, not only because of the way they respond but also because the feedback loops they are involved in—for example those controlling blood pressure—contain both neuronal and physiological components. As he put it: 'living organisms are very complex—part digital and part analogy mechanisms.'" Cobb, *Idea of the Brain*, 189.
- 11 Cobb, 24–26.
- 12 Avicenna, *The Canon of Medicine*, ed. Laleh Bakhtiar, 5 vols. (Chicago: Kazi Publications, 1999–2014).
- 13 See A. I. Fumagalli, "Neuro Expressionism in Avicenna Contributions," *Journal of the Neurological Sciences* 405S (2019): 317, https://doi.org/10.1016/j.jns.2019.10.1422; Pedzisai Mazengenya and R. Bhikha, "A Critical Appraisal of 11th Century Treatise by Ibn Sina (Avicenna) on the Anatomy of the Vascular System: Comparison with Modern Anatomic Descriptions," *Morphologie* 102, no. 337 (June 2018): 61–68, https://doi.org/10.1016/j.morpho.2018.03.001.
- 14 For more information, see Peter E. Pormann, ed., *Islamic Medical and Scientific Tradition*, 4 vols., Critical Concepts in Islamic Studies (London: Routledge, 2011); Peter E. Pormann and Emilie Savage-Smith, *Medieval Islamic Medicine* (Edinburgh: Edinburgh University Press, 2007); Simon Knuuttila, *Emotions in Ancient and Medieval Philosophy* (Oxford: Oxford University Press, 2004).
- 15 These Muslim figures lived in the seventeenth and eighteenth centuries. See also Ahmed Ragab, *Medicine and Religion in the Life of an Ottoman Sheikh: Al-Damanhūrī's "Clear Statement" on Anatomy* (London: Routledge, 2020); Nahyan Fancy, *Science and Religion in Mamluk Egypt: Ibn al-Nafīs, Pulmonary Transit and Bodily Resurrection* (London: Routledge, 2013).
- 16 Muhammad U. Faruque, "Sufism and Philosophy in the Mughal-Safavid Era: Shāh Walī Allāh and the End of Selfhood," in *Islamic Thought and the Art of Translation: Texts and Studies in Honor of William C. Chittick and Sachiko Murata*, ed. Mohammed Rustom (Leiden: Brill, 2023), 323–70.
- 17 J. Andrew Armour, "Potential Clinical Relevance of the 'Little Brain' on the Mammalian Heart," *Experimental Physiology* 93, no. 2 (February 2008): 165–76, https://doi.org/10.1113/expphysiol.2007.041178.
- 18 Matthew N. Peters, Praveen George, and Anand M. Irimpen, "The Broken Heart Syndrome: Takotsubo Cardiomyopathy," *Trends in Cardiovascular Medicine* 25, no. 4 (May

2015): 351–57, https://doi.org/10.1016/j.tcm.2014.11.005.

- 19 Marlene A. Wilson et al., “Common Pathways and Communication between the Brain and Heart: Connecting Post-traumatic Stress Disorder and Heart Failure,” *Stress* 22, no. 5 (June 2019): 530–47, https://doi.org/10.1080/10253890.2019.1621283; Beatrice C. Lacey and John I. Lacey, “Two-Way Communication between the Heart and the Brain: Significance of Time within the Cardiac Cycle,” *American Psychologist* 33, no. 2 (February 1978): 99–113, https://doi.org/10.1037//0003-066x.33.2.99.
- 20 *St Andrews Encyclopaedia of Theology*, s.v. “The Heart (*Qalb*),” by Seyyed Hossein Nasr and Oludamini Ogunnaike, August 29, 2024, https://www.saet.ac.uk/Islam/Heart.