

Soul searching: a brief history of the mind/body debate in the neurosciences

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✓Anatomical and physiological understandings of the structure and function of the brain have worked to establish it as the “seat of the soul.” As an organ of reflection, meditation, and memory, the brain becomes synonymous with what defines the “self” through the existence of consciousness—of mind. Thus, the brain has been associated with a range of transcendent concepts—the soul, spirit, mind, and consciousness—that all relate in fundamental ways to each other both in terms of their perceived location within the brain and because of the way each works ultimately to define the person to whom the brain belongs. In this article, the author provides a brief exploration of how interrelated these categories have been when seen in the context of ancient, Renaissance, early modern, and modern philosophical and medical concerns; how the brain has variously been perceived as home to these intimate states of being; and how practitioners from the neurosciences have reflected on these questions. The author provides novel insights into the interrelationships of philosophy, theology, and medicine by examining these issues through the lens of the history of neuroscience.

KEY WORDS • history of medicine • mind/brain problem • neurology • soul

NEUROLOGISTS rank high among medical professionals most engaged in philosophical debates about what might extend beyond the world of physical ontology and into the abyss of consciousness, spirituality, or the realm of the soul. Reflections have been published in medical, philosophical, ethical, and religious literature, revealing an essential tension in situating medicine as an endeavor both to “mend bodies and save souls.”³⁴ Dr. Herbert Vaughn’s 1975 historical review of the practice of psychosurgery illustrates the unease associated with crossing sacred boundaries.

Although the force of the conceptual dichotomy between mind and brain has been substantially reduced by evidence demonstrating the dependence of mental processes upon brain mechanisms, willful alteration of the personality of a human being through the slash of a knife or a stereotaxic lesion represents to many an intrusion upon the most private aspects of the self—essentially, an assault upon the soul.⁴⁰

Part of the reason for the repeated return to what is generally discussed as the mind/body problem was the growing concern that increasing dependence on technology in 20th-century medicine was causing the dehumanization of patient care, making the practice reductionist rather than holistic. The search for the soul, therefore, can be read as a restoration of humanity in medicine.

In his 1994 presidential address to the Congress of Neurological Surgeons, Dr. Arthur Day raised this concern, noting that since the 1970s neurosurgery had become phe-

nomenally successful primarily because of technological advancements in imaging, surgical microscopy, and stereotactic biopsy, among other innovations. However, each new technique introduced a risk of displacing further the conventional clinical practice of obtaining patient histories and performing neurological examinations, representing a shift away from seeing the whole person.

“To defeat our enemies,” Day said, referring to malignant gliomas, ruptured aneurysms, and the like, “we must invoke the best part of our art and science to resist the practice of a mechanical body-parts medicine and utilize our technological resources wisely. . . . [We must have] an awareness that the mind and body are connected but separate, and that many physical ailments are expressions of mental conflict that no amount of high-tech physical correction will heal.”

He reflected on a recent personal experience he had had while performing an operation in a woman with a “large, deep seated arteriovenous malformation in her corpus callosum.” During the procedure he suddenly “became intensely aware that somewhere in that marvelous organ that lay open before me dwelt the connection with her spirit, and that I had been entrusted with maintaining her connection with the physical world.” Remarkably, he managed to keep his nerve after this thought and finished a successful operation. The moral of the story was a reiteration of William Osler’s sage remark that “happiness lies in the absorption in some vocation which satisfies the soul. . . that we are here to add what we can to, not get what we can from, life.”¹²

Abbreviation used in this paper: MR = magnetic resonance.

This midoperation philosophical reflection was not unique to Dr. Day. Neurosurgery has long been identified as a practice that bears on the treatment of the soul. Harvey Cushing's pioneering surgery on the pituitary gland in the early 20th century has been characterized as forging "the path to the soul."² Two surgeons who specialize in orbital reconstruction reviewed technological progress in treating orbital injuries, but regretfully concluded that "there are many unanswered challenges in the treatment of the fragile frame of the window to the human soul."²⁷

The human soul has historically—both philosophically and theologically—been associated with the essence of the individual; the soul is what makes the person more than a machine, what constitutes individuality. What ancient writers called the "animal spirit" similarly provided the "vital principle" that animated life. Anatomical and physiological understandings of the structure and function of the brain have further established it as the "seat of the soul" because of an increased understanding of its cognitive powers. As an organ of reflection, meditation, and memory, the brain becomes synonymous with what defines the self through the existence of consciousness—of mind. Thus, the brain has been associated with a range of transcendent concepts—soul, spirit, mind, and consciousness—all relating in fundamental ways to one another, both in terms of their perceived location within the brain, and because of the way each works ultimately to define the person to whom the brain belongs.

What follows is not a comprehensive history of any of these individual concepts or a discussion of the relationships between science, medicine, philosophy, and religion—although elements of the latter are woven throughout. Rather this is a brief exploration of how interrelated these categories have been when seen in the context of ancient, Renaissance, early modern, and modern philosophical and medical concerns; how the brain has variously been perceived as home to these intimate states of being; and how practitioners from the neurosciences themselves have reflected on these questions.

An Ancient Problem: The Headless Human

Technological intervention, a feature of modern medical science which has so elevated the status of neurology throughout the last century, nevertheless reminds us of centuries' old questions about individual identity—the concepts of humanness and personhood—in medical explorations of the mind and body. Amidst much press attention to cloned animals and ethical debates about manufacturing spare body parts, an announcement was made in 1997 that a scientist was creating headless frog embryos in the laboratory.³ This immediately raised more profound religious and philosophical questions about the nature of "animalness"—whether because the clones were "without a brain or central nervous system [they] may not technically qualify as embryos." One scientist wrote that with these developments, "it would almost certainly be possible to produce a human body without a forebrain. These human bodies without semblance of consciousness would not be considered persons, and thus it would be perfectly legal to keep them alive as a future source of organs."¹

This piqued the curiosity of philosopher Timothy Mosteller, of the Christian-oriented Biola University in southern California, who wondered what Aristotle would have to say about this: "Would Aristotle believe that headless human clones have souls?"²⁵ After scrutinizing Aristotle's tract *On the Soul*, in which the sage meditates on the causes and sources of the living body, Mosteller concludes that yes, Aristotle would have believed that even headless humans had souls—souls which had caused the development of the body, but are for external, manipulative reasons prevented from realizing one element of the whole person—the head.

For Aristotle, then, it appears that the soul has no "seat" per se; it is, rather, the whole which is greater than the sum of the parts: "all natural bodies," wrote Aristotle, "are instruments for the soul . . . showing that they exist for the sake of the soul." Other ancients differed in their theories about whether and which organs housed different life forces. The Greek philosopher Anaximander said that "mind gives body a life force," while Pythagoras was persuaded that "the brain served as the organ of the mind and the temple of the soul."⁷ Others emphasized different organs. Galen spoke of life spirits, "vital pneuma," that originated in the heart and were distributed to the brain, where the spirits were turned into memories, cognition, expression, and imagination. This view was shared by Paracelsus, whereas Harvey declared that he was unable to find any animal spirits in his dissections.³³ Cardiologists today occasionally still link the heart to the seat of soul: "most cultures consider the heart to be the location of the soul or mind, the 'center' of the human body," wrote the authors of an historical essay on cardiac surgery. "Dealing with this central organ of the body, cardiac surgery is a royal discipline among the medical professions."¹⁷ When facing a similar conundrum about a human without a heart and the implications of the development of artificial hearts, one medical writer asked "the human heart: vault of the soul or pump?"³⁸

Reflections from the Renaissance: the Soul as Self

Although vestiges of the discussion about the seat of the soul can be found in ancient philosophy, thinking of the body in terms of "mechanism" versus "vitalism"—a separation of the nuts and bolts of anatomical construction and the life force that animates it—was in different ways a product of the Scientific Revolution. The year 1543 was a watershed for Western civilization. Copernicus's *De revolutionibus orbium coelestium* (*On the revolution of the celestial spheres*) was published, dethroning the earth from its privileged central position in the universe and Vesalius's *De humanis corporis fabrica* (*On the fabric of the human body*) appeared, overturning centuries of Galenic misconceptions of human anatomy. This was also the year that the first Protestants were charged with heresy by the Spanish Inquisition and burned at the stake in Spain, and Pope Paul III issued the notorious Index of Prohibited Books. Thus both celestial and terrestrial bodies were radically reconceptualized, and discussions of these topics were undertaken at great risk to one's body and soul. It has been said that the work that went into constructing the Scientific Revolution depended on the Renaissance's tools

of visualization—artistic perspective and techniques of printing. However the Renaissance also instilled a sense of humility in its humanist scholars, who were contemplative of their own psyches, leading to the philosophical introspections of Montaigne, Leonardo da Vinci, and Descartes. Introspection is a search for meaning through a quest to discover oneself. As medical historian Roy Porter commented, “ideas of identity in the West presuppose some real and essential inner-self”; that is, the concept of an inner self provides the realm where meanings of the self, consciousness, and soul are sought.³²



A number of theorists in the early modern period equated the soul with the self, and determined that the brain was the site of the soul. Leonardo da Vinci used a variety of methods—historical, philosophical, and scientific—to throw light on the issue.¹³ According to Jonathan Pevsner, a molecular biologist in the neuroscience department at The Johns Hopkins University, da Vinci “undertook his research with the broad goal of providing physical explanations of how the brain processes visual and other sensory input, and integrates that information via the soul.”³¹ Michelangelo seems to have given some thought to this issue as well. Well-known to be an expert in anatomy, Michelangelo was found to have concealed an accurate picture of the human brain in background clouds of his famous “Creation of Adam” fresco in the Sistine Chapel. This picture depicts the frontal lobe, optic chiasm, brainstem, pituitary gland, and the major sulci of the cerebrum.²⁴ The existence of this hidden painting was disturbing to Dutch neurologist J. P. Lakke, who argued that: “As a renaissance artist [Michelangelo] was not supposed to believe that the brain is the seat of the soul. Only when the concept of structure and function of the central nervous system had developed, artistic presentation of the brain did become possible.”²² I suggest that the context for the debates concerning the seat of soul and the artist’s own demonstrated anatomical knowledge weakens this objection.

Descartes’ “I think” statement makes an easy association between expressions of self-reflection and the mind/body problem. Humans, according to Descartes, have a rational soul independent of the body in contrast to animals which live like automata, mechanically responding to external stimuli. Descartes specifically believed that in humans the interaction between the body and soul took place in the pineal gland, where one had conscious recognition of sensations and could control voluntary actions, including the act of thinking consciously about oneself.²³ In his treatise *Passions of the Soul*, Descartes invoked his sophisticated anatomical understanding of the position of the pineal gland to link the machine-like somatic actions of the body to this seat of self-consciousness;³⁶ thus the soul was considered brain-bound.

Sometimes when anatomical knowledge grew very detailed it left no room for situating the soul. “The early concept that the cerebral ventricles harbor the soul began to break down only in the Renaissance,” wrote neurologist Francis Schiller of the University of California, San Francisco, “thanks to determined anatomical studies and physiological considerations regarding the role played by the cerebrospinal fluid, the function of the ventricles was re-

duced to merely being a receptacle for metabolic waste.”³⁵ It should be noted, however, that the German neuro-anatomist Samuel Thomas Soemmerring postulated in his 1796 publication *On the Organ of the Soul* that the soul was located in the cerebral ventricles.¹⁹ There are other instances in which the more detailed neuroanatomical knowledge became, the more elaborate were the theories of how the soul operates within the bodily system. Consider the philosophy of the English physician and oft-referred “father of neurology” Thomas Willis. While performing dissections in criminals and “brutes,” he found that the intercostal nerve “which we call the internuncius of the brain and heart, proper to man, was very small in this fool, and beset with a weaker guard of nerves.”⁴¹ By focusing on the nerves which connect the brain to the heart and lower viscera, Willis was able to shift attention from an either heart or brain as seat of soul debate to a more nuanced account of how intercostal nerves act as the “reins of the soul” to control bodily passions and moral actions. Willis’s connection between a brain and heart that worked to reunite the body and soul was adopted by theologians as a physiological explanation of how people could live above the reach of passions (the mind controls the heart) and live virtuously (a well-developed bundle of nerves allows room for the soul to grow).²¹

The 18th and 19th Centuries: Enlightenment Theories of Spirits and Seizures

The 18th century saw the emergence of a new theory concerning the location of the soul. Following revolutionary research in chemistry that identified the constituent elements of different gases (including oxygen) and medical research into the pneumatic diseases acquired by industrial laborers, the lungs took on new meaning—they became “the monarch of the body,” the control center and life-giver. Experimentalists, such as the radical chemist Joseph Priestley, began speaking of research into “spirits” when referring to their work on the isolation of different gases and the effects of these gases in sustaining life. At the same time, the technique of mouth-to-mouth resuscitation was developed for one person to breath life into the lungs of another.¹⁴ This is the modern understanding of the role of breathing, and is in contrast to the Hippocratic notion that air first travels to the brain, where it leaves its quintessence, before being dispersed to the rest of the body.³⁹ Yet, the 18th century also witnessed “the birth of the clinic,” to use the well-worn phrase of French philosopher Michel Foucault. Clinical observations of the state of madness by correlating brain lesions with the disruption of the faculties of the soul once again raised the classic paradigm of the mind/body problem.

At the beginning of the 18th century, French surgeon Gigot de la Peyronie established the methodological principles that formed the basis of modern neuropsychology. However, his work has been largely overlooked, precisely because of his attempts to interpret his observations as proof about the faculties of the soul rather than concentrating on localized cerebral pathological entities and psychic defects. As Finnish psychologist and philosopher Timo Kaitaro explains, “the reasons for this failure obviously lay in the dualistic presuppositions which made him look for

the unique locus of mind-body interaction instead of localizing specific functions.”²⁰ To de la Peyronie’s contemporaries, however, asking questions about the seat of the soul or framing investigations according to predominant philosophical issues was as legitimate a pursuit as any clinical course of action. Indeed, we continue to find that later physicians’ inquiries were driven by concerns over the influences of higher spirits. Jacobus Schroeder van der Kolk, for instance, who in 1826 became Professor of Anatomy and Physiology at the University of Utrecht, studied patients with epilepsy in the mid-19th century. In a series of lectures on “Body and Soul,” he described psychic processes and material disorders as the outcome of a controlling higher spirit.²⁹ Kolk is often regarded as the founder of Dutch neurology, and his research demonstrates a strong streak of antimaterialism meant to counteract the theories of some of his French and German contemporaries.¹⁶

Later 19th-century cerebral investigations by Franz Gall, Paul Broca, Pierre Flourens, David Ferrier, Carl Wernicke, John Hughlings Jackson, and others ushered in the era of cerebral localization, in which cognitive processes were linked to particular parts of the brain.²⁸ With more detailed information about the brain’s circuitry stemming from the neurophysiological work of physicians such as Santiago Ramon y Cajal and Sir Charles Sherrington, synapses, nerve action potentials, and neural pathways provided a new material basis for the study of the workings of the mind, displacing the soul but returning to the question of the neurological basis of self.

The 20th Century: A Renaissance of Materialism and Medical Humanism

If the Scientific Revolution of the 16th and 17th centuries instilled a humility in philosophers that raised the status of self-reflection, or self-representation, to a science of soul searching and theories about mind/body relations, then the Darwinian revolution of the 19th century and the Freudian revolution in psychology in the early 20th century provides a materialist twist to addressing the soul/mind/consciousness/body/brain series of problems. Although questions of the seat of the soul did not disappear from the discourse, concerns in the emerging fields of scientific and medical humanism focused much of the discussion on how to do away with classic Christian dualism without ending up with a crass, reductionist materialism. The resolution to this dilemma lay in defining new roles for the sciences, embracing a philosophical agenda to work toward an answer to the question “what is life?”

New bridging concepts were commonly deployed in medical–philosophical discussions to close the gaps between the mind and body, science and religion, and arts and humanities, such as holism, synthesis, and emergent properties. The concept of Darwinian evolution seemed to have raised the flag of reductionist materialism to its highest level, but as a broad range of scientific humanists proclaimed in an attempt to save science itself from the ignominy of vulgar utilitarianism, Darwinism could not account for the emergence of life and mind. “Emergent evolution” and holistic conceptions of the organization of life, in which higher faculties are considered extensions of

characteristics of the lower physical structures, were used not only to create a continuum linking “molecule to man,” but also to link research in the basic physical sciences with morally charged philosophical investigations. Big concepts are built on detailed data. Both scientific humanists and theologians could be pleased to find that the biochemical concepts developed by Gowland Hopkins vindicated an organic, symbiotic grasp of human physiology, and that Charles Sherrington’s investigations into neurology demonstrated that consciousness was not a mechanical accident, but that mind operated as the product of organized higher nervous functions, allowing room for a discernible overarching order compatible with both science and theology.

Investigations into neuroanatomy and neurophysiology continued to provide new connections between different parts of the brain and ideas about behavior and cognition. Neurologist Phiroze Hansotia writes that before the 20th century “there was uncertainty as to the nature and source of the human mind.” In the past the mind had been linked to extracorporeal phenomena such as a “life force” or “animal spirit,” with each also equated with the soul.²⁰ The theological basis of identifying the soul with the mind—or as seated within the brain—has recently returned to an association of the brain as the organ of self-reflection. The intellectual turn that once again privileged the brain, suggests the neurosurgeon J. Abraham, occurred when there was a turn from outside worship to an inner search for meaning. “It was interesting how capacity to categorize the need to worship by referring to environment outside evolved into a search within our minds. As the next stage of evolution, neuroscience may, thus, serve as the next gateway to understanding the mind and soul.”²¹ The neurosciences themselves might evolve along similar lines of inquiry. If the 1990s marked the “decade of the brain,” then it “would be apt to designate the next decade as the ‘decade of the mind,’ and dedicate the following decade to ‘the mind in search of its soul.’”²¹

It seemed possible to others that mapping neural networks to analyze the thought process itself eliminated the need for a transcendental philosophy of spirit or soul, reducing the notion of such a philosophy to synaptic firings.

Since the central nervous system took place of the blood vascular already at an early time, it follows that the brain . . . passed for the material form of our intellectual-psychic abilities. It is true, today we renounce to speak in the body-soul-discussion of single structures of the brain . . . but we still follow the old localization concept perceiving in the brain and its estimated hundreds of millions of nerve cells the unimaginable complex organ that offers the substratum for our intellectual-psychic abilities.⁴

Others use neurological findings to search for a physical explanation of the origin of thoughts about the “self” which obviate the need for referencing the soul. Opines Dr. Hansotia, “The human brain, the most complex object in the universe, comprises a hundred billion neurons linked in networks that give rise to intelligence, emotion, consciousness, memory and creativity. Emerging from the collective activity of all brain regions is the most fascinating neurological phenomenon of all—the mind.”¹⁹

The concept of emergent properties gives rise to a theory of consciousness by making the latter the sum of all

the neural activities that can be studied at the molecular level. Some have argued that rationality evolved as part of a broader process of biological regulation—the mind is contingent on body. Failing to see this was, in the words of neurologist Antonio Damasio, “Descartes’ error.” There can be no separation between mind and body, as all thought is grounded in “body-representing” neural structures.¹¹ Again, we see a view in which the capacity for self-representation places the mind back within the body. According to the University of California, San Diego, philosopher Patricia Churchland, “a brain whose wiring enables it to distinguish between inner-world representations and outer-world representations and to build a meta-representational model of the relation between outer and inner entities is a brain enjoying some degree of consciousness.”⁸ In the words of the Dutch neurologist G.W. Bruyn, who also wrote on ancient concepts of the brain as the “seat of the soul,” the state of neurological knowledge in 1982 showed that the myriad energy transients in the brain form “an emergent field force denoted as ‘mind,’ comparable to the field force ‘gravity’ emerging in the presence of sufficient matter. Mind and matter are two sides of the coin.”⁶

An early advocate of a view of the mind as a product of emergent properties was Roger Sperry, Professor of Psychobiology at Caltech from 1954 until his death in 1994. His experiments in “split brain” patients demonstrated how questions of self could be subjected to anatomical manipulation. In his work with California neurosurgeons Joseph Bogen and Philip Vogel, he demonstrated that the resection of the cerebral commissures in patients with epilepsy interrupted information flow between the two hemispheres of the brain and gave rise to disconnection effects: the perceptions and analytical processes of one hemisphere were disconnected from those of the other. Critical of what he called “today’s prevailing objective, mechanistic, materialistic, behavioristic, reductionistic, fatalistic view of the nature of mind and psyche,” Sperry used the results of these surgical experiments to argue that the “evidence in neuroscience leads overwhelmingly today to the conviction that conscious mental awareness is a property of, and inseparably tied to, the living brain.”³⁷

Sperry’s account of the rise of consciousness, what he dubbed the “new holist-mentalist paradigm,” was an explicit attempt to reunite the mind/body split. Although he drew on philosophically oriented neoevolutionary concepts like emergent properties to account vaguely for the relationship between brain matter and consciousness, he pointed out that embracing such a philosophical turn was necessary because there was no other scientific way to study the mind. Some authors were still not prepared to eschew religious overtones in discussion of the human soul, however. Australian neurophysiologist and Nobel laureate Sir John Eccles, although accepting of the principles of Darwinian evolution, nonetheless argues that “there is a Divine Providence operating over and above the materialist happenings of biological evolution.” For Eccles—in accordance with a version of the emergent properties concept which he had discussed with Roger Sperry—the physical world gives rise to the mental world. Thus, “in hominid evolution there eventually came higher levels of conscious experiences, and ultimately in *Homo sapiens sapiens*—self-consciousness—which is the unique life-long experi-

ence of each human self, and which we must regard as a miracle beyond Darwinian evolution.”¹⁵ However Sperry, apparently as antisupernatural as he was antireligious, referred to the lack of apparatus for aiding investigation. As he commented in 1966, “The inner sensations, feelings, percepts, concepts, mental images, and the like cannot be weighed or measured, photographed, spectrographed, or chromatographed, or otherwise recorded or dealt with objectively by any known scientific methodology.” Technology—the force of dehumanization in medicine—was incapable of penetrating beyond the material to reveal anything about consciousness, mind, or “other spiritual components in human nature.”³⁷



Within the next two decades, however, this perception had changed, and a new generation of medical technology offered new powers of observation and analysis. As neurophilosopher Patricia Churchland has said, “improvements in technology, data analysis, and computational modeling, have meant that virtually all topics concerning the mind are now vigorously explored at the interface of neuroscience, cognitive science, and philosophy.”⁸

Interest in what constitutes the self, “personhood,” is now pursued by looking at pictures, offering new fodder for materialist, reductionist investigations of self. In 1994, Francis Crick published *An Astonishing Hypothesis: The Scientific Search for the Soul*, the culmination of his research into a new area for him—the problem of consciousness. Forty years after his role in the triumphant discovery of the structure of DNA, he confidently commented that the advances of science were “due to our understanding of the molecular nature of genes, the processes involved in their exact replication, together with our detailed knowledge of proteins and the mechanisms of their synthesis.” Owing to this growth in scientific knowledge, he added, “the neurobiologist sees no need for the religious concept of a soul to explain the behavior of humans and other animals.” Everything was a matter of objective investigation. “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 behavior of a vast assembly of nerve cells and their associated molecules.”¹⁰ As part of his proof, Crick surveyed the recent methods of studying the brain, such as the scanning techniques of MR imaging, positron emission tomography, and computed tomography, to show how much information can be gleaned from pictures.

At a meeting on the “convergence of natural and human science” held at the New York Academy of Sciences in 2000, Harvard University entomologist and inaugurator of sociobiology debates Edward O. Wilson was similarly sanguine about science’s ability to illuminate the deepest secrets of human nature, and urged more collaboration between cognitive neuroscientists, human geneticists, sociobiologists, cognitive psychologists, and biological anthropologists. Wilson conceded that persisting with a biological foundation of complex social and cultural belief systems “runs against the grain for many scholars,” but just as the mysteries of heredity were reduced to DNA, so human nature seems definable by technological intervention. “Only recently have doubts about the accessibility of the physical basis of mind, and even the physical

basis itself, faded before the advance of sophisticated imaging techniques.”⁴²

There is a more than 100-year history of noninvasive imaging in medicine, and it is increasingly clear that the applications of these modalities do not stop at offering mere diagnostic information. One group at a British hospital using MR imaging in the study of the human prefrontal cortex proposed to use their data to define the neuroanatomical basis of souls: “the soul will be an elusive but not an impossible concept to study with neuroimaging,” they state. “The idea would be bizarre if it were not archetypal and therefore must be closely linked to the development of the human nervous system.”⁹ Academics, journalists, and popular-science writers want to go beyond the identification of media-hyped “centers” of the brain that are linked in some way to certain traits—the “speech center” or “jealousy center” for instance—to see if neuroscience can help us to understand something more fundamental about human nature. As Steven Johnson asked in his book *Mind Wide Open* (2004), in which he recounts his personal experiences undergoing functional MR imaging, “Could tools that measure the minute-by-minute levels of those substances in your body and brain teach you something about your own emotional toolbox?”

PICTURES ARE APPEALING to the public imagination, and it should not be forgotten that “spirits” have allegedly been captured on camera since the invention of the daguerreotype and photography.²⁶ Yet perhaps in no other field besides neurology have questions about the mind/body problem been seen to have such pragmatic importance relative to the rise of medical humanism in the second half of the 20th century—owing not least to the long history of discussions about it. For all the risks of falling back into a materialist–reductionist view of the body—emphasizing what is technologically visible, or measurable—there nonetheless remains an imperative to see the patient in a holistic way that must confront the whole as a sum greater than its parts. “The doctor has unique opportunities for observing the correlations which exist between states of mind and states of body,” wrote British neurosurgeon Lord W. R. Brain in 1964, “which range from the broad experiences of everyday practice to the more precise studies of the neurologist and psychiatrist. These observations provide data which any philosophical theory of the relationship between body and mind must take into account.”⁵

In similar terms, nearly a quarter of a century later, the Catholic-trained ethicist and physician Edmund Pellegrino stated that “the findings of neuropathology, neurosurgery, and the physiology and pharmacology of the nervous system are essential, for example, to any serious deliberation on the philosophy of mind or psyche. Out of the interaction of medicine and philosophy may come part of a synthesis of the constellation of interpretations which now constitute the idea or image of man.”³⁰

Although the image may be altered according to the continually evolving technological developments in medicine, ideas about the body, mind, self, consciousness, and soul will no doubt continue to be a matter of lively discussion as they have been for centuries.

References

1. Abraham J: Neurosciences—a neurosurgeon’s perspective. **Neurol India** 47:3–7, 1999
2. Aron DC: The path to the soul: Harvey Cushing and surgery on the pituitary and its environs in 1916. **Perspect Biol Med** 37: 551–565, 1994
3. Associated Press: Scientist creates headless frog embryos in laboratory. **Miami Herald**. 17 October, 1997, p 26A
4. Benedum J: [Importance of the brain in body-soul discussion from the history of medicine perspective.] **Zentralbl Neurochir** 56:186–192, 1995 (Ger)
5. Brain WR: The need for a philosophy of medicine. Reprinted in **Doctors Past and Present**. London: Pitman Medical Publishing, 1964, pp 250–266
6. Bruyn GW: The seat of the soul, in Rose FC, Bynum WF (eds): **Historical Aspects of the Neurosciences**. New York: Raven Press, 1982, pp 55–81
7. Cassano D: Neurology and the soul: from the origins until 1500. **J Hist Neurosci** 5:152–161, 1996
8. Churchland PS: Self-representation in nervous systems. **Science** 296:308–310, 2002
9. Corrigan FM: Parapsychotic grief, theory of mind and the concept of the soul. **Med Hypotheses** 49:301–302, 1997
10. Crick F: **An Astonishing Hypothesis: The Scientific Search for the Soul**. New York: Charles Scribner, 1994
11. Damasio AR: **Descartes’ Error: Emotion, Reason, and the Human Brain**. New York: Putnam, 1994
12. Day A: Keeping neurosurgery special. **Neurosurgery** 34: 1052–1057, 1994
13. Del Maestro RF: Leonardo da Vinci: the search for the soul. **J Neurosurg** 89:874–887, 1998
14. Dolan B: Conservative politicians, radical philosophers and the aerial remedy for the diseases of civilization. **Hist Hum Sci** 15:35–54, 2002
15. Eccles JC: **How the Self Controls Its Brain**. New York: Springer-Verlag, 1994
16. Eling P: Jacobus Schroeder van der Kolk (1797–1862): his resistance against materialism. **Brain Cogn** 37:308–337, 1998
17. End A, Wolner E: The heart: location of the human soul—site of surgical intervention. **J Card Surg** 8:398–403, 1993
18. Hagner M: The soul and the brain between anatomy and Naturphilosophie in the early nineteenth century. **Med Hist** 36:1–33, 1992
19. Hansotia P: A neurologist looks at mind and brain: “The Enchanted Loom.” **Clin Med Res** 1:327–332, 2003
20. Kaitaro T: La Peyronie and the experimental search for the seat of the soul: neuropsychological methodology in the eighteenth century. **Cortex** 32:557–564, 1996
21. Knoeff R: The reins of the soul: the centrality of the intercostal nerves to the neurology of Thomas Willis and to Samuel Parker’s theology. **J Hist Med Allied Sci** 59:413–440, 2004
22. Lakke JPWF: Artful imaging of the brain: From logo to metaphor, about Michelangelo and Kiefer. **Arch Physiol Biochem** 107:1–14, 1999
23. Lokhorst GJ, Kaitaro TT: The originality of Descartes’ theory about the pineal gland. **J Hist Neurosci** 10:6–18, 2001
24. Meshberger FL: An interpretation of Michelangelo’s Creation of Adam based on neuroanatomy. **JAMA** 264:1837–1841, 1990
25. Morus I: Seeing and believing science. **Isis** 97:101–110, 2006
26. Mosteller T: Aristotle and headless Clones. **Theor Med Bioeth** 26:339–350, 2005
27. Nguyen PN, Sullivan P: Advances in the management of orbital fractures. **Clin Plast Surg** 19:87–98, 1992
28. Peacock A: The relationship between the soul and the brain, in Critchley M, Rose FC, Bynum WF (eds): **Historical Aspects of the Neurosciences: a Festschrift for Macdonald Critchley**. New York: Raven Press, 1982, pp 83–98

Mind/body debates in the neurosciences

29. Pearce JM: Schroeder van der Kolk: the soul and epilepsy. **J Neurol Neurosurg Psychiatry** **64**:805, 812, 1998
30. Pellegrino E: **Humanism and the Physician**. Knoxville: The University of Tennessee Press, 1979
31. Pevsner J: Leonardo da Vinci's contributions to neuroscience. **Trends Neurosci** **25**:217–220, 2002
32. Porter R: **Flesh in the Age of Reason: The Modern Foundations of Body and Soul**. New York: Norton, 2003
33. Quin CE: The soul and the pneuma in the function of the nervous system after Galen. **J R Soc Med** **87**:393–395, 1994
34. Risse GB: **Mending Bodies, Saving Souls: A History of Hospitals**. New York: Oxford University Press, 1999
35. Schiller F: The cerebral ventricles. From soul to sink. **Arch Neurol** **54**:1158–1162, 1997
36. Smith CU: Descartes' pineal neuropsychology. **Brain Cogn** **36**:57–72, 1998
37. Sperry PA, Sperry RW: **Science and Moral Priority: Merging Mind, Brain and Human Values**. New York: Columbia University Press, 1983
38. Szycher M: The human heart: vault of the soul or pump? **J Biomater Appl** **1**:3–12, 1986
39. Tercier JA: **The Contemporary Deathbed: The Ultimate Rush**. Basingstoke: Palgrave Macmillan, 2005
40. Vaughan H: Psychosurgery and brain stimulation in historical perspective, in Gaylin W, Meister J, Neville R (eds): **Operating on the Mind: The Psychosurgery Conflict**. New York: Basic Books, 1975, pp 24–72
41. Willis T, Feindel W (ed): **The Anatomy of Brain and Nerves. Facsimile of the English edition by Samuel Pordage**. Montreal: McGill University Press, 1965
42. Wilson EO: How to unify knowledge. Keynote address. **Ann N Y Acad Sci** **935**:12–17, 2001

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