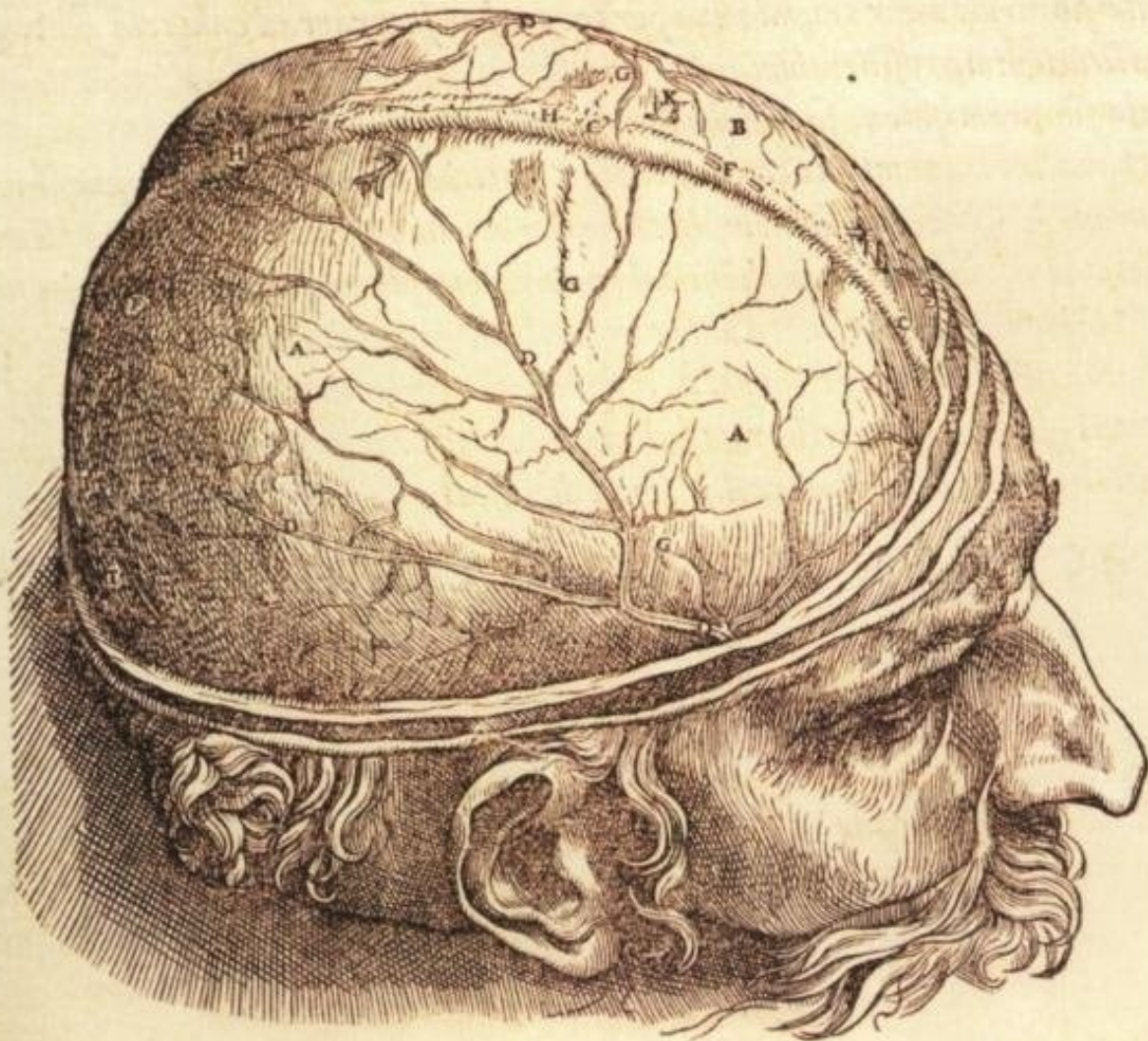


"Stirring . . . a daring rescue of the concept of the free human will."

—George Gilder, author of *Microcosm and Telecosm*

The Mind & The Brain

Neuroplasticity and the Power of Mental Force



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{ ONE }

THE MATTER OF MIND

Nature in her unfathomable designs has mixed us of clay and flame, of brain and mind, that the two things hang indubitably together and determine each other's being, but how or why, no mortal may ever know.

—*William James*

Principles of Psychology, Chapter VI

What is mind? No matter. What is matter? Never mind.

—*T. H. Key*

Of all the thousands of pages and millions of words devoted to the puzzle of the mind and the brain, to the mystery of how something as sublime and insubstantial as thought or consciousness can emerge from three pounds of gelatinous pudding inside the skull, my favorite statement of the problem is not that of one of the great philosophers of history, but of a science fiction writer. In a short story first published in the science and sci-fi magazine *Omni* in 1991, the Hugo-winning author Terry Bisson gets right to the heart of the utter absurdity of the situation: that an organ made from basically the same material ingredients (nucleated, carbon-based, mitochondria-filled cells) as, say, a kidney, is able to generate this ineffable thing called mind. Bisson's story begins with this conversation between an alien commander and a scout who has just returned from Earth to report the results of his reconnaissance:

"They're made out of meat."

"Meat?"

"There's no doubt about it. We picked several from different parts of the planet, took them aboard our recon vessels, probed them all the way through. They're completely meat."

"That's impossible. What about the radio signals? The messages to the stars?"

"They use the radio waves to talk, but the signals don't come from them. The signals come from machines."

"So who made the machines? That's who we want to contact."

"They made the machines. That's what I'm trying to tell you. Meat made the machines."

"That's ridiculous. How can meat make a machine? You're asking me to believe in sentient meat."

"I'm not asking you, I'm telling you. These creatures are the only sentient race in the sector and they're made of meat."

"Maybe they're like the Orfolei. You know, a carbon-based intelligence that goes through

a meat stage.”

“Nope. They’re born meat and they die meat. We studied them for several of their lifespans, which didn’t take too long. Do you have any idea of the lifespan of meat?”

“Spare me. Okay, maybe they’re only part meat. You know, like the Weddilei. A meat head with an electron plasma brain inside.”

“Nope, we thought of that, since they do have meat heads like the Weddilei. But I told you, we probed them. They’re meat all the way through.”

“No brain?”

“Oh, there is a brain all right. It’s just that the brain is made out of meat.”

“So...what does the thinking?”

“You’re not understanding, are you? The brain does the thinking. The meat.”

“Thinking meat! You’re asking me to believe in thinking meat!”

“Yes, thinking meat! Conscious meat! Loving meat. Dreaming meat. The meat is the whole deal! Are you beginning to get the picture, or do I have to start all over?”

It was some 2,500 years ago that Alcmaeon of Croton, an associate of the Pythagorean school of philosophy who is regarded as the founder of empirical psychology, proposed that conscious experience originates in the stuff of the brain. A renowned medical and physiological researcher (he practiced systematic dissection), Alcmaeon further theorized that all sensory awareness is coordinated by the brain. Fifty years later, Hippocrates adopted this notion of the brain as the seat of sensation, writing in his treatise on seizures: “I consider that the brain has the most power for man.... The eyes and ears and tongue and hands and feet do whatsoever the brain determines...it is the brain that is the messenger to the understanding [and] the brain that interprets the understanding.” Although Aristotle and the Stoics rejected this finding (seating thought in the heart instead), today scientists know, as much as they know anything, that all of mental life springs from neuronal processes in the brain. This belief has dominated studies of mind-brain relations since the early nineteenth century, when phrenologists attempted to correlate the various knobs and bumps on the skull with one or another facet of personality or mental ability. Today, of course, those correlations are a bit more precise, as scientists, going beyond the phrenologists’ conclusion that thirty-seven mental faculties are represented on the surface of the skull, do their mapping with brain imaging technologies such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), which pinpoint which brain neighborhoods are active during any given mental activity.

This has been one of the greatest triumphs of modern neuroscience, this mapping of whole worlds of conscious experience—from recognizing faces to feeling joy, from fingering a violin string to smelling a flower—onto a particular cluster of neurons in the brain. It began in the 1950s, when Wilder Penfield, a pioneer in the neurosurgery of epilepsy, electrically stimulated tiny spots on the surface of patients’ brains (a painless procedure, since neurons have no feeling). The patients were flooded with long-forgotten memories of their grandmother or heard a tune so vividly that they asked the good doctor why a phonograph was playing in the operating theater. But it is not merely the precision of the mental maps that has increased with the introduction of electrodes—and later noninvasive brain imaging—to replace the skull-bump cartography beloved of phrenologists. So has neuroscientists’ certainty that tracing different mental abilities to specific regions in the brain—verbal working memory to a spot beneath the

on the mind-matter enigma. The Canadian neurosurgeon Wilder Penfield, after a long career dedicated to explaining the material basis of mind, in the end decided that brain-related explanations are intrinsically insufficient. Charles Sherrington, the founder of modern neurophysiology, contended in 1947 that brain processes alone cannot account for the full range of subjective mental phenomena, including conscious free will. “That our being should consist of two fundamental elements offers, I suppose, no greater inherent improbability than that it should rest on one only,” he wrote. One of Sherrington’s greatest pupils, Sir John Eccles, held similar views. Eccles won a Nobel Prize for his seminal contributions to our understanding of how nerve cells communicate across synapses, or nerve junctions. In his later years, he worked toward a deeper understanding of the mechanisms mediating the interaction of mind and brain—including the elusive notion of free will. Standard neurobiology tells us that tiny vesicles in the nerve endings contain chemicals called neurotransmitters; in response to an electrical impulse, some of the vesicles release their contents, which cross the synapse and transmit the impulse to the adjoining neuron. In 1986 Eccles proposed that the probability of neurotransmitter release depended on quantum mechanical processes, which can be influenced by the intervention of the mind. This, Eccles said, provided a basis for the action of a free will.

It is fair to say that the debate instigated by Descartes over the mind-body problem has not ended at all; it has instead become almost painfully sophisticated and complex. Among the warring theories in play today we have (in one contemporary rundown) “the identity theory, the central state theory, neutral monism, logical behaviorism, token physicalism and type physicalism, token epiphenomenalism and type epiphenomenalism, anomalous monism, emergent materialism, eliminative materialism, various brands of functionalism”—and, undoubtedly, enough additional isms to assign one to every working philosopher in the world. A few words on a small handful of these philosophies of mind and matter (listed from most to least materialistic) should capture the flavor of the debate and give a sense of the competing ideas.

- FUNCTIONALISM, or “Mentalistic Materialism” as the neurosurgeon Joe Bogen has termed it, denies that the mind is anything more than brain states; it is a mere by-product of the brain’s physical activity. As the philosopher Owen Flanagan puts it, “Mental processes are just brain processes,” and understanding what those brain processes are and how they work tells us all there is to know about what mind is. This view recognizes only material influences. Paul and Patricia Churchland and Daniel Dennett are leading advocates of such materialist views, which are closely akin to behaviorism. The materialist position goes so far as to deny the ultimate reality of mental “events” like our color-blind scientist’s sudden experience of the redness of a peony, as well as the actual fact of consciousness itself. Other than the action potentials coursing through brain circuits, they insist, there is nothing more to the workings of the mind—at least, nothing that science needs to address. If we hold tenaciously to such quaint notions as experiential reality, consciousness, and the ontological validity of qualia, it is only out of ignorance: once science parses the actions of the brain in sufficient detail, qualia and consciousness will evaporate just

as the “vital spark” did before biologists nailed down the nature of living things. Materialism certainly has one thing going for it. By denying the existence of consciousness and other mental phenomena, it neatly makes the mind-matter problem disappear. No mind, all matter—no mind-matter problem.

- EPIPHENOMENALISM acknowledges that mind is a real phenomenon but holds that it cannot have any effect on the physical world. This school acknowledges that mind and matter are two separate beasts, as are physical events and mental events, but only in the sense that qualia and consciousness are not strictly reducible to neuronal events, any more than the properties of water are reducible to the chemical characteristics of oxygen and hydrogen. From this perspective, consciousness is an epiphenomenon of neuronal processes. Epiphenomenalism views the brain as the cause of all aspects of the mind, but because it holds that the physical world is *causally closed*—that is, that physical events can have only physical causes—it holds that the mind itself doesn’t actually cause anything to happen that the brain hasn’t already taken care of. It thus leaves us with a rather withered sort of mind, one in which consciousness is, at least in scientific terms, reduced to an impotent shadow of its former self. As a nonphysical phenomenon, it cannot act on the physical world. It cannot make stuff happen. It cannot, say, make an arm move. Epiphenomenalism holds that the brain is the cause of all the mental events in the mind but that the mind itself is not the cause of anything. Because it maintains that the causal arrow points in only one direction, from material to mental, this school denies the causal efficacy of mental states. It therefore finds itself right at home with the fundamental assumption of materialist science, certainly as applied to psychology and now neuroscience, that “mind does not move matter,” as the neurologist C. J. Herrick wrote in 1956. Put another way, all physical action can be but the consequence of another physical action. The sense that will and other mental states can move matter—even the matter that makes up one’s own body—is therefore, in the view of the epiphenomenalists, an illusion.

Although epiphenomenalism is often regarded these days as the only generally acceptable alternative to stark materialism, one problem with this position is that it contradicts our basic core experience that mental states really do affect our actions. To deny the causal efficacy of mental states altogether is to dismiss the experience of willed action as nothing but an illusion. Another critical problem with epiphenomenalism (and other schools that deny the causal efficacy of mind) was raised in 1890 by the psychologist and philosopher William James. The basic principles of evolutionary biology would seem to dictate that any natural phenomenon as prominent in our lives as our experience of consciousness must necessarily have some discernible and quantifiable effect in order for it to exist, and to persist, in nature at all. It must, in other words, confer some selective advantage. And that raises an obvious question: What possible selective advantage could consciousness offer if it is only a functionless phantasm? How could consciousness ever have evolved in the first place if, in and of itself, it does nothing? Why, in short, did nature bother to produce beings capable of self-awareness and subjective, inner experience? True, evolutionary biologists can trot out many examples of traits that have been carried along on the river of evolution although not specifically

selected for (the evolutionary biologists Stephen Jay Gould and Richard Lewontin called such traits *spandrels*, the architectural term for the elements between the exterior curve of an arch and the right angle of the walls around it, which were not intention-ally built but were instead formed by two architectural traits that were “selected for”). But consciousness seems like an awfully prominent trait not to have been the target of some selection pressure. As James put it, “The conclusion that [consciousness] is useful is...quite justifiable. But if it is useful, it must be so through its causal efficaciousness.”

- EMERGENT MATERIALISM argues that mind arises from brain in a way that cannot be fully predicted from or reduced to brain processes. The attributes of mind, that is, cannot be explained solely by brain’s physical activity. Further, according to this view, mind may have the power to effect both mental and physical change. Emergentists like Steen Rasmussen suggest that, sometimes, a high-order, emergent property like mind has the power to exert an effect on the lower-order processes that created it. In other words, what emerges can affect what it emerges from.

The Nobel-winning neuroscientist Roger Sperry taught at the California Institute of Technology from 1954 until his death in 1994. Best known for his study of “split brain” patients (many of whose surgeries severing the connections between the right and left cerebral hemispheres were actually performed by Joe Bogen), Sperry produced the most detailed and scientifically based version of emergent materialism. He variously called his own emergent theory “mentalism,” “emergent mentalism,” or just “the new mentalism.” At first, he argued only that mind is not reducible to cerebral activity, echoing the mainstream emergent position that mind arises from brain as a unique entity whose attributes and power cannot be predicted, or even explained, from its material components alone. But later Sperry became uneasy with the triumph of materialism in neuroscience and what he called its “exclusive ‘bottom-up’ determination of the whole by the parts, in which the neuronal events determine the mental but not vice versa.” As a result he later espoused a view that mental states can indeed have causal efficacy. In contrast to agnostic physicalism (discussed later), which allows mental states to influence other mental states only through the intermediary of the brain, emergent materialism grants to some mental states the power directly to change, shape, or bring into being other mental states, as well as to act back on cerebral states. In the years just before his death, Sperry hinted that mental forces could causally shape the electrochemical activity of neurons.

This represented a radical new vision of the causal relations between higher-order mental processes and neuronal events. What Sperry termed “mental forces” could, he argued, direct the electrochemical traffic between neurons at the cellular level. This view thus argues that emergent mental properties can exert top-down causal control over their component parts—“the downward control by mental events over the lower neuronal events.” This, as we will see in Chapter 2, describes very well the control by an OCD patient’s mind of his neuronal events, specifically the activity in the pathological circuits underlying the disease. Sperry was at pains to point out that his belief did not constitute dualism (that dreaded word!) in any Cartesian sense, but rather a radically revised form of materialism in which the

mind is not only emergent but also causal. He maintained (as classical, non-science-based dualists do not) that the myriad conscious experiences cannot exist apart from the brain; he did not posit an unembodied mind or consciousness as, again, classical dualists do. The mental forces he considered causally efficacious were no spooky, nonmaterial, preternatural entities. As he put it in 1970, “The term [mental forces] ... does not imply here any disembodied supernatural forces independent of the brain mechanism. The mental forces as here conceived are inseparably tied to the cerebral structure and its functional organization.” They shape and direct the lower-level traffic of electrical impulses. The form of causal efficacy Sperry proposed was one that adherents of materialist, bottom-up determinism dismissed—namely, one in which “higher-level” mental properties exert causal control over the “lower level” of neurons and synapses. In this scheme, Sperry wrote in 1965, “the causal potency of an idea, or an ideal, becomes just as real as that of a molecule, a cell, or a nerve impulse.” He fervently hoped that the new view of mind would integrate “traditionally conflicting positions on mind and matter, the mental versus the material,” and that “science as a whole may be in the process of shifting away from its centuries-old microdeterminate materialist paradigm to a more valid macromental model for causal explanation and understanding.”

Not even a Nobel Prize offered adequate shielding from the brickbats hurled at Sperry for this plunge into the mind-and-matter wars. When the English psychologist Oliver Zangwill visited Caltech in August 1970, as Joe Bogen recounts, he expressed to Sperry his concern that if “Sperry went on in this vein it is likely to diminish the impact of his many marvelous achievements.” How, Bogen asked, did Sperry react? Very little, replied Zangwill. From about 1980, almost all of Sperry’s writings were about consciousness and mental forces acting from the top down. When he was honored at Caltech in 1982 on the occasion of his Nobel, those who had come to know him only recently assumed, recalls Bogen, “that he’s gone religious like so many old folks.” By 1990, even Caltech professors who had known Sperry for four decades “had given up trying to defend or even to understand ‘the philosophy of his later years,’ as one of them put it.”

Although Sperry put great stress on the reality of the mind in the causal chain, when pressed he seemed to fall back on classical materialist assumptions. He emphatically denied the importance of quantum mechanics for understanding mind-brain relations, insisting that Newtonian physics was entirely up to the task. “It remains true in the mentalist model that the parts... determine the properties of the whole, i.e. microdeterminism is not abandoned,” he wrote in his last major paper. “The emergent process is... in principle, predictable.” Thus the mental forces he was so fond of referring to were themselves determined from below. To those, like me, who were becoming committed to the genuine power of mental force and its integral role in a quantum-based mind-brain theory, Sperry’s views seemed like a refined form of epiphenomenalism.

- AGNOSTIC PHYSICALISM also holds that mind derives exclusively from the matter of the brain. In contrast to the epiphenomenalists and functionalists, however, adherents of this school acknowledge that this may not be the whole story. That is what the “agnostic” part reflects: those who subscribe to this worldview do not deny

the existence of nonmaterial forces, just as an agnostic does not actively deny the existence of God. Rather, they regard such influences, if they exist, as capable of affecting mental states only as they first influence observable cerebral states. William James falls into this camp. Joe Bogen is careful to distinguish physicalism from materialism. The former holds that the mental does not change without the physical's (that is, brain states) changing, too. This says nothing about the existence of nonmaterial influences on the mind. It simply asserts that any such influences must work through the brain in order to affect the mind. In contrast, materialism transcends physicalism in actively denying the existence of nonmaterial influences.

In explaining his own position, Bogen recounts an argument he once had with the philosopher Paul Churchland about the mystery of how brain produces mind, and the need some philosophers and neuroscientists perceive to invoke something immaterial and without spatial extent to affect the brain. Churchland burst out, "Throughout the history of this subject the mind has been considered to be between God and brain. But now you presume to put the brain between God and mind." To which Bogen replied, "Exactly so, which is how I can be a committed physicalist while remaining agnostic or even indifferent about the immaterial."

- **PROCESS PHILOSOPHY**, a school greatly influenced by Alfred North Whitehead, holds that mind and brain are manifestations of a single reality, one that is in constant flux. It thus is compatible with classical Buddhist philosophy, which views clear and penetrating awareness of change and impermanence (*anicca* in Pali) as the essence of insight. Thus, as Whitehead put it, "The reality is the process," and it is a process made up of vital transient "drops of experience, complex and interdependent." This view is strikingly consistent with recent developments in quantum physics.
- **DUALISTIC INTERACTIONISM** holds that consciousness and other aspects of mind can occur independently of brain. In this view, mental states have the power to shape brain or cerebral states—and, going even further, the mind cannot in any sense be reduced to the brain. Although mind depends on brain for its expression, brain is by its very material nature not sufficient to explain mind completely, for consciousness and everything else lumped under this thing called mind are categorically different beasts from brain and everything else material. John Eccles, who along with the philosopher Karl Popper for many years gallantly championed this view, put it this way not long before his death: "The essential feature of dualist-interactionism is that the mind and brain are independent entities...and that they interact by quantum physics." Scientists and philosophers in this camp reject materialism to the point of actually positing a nonmaterial basis for the mind. Even worse, they seem to have a penchant for speaking about the possibility of life after death, something no self-respecting scientist is supposed to do in public (although both Eccles and Penfield did). Even scientists and philosophers who question whether simply mapping neural correlates can truly provide the ultimate answer have doubts about dualistic interactionism: neuroscientists may have worlds to go before they understand *how* brain gives rise to mind, but even in a field not generally marked by certainty they are as sure as sure can be that it does, somehow, manage the trick.