

CHAPTER 3

Panpsychism, Panprotopsychism, and Neutral Monism

Donovan Wishon

*Assistant Professor of Philosophy
University of Mississippi, Oxford*

Penultimate Draft - Please Cite Published Version

*In our endeavour to understand reality we are somewhat like a man trying to understand the mechanism of a closed watch. He sees the face and the moving hands, even hears its ticking, but he has no way of opening the case. —Albert Einstein and Leopold Infeld, *The Evolution of Physics* (1938)*

In everyday life, we generally suppose that conscious mental lives are relatively rare occurrences in nature—enjoyed by humans and select species of animals—especially when reflecting on the vast scale of the cosmos and its history. By all appearances, this natural conviction receives enormous support from the picture of the natural world provided by physics, astronomy, chemistry, biology, geology, and other branches of the physical sciences. In general outline, this scientific picture characterizes consciousness as a relatively recent product of the long course of the earth’s natural and evolutionary history whose emergence is intimately linked, in some fashion, to the highly complex functioning of the brains and central nervous systems of certain sophisticated biological organisms residing at or near the planet’s surface. Against this background, philosophical and empirical questions about the distribution of minded beings in nature typically concern when and where consciousness and thought first came onto the scene and which highly evolved biological organisms do, in fact, enjoy conscious mental lives. In a more speculative frame of mind, we might wonder whether computers, robots, or other inorganic systems are, in principle, capable of genuine thought and/or experience (see the “The Computational Theory of Mind” and “The Philosophy of Artificial Intelligence” chapters elsewhere in this volume). Scientifically informed common sense usually recoils, however, from the thought that consciousness reaches, to any great extent, farther into the natural world.

Some have wondered whether this intuitive resistance is warranted. There is a long and distinguished history of philosophers, scientists, theologians, and environmentalists, among others, who have maintained that conscious minds, or the primordial elements that make them up, are far more pervasive and deeply rooted aspects of reality.

One might start down this path through the biological sciences. There is a growing body of neurological, behavioral, and morphological evidence that (though it is still controversial and incomplete) suggests that consciousness is a trait shared by all mammals.

There is also increasing evidence of the presence of consciousness, with progressively less certainty, in birds, reptiles, mollusks, fish, and perhaps even crustaceans, insects, and spiders. Some biologists have gone so far as to propose the likelihood of primitive consciousness in even the simplest animals—perhaps even single-celled organisms (Margulis 2001; Ginsburg and Jablonka 2007). In fact, a few plant biologists have even argued for plant consciousness on the grounds that plants have multimodal sensitivity to their environments, process and store information, send chemical signals to one another, and react in flexible, goal-directed ways (Nagel 1997; Chamovitz 2012). If these surprising claims are true, consciousness is a far more common trait within the biological domain than we ordinarily suppose (see the “Animal Minds” chapter in this volume).

Others have suggested that it is likely that consciousness extends far beyond the plant and animal kingdoms. John Muir (1838–1914), one of America’s most famous conservationists and the founder of the Sierra Club, took seriously the possibility that consciousness is infused throughout the natural world. In his 1916 classic *A Thousand-Mile Walk to the Gulf*, he mused, “Plants are credited with but dim and uncertain sensation, and minerals with positively none at all. But why may not even a mineral arrangement of matter be endowed with sensation of a kind that we in our blind exclusive perfection can have no manner of communication?” (140). Though few thinkers follow Muir in attributing consciousness to medium-sized natural phenomena such as sticks, stones, and rivers, a number of prominent physicists have endorsed views according to which mentality is a ubiquitous feature of the cosmos at the smallest and/or grandest scale. In his 1928 *The Nature of the Physical World*, the eminent British physicist, astronomer, and mathematician Sir Arthur Eddington (1882–1944) pronounced the likelihood that “the stuff of the world is mind-stuff,” which is “something more general than our individual conscious minds; but we may think of its nature as not altogether foreign to the feelings in our consciousness” ([1928] 2012, 270). One can reasonably interpret Eddington as here endorsing a version of the view that some (and perhaps all) fundamental physical entities, such as quarks, photons, bosons, and so on, are conscious in an attenuated sense.

This chapter considers and assesses three different philosophical views that share the belief that conscious minds, or their fundamental ingredients, are widely distributed throughout the natural world in a manner that in some sense eludes the explanatory reach of the physical sciences. The first is *panpsychism*, which is the doctrine that mind is a fundamental and pervasive feature of the universe. The second is *panprotopsychism*, which is the doctrine that fundamental physical entities, while not themselves minded, have special features that give rise to conscious minds when they are arranged into a sufficiently complex physical system. The third is *neutral monism*, which is the doctrine that both minds and physical entities are constructed from more basic elements of reality that are in themselves neither mental nor physical. While each of these views is likely to sound pretty strange at first, there are reasonable grounds for taking all three seriously.

This chapter focuses primarily on how panpsychism, panprotopsychism, and neutral monism figure into ongoing debates in the philosophy of mind. It begins by briefly considering why there has been increasing interest in exploring alternatives to mainstream dualism, functionalism, and physicalism (see the “Dualism,” “Functionalism,” and “Physicalism” chapters in this volume). The “Breathing Fire into the Equations” section later in this chapter explains how philosophical issues about the nature of physical theories might clear unexpected paths for finding a place in nature for consciousness. “Mind-Dust” examines some of the motivations for adopting panpsychism and highlights its main

challenges. The sections “The Unknown Alchemy of Consciousness” and “Neutral Stuff” do the same for panprotopsyism and neutral monism, respectively. This chapter concludes by taking stock of the contributions, if any, these three views make toward the philosophical understanding of the mind and its place in the world.

WHAT WE’VE GOT HERE IS A FAILURE TO INTEGRATE

The core problem in the philosophy of mind, both currently and historically, is the problem of integration. Here is the problem in a nutshell. On one hand, we have an everyday conception of what conscious minds are like based largely on how ours are presented to us in experience together with a hodgepodge of (sometimes conflicting) elements from such sources as folk theory, popular psychology, religion, and cultural tradition. On the other hand, we have a scientific conception of what brains and other physical phenomena are like, which comes from neuroscience, biology, chemistry, physics, astronomy, and the rest of the natural sciences. The fundamental question is whether we can reconcile these two conceptions of reality and, if not, how we are to revise one or both of them so as to end up with the best overall picture of how everything hangs together. When posed in its most common form, the question is whether we can find a place for conscious minds, as we ordinarily conceive of them, within the scientific picture of physical reality or whether they are best seen as something above and beyond the physical aspects of reality.

The landscape in the philosophy of mind is largely divided between those who think that conscious minds can, in principle, be fully integrated into the explanatory framework of the physical sciences (without any radical departure from their current form) and those who think they cannot.

THE CASE FOR INTEGRATION

Those optimistic about the prospect of integration often point to the immense progress of the physical sciences toward explaining a myriad of once-mysterious phenomena—including the origin and history of the cosmos, the fundamental particles and forces that account for its workings and complexity, and the nature of life and reproduction. They also point to the rapid advances the biological and cognitive sciences are making in our understanding of the structure and functioning (both normal and abnormal) of human and animal brains. More controversially, some would contend that we are already designing artificial systems with varying degrees of (goal-specific) intelligence and that we will likely be able to engineer humanlike artificial intelligence at some point in the future. In any case, many philosophers see no compelling reason for thinking that our minds alone will elude the relentless march of the physical sciences. What is more, Occam’s razor—the scientific principle that entities must not be multiplied beyond necessity—cuts against the idea that our minds are something above and beyond the physical aspects of reality.

There are also causal considerations that tell in favor of such integration (see the “Mental Causation” chapter in this volume). From the side of reflective common sense, we have overwhelming reason to think that conscious mental phenomena are *causally efficacious*; they have some physical occurrences as causes and other physical occurrences as effects. From the side of scientific theory, we have good reason to think that physical reality is a *causally closed system*; if a physical occurrence has a cause, then that cause is itself a physical occurrence. When these two theses are combined with the quite plausible

assumption that there is no systematic causal redundancy in the workings of the world, we are led straightforwardly to the conclusion that conscious mental phenomena *just are* a kind of physical occurrence. This line of reasoning leaves open the question of whether minds are identical with neurobiological processes in brains, representational or computational features of complex physical systems, or something whose features extend into the body or external physical environment, among other possibilities (see the “Physicalism,” “The Computational Theory of Mind,” and “Embedded, Embodied, Extended, and Enactive Cognition” chapters in this volume). The nature of numerical identity, however, precludes the possibility that the physical domain lacks features that conscious experience has, and vice versa. Thus, we have good reason to think that minds can be integrated into our scientific picture of the physical universe.

THE CASE AGAINST INTEGRATION

On the other hand, many find it hard to see how our conscious mental lives could be part of physical reality. In particular, they are skeptical that anything physical, given what we know about physical phenomena, could exhibit the subjective and qualitative aspects our conscious mental lives seem to enjoy (see the “Consciousness” chapter in this volume). In claiming that our conscious mental lives are *subjective*, philosophers typically mean that they are tied to our first-person perspective on the world and that our knowledge of them is different in some significant way from our knowledge of other things, including the minds of anyone else. In saying that they have *qualitative* aspects, philosophers are pointing to the fact that there is something it is like, experientially speaking, for us to undergo conscious mental episodes of various kinds (see the “Consciousness” chapter). For instance, there is often something it is like, experientially speaking, for us to feel pleasure or pain, to feel hunger or thirst, to have various kinds of sensory experiences, to imagine or desire things, and arguably to think about something (see the “Cognitive Phenomenology” chapter). The problem is that such subjectivity and qualitativity are seemingly absent from the objective picture of physical reality provided by the sciences.

Worries about integrating such features into the explanatory framework of the physical sciences have been sharpened by a number of well-known (and hotly contested) philosophical arguments. These arguments aim to show that our conscious mental lives merely happen to accompany neurophysiological processes in our brains. More specifically, they aim to show that there is no essential link between the biological makeup or functioning of our brains and the subjective and qualitative aspects of conscious mental episodes. For instance, many philosophers argue that no amount of physical information about a sentient creature’s biology, history, functioning, or relations to its environment can by itself provide us with knowledge of the character of its experiential life. Many philosophers also maintain that we can clearly and coherently imagine (1) beings physically and functionally just like us in indistinguishable environments whose conscious mental lives differ qualitatively from ours (perhaps lacking them altogether) and/or (2) beings with conscious mental lives just like ours who radically differ from us in the relevant physical and functional respects (perhaps lacking bodies altogether). Such considerations provide weight to the view that conscious mental lives are something over and above the neurophysiological processes and broader physical conditions with which they are systematically correlated.

Hence, when it comes to the question of whether conscious minds can be integrated into the scientific picture of physical reality, many feel that we are confronted with something like an impasse. On one hand, there are forceful arguments for the conclusion

that conscious mental episodes are wholly physical in nature. On the other hand, there are forceful arguments that suggest that they have features that outstrip the explanatory reach of the physical sciences (and so perhaps are not physical after all). Unsurprisingly, most philosophers respond by trying to show that one or the other set of arguments is, all things considered, more compelling than its alternative. Perhaps they are right to do so. Others have responded by reexamining the relationship between the physical sciences and the natural world they describe with the hope that doing so will be more philosophically profitable.

BREATHING FIRE INTO THE EQUATIONS

It is natural to view scientific theories, when they are complete and true, as capable of providing an exhaustive characterization of some aspect of the natural world. If, for instance, physics were to have a fully worked-out, complete scientific theory of electrons, bosons, or another fundamental physical particle, we would expect that a full understanding of this theory would yield a full understanding of the nature of the relevant particle—and similarly with other physical phenomena, such as mass, electromagnetism, gravity, dark matter, and so on. In this view, if the physical sciences were to achieve the ideal of providing a comprehensive Theory of Everything, then we could, at least in principle, use it to understand fully any physical aspect of the cosmos whatsoever. So when we are confronted with arguments that (taken at face value) suggest that conscious mental lives possess features that resist integration into the explanatory framework of the physical sciences, it is easy to draw the conclusion that these features must be nonphysical aspects of reality.

However, a number of philosophers and scientists accept the view that physical theories, even when complete and accurate, characterize the natural world in a remarkably limited fashion. In particular, they endorse a view popularized by the eminent British philosopher, logician, and social activist Bertrand Russell (1872–1970) according to which physical theories ultimately describe the universe abstractly and (almost) wholly in terms of its structure and how its structure changes over time. Put simply, they maintain that physical theories tell us only *which* things there are in the universe (in the sense that we have names for classifying them), *when* and *where* they are located in space and time, and *how* they causally interact with other things (including how they affect our sensory experiences of the world). Even more crudely, they maintain that physical theories provide a purely formal and mathematical description of the parts and mechanical workings of the cosmos.

These philosophers and scientists argue that there is more to physical reality than can be gleaned from physical theories alone. This is because the physical universe is not itself abstract and includes entities and forces that cannot be specified only and entirely in terms of their space-time locations and how they are apt to behave in various circumstances. From their point of view, such a picture of reality is far too insubstantial. Instead, the universe consists of concrete natural phenomena with substantial underlying natures that physical theories partially describe in terms of abstract mathematical measurements and equations. In his 1988 *A Brief History of Time*, renowned British physicist and cosmologist Stephen Hawking (1942–) expresses something like this point as follows: “Even if there is only one possible unified theory [of physics], it is just a set of rules and equations. What is it that breathes fire into the equations and makes a universe for them to describe?” (1988, 174). Many of these philosophers and scientists also maintain that the concrete underlying natures

of physical phenomena ultimately account for why they behave in accordance with the abstract mathematical descriptions of physical theories. Unfortunately, they argue, physical theories leave inscrutable (that is, unknown and unknowable) the underlying nature of the physical phenomena they describe.

One can make this position more intuitive by considering a more familiar case: the kind of understanding physical science gives us about black holes. Simply put, a black hole is a mathematically describable region in space-time produced when a massive star collapses and results in a core of matter so dense that its gravitational field does not permit electromagnetic radiation to escape. Because no electromagnetic radiation can escape the extreme gravity of a black hole (including visible light, ultraviolet light, X-rays, and so on), it is impossible for scientists to observe them directly. Nevertheless, scientists can infer the existence of black holes from their tremendous effects on nearby stellar matter, gases, and electromagnetic radiation. From these indirect measures, scientists have been able to infer the size and locations of many black holes and can describe with great detail and mathematical precision many of their physical properties as well as much of their internal structure. Despite the incredible explanatory power of our best scientific theories of black holes, however, we remain deeply ignorant (and seemingly necessarily so) about what they are really like “from the inside.”

Philosophers and scientists who hold Russell’s view of physical theories take it that all (or at least most) of our scientific knowledge about the natural world is analogous to our knowledge of black holes. Many accept the view that our perceptual experience of the world provides us with only indirect evidence of what physical entities are like based on how they affect our sensory faculties in various conditions. Others claim that while perceptual experience provides us with direct knowledge of some aspects of ordinary physical entities in our environment, it does not disclose their full natures to us. In either case, they insist that we are inexorably closed off from achieving a substantial understanding of what most physical entities (whether microscopic or macroscopic) are really and fully like beyond the abstract descriptions of their structure and workings provided by physical theory. The same is true of physical properties such as mass and charge: ultimately, we grasp them only in terms of how physical entities that possess them are apt to affect other physical entities and our perceptual experiences in various circumstances. Otherwise, we are left completely in the dark about what they, or any other physical phenomena, are really like “from the inside.”

Of course, many of the assumptions made by those who endorse the view that the natural world outstrips the structural descriptions of physical theory are controversial. For one thing, many reject theories of perception according to which we have only indirect evidence of what physical objects are like or according to which the full natures of such objects are hidden from us (see the “Perception” chapter). As such, they would deny that our knowledge of the familiar parts of physical reality is in any way analogous to our knowledge of black holes or other physical entities we cannot directly observe. For another, many reject the assumption that physical theories are, by their nature, limited to describing physical phenomena in wholly abstract and structural terms. Finally, there are a number who reject the claim that there is anything more to the natural world than its physical structure.

For those who accept structuralism about physical theories and hold that the natural world has an underlying nature that (at least at present) lies outside the scope of our knowledge, the question of this scientifically inscrutable nature emerges. Moreover, it is natural to consider whether this underlying nature is in some way relevant to the problem of

integration. After all, if there is indeed more to the natural world than can be fully and adequately described by physical theories, then we could simply chalk up our inability to find a place in the natural order for consciousness to our ignorance rather than to any deep divide in reality. Among other things, this opens the possibility that the hidden nature of physical reality is consciousness itself, the nonconscious building blocks of consciousness, or building blocks that are neither physical nor mental but which give rise to both. The following sections examine each of these surprising possibilities.

MIND-DUST

In a 2014 article in *Scientific American Mind*, Christof Koch (1956–), a leading pioneer in the neuroscience of consciousness, declared that “as a natural scientist, I find a version of panpsychism modified for the 21st century to be the single most elegant and parsimonious explanation of the universe I find myself in” (26). Taken strictly, panpsychism is the view that everything (*pan*) in the universe, whether on the smallest or grandest scale, is a mind or has some mental aspect (*psyche*). Yet most self-avowed panpsychists hold weaker views than this. As such, panpsychism is perhaps better characterized as the view that minds or mind-like qualities are a pervasive feature at the most basic or fundamental level of the cosmos. In other words, it is typically expressed as the view that at least some of the most basic physical entities and/or forces possess mental aspects of a primordial and elemental kind, which for ease we could call *microconsciousness*. In this view, the sophisticated conscious mental lives of the sort we and other sentient animals enjoy result from complex arrangements of and interactions between vast numbers of fundamental physical entities exhibiting such microconsciousness. Of course, one might reasonably wonder, why should anyone take such a wild and fanciful proposal seriously? In point of fact, philosophers and scientists have advanced a number of different arguments in support of panpsychism, some of which we will survey in the following sections.

THE ARGUMENT FROM SIMPLICITY

As mentioned by Koch, one straightforward argument for panpsychism is that it provides the simplest and most parsimonious picture of reality. Whereas most answers to the problem of integration hold that there are both minds and physical entities that lack mentality altogether, panpsychism maintains that the most basic physical entities and forces are in some sense minded—that all energy, for instance, is consciousness. But then Occam’s razor (“entities must not be multiplied beyond necessity”) suggests that, all other things being equal, we should favor panpsychism over alternatives that commit us to the existence of wholly nonmental entities. We can call this the *argument from simplicity* for panpsychism.

The main worry about this argument is that appeals to parsimony carry only so much weight. For one thing, we must pay heed to the qualification “all things being equal.” It is rarely, if ever, the case that any two theories are truly equal in all respects except concerning parsimony. As such, panpsychism’s (alleged) advantage in terms of ontological austerity has to be weighed against any advantages its alternatives might have in their favor. For another thing, while the dictate not to multiply entities “beyond necessity” is often a useful heuristic, what we are ultimately after is a theory that adequately accounts for *what there is* in the universe. For this reason, some have countered that we have equally good reason to accept

the principle that theories must not commit us to fewer entities than are needed (Chatton 1321–1323; Kant [1781] 1998). They argue that our guiding dictate for the adoption of theories really ought to be that we must not posit more or fewer entities than there in fact are. In this view, a theory cannot be adequate if it posits complexity where there is really simplicity or simplicity where there is really complexity. So the mere fact that panpsychism is not committed to the existence of entities that are fundamentally nonmental is weak evidence, at best, for its truth.

THE ARGUMENT AGAINST MYSTERIOUS NATURES

A number of panpsychists, including the British philosopher and literary critic Galen Strawson (1952–), have retorted that our evidence for the existence of wholly insentient entities is, in point of fact, more precarious than the evidence for microconsciousness (Strawson 2016). After all, they contend, the only part of reality regarding which we have any substantial knowledge of what it is like “from the inside” includes our own conscious mental lives. Once matters are looked at in this way, they insist, panpsychism is more modest than its alternatives, because it takes reality to be of a kind with the only part of reality whose underlying nature we grasp. We can call this the *argument against mysterious natures* for panpsychism.

Critics of panpsychism have responded to this challenge in a number of ways. As noted earlier, many deny that there is extrastructural reality with an underlying nature of which we are deeply ignorant. Others have noted that if we really are deeply ignorant of the underlying nature of most of the physical world, this very fact makes it equally immodest for us to attribute, without further argument, microconsciousness to basic physical entities as it would be to attribute a nonmental nature to them. Thus, if we are to avoid complete agnosticism about the nonstructural nature of reality, it must be on the basis of considerations other than our limited knowledge of it.

THE INTEGRATED INFORMATION THEORY

Panpsychists have offered a number of arguments that aim to show that the existence of microconsciousness is, in fact, the best explanation of what we know about the natural world. For instance, Koch and several other prominent neuroscientists have suggested that panpsychism is a consequence of our current best theory of how our brains generate highly differentiated, informationally rich, and highly unified conscious experience: the integrated information theory of consciousness. First proposed by Italian psychiatrist and neuroscientist Giulio Tononi, this theory maintains that (1) conscious experience is identical to the integrated information in a system and (2) its degree of complexity is a function of how integrated this information is (which can be measured with a precise mathematical formula). In this view, the richness of our conscious mental life results from the complex way in which our brain’s thalamocortical system is organized—it exhibits both a high degree of functional specialization by different groups of neurons and a high degree of informational integration among them through a vast network of neural connections (Tononi 2007, 293–294).

One surprising consequence of this view is that any system that exhibits a nonzero amount of integrated information will have some degree of consciousness, however simple it might be. This implies that other complex biological organisms are conscious, as are simple unicellular organisms, the individual cells that make up plants and animals, artificial systems

such as the Internet and neural networks, and perhaps even entangled systems of quantum particles, among other possibilities.

The main problem with this argument is that our understanding of the biological basis of consciousness remains relatively poor and many competing theories might turn out to be correct. On some of these theories, such as British neurobiologist Semir Zeki's (1940–) “theory of micro-consciousness,” conscious experience requires little or no informational integration. On others, the presence of a high degree of informational integration is not, by itself, enough for conscious experience. As evidence for this, one might point to cases of “blindsight” in which subjects, owing to lesions in their primary visual cortex, lack conscious awareness in part of their visual field despite being able to react to the presence of stimuli there in ways approximating normal conscious vision (Weiskrantz 2007). Such individuals can, for instance, discriminate, classify, and react in complex ways to objects presented in the blind spot in their visual field at levels well above chance—tasks that seemingly require some degree of informational integration. There is even evidence that they can be subject to visual illusions in their blind spots (Azzopardi and Hock 2011). Hence, whether the available empirical evidence supports the integrated information theory of consciousness remains an open question.

THE CONTINUITY ARGUMENT

A more general empirical argument for panpsychism is the *continuity argument*, which appeals to the high degree of continuity we observe in the natural world. In the past two centuries, evolutionary biologists have amassed staggering evidence that the immense diversity and complexity of life on the earth is the result of a long continuous process of heritability and descent that ultimately can be traced back to ancient self-replicating unicellular organisms. Along these lines of descent (as well as among currently living organisms of varying complexity), scientists have discovered remarkable continuity in the neuroanatomy, physiology, biochemistry, and goal-directed ecologically shaped behavior of living organisms of diverse kinds. Though it is undeniable that this process results in varied organisms with distinctive features, the emergence of such biological novelty is typically gradual and (arguably) a matter of small modifications of preexisting materials (Clifford 1874; Seager and Allen-Hermanson 2015). Some have concluded from this that there is no determinate point in the evolutionary development of complex organisms from simpler ones where conscious mental lives plausibly first came onto the scene. Rather, they contend, complex minds like ours have emerged gradually from those of more primitive organisms, seemingly going all the way back to the rudimentary minds of the earliest forms of life.

Similar considerations can be used to call into question whether there is a sharp boundary between living organisms and inanimate matter. For one thing, the predominant view within the natural sciences is that life itself emerged gradually from more basic nonliving chemical building blocks (a process called “abiogenesis”). For another, many similarities exist in the behaviors of inorganic systems and those characteristic of simple organisms. For instance, some note that quantum particles exhibit spontaneous activity that is not fixed by antecedent conditions and informational coordination among mutually entangled particles over any distance (Lockwood 1989; Seager and Allen-Hermanson 2015). Evidence also suggests that complex nonliving systems, like living organisms, can replicate themselves, spontaneously self-organize, and adapt to their environments to better dissipate energy (England 2013). Some see these and other findings as strong evidence for unbroken continuity between complex conscious organisms and events happening at the microphysical level of reality.

Still, it is unclear that either the random behavior of quantum particles or the covariation of discontinuous parts of an entangled quantum system is sufficiently analogous to the activities of living organisms to support the claim of mental continuity. Moreover, the fact that life seemingly emerged from nonlife can just as well be taken as evidence that there *was*, in fact, some determinate point in the natural history of the universe when conditions were suitable for consciousness to first come into existence. In any case, it is questionable whether establishing unbroken continuity in the natural world with respect to life and nonlife provides sufficient evidence for mental continuity as well. In light of these kinds of issues, many panpsychists have sought defenses of their position that do not rest on specific empirical details that might be overturned and/or admit of competing interpretations.

THE ARGUMENT AGAINST RADICAL EMERGENCE

It can be said that the most important argument of this sort is the *argument against radical emergence* for panpsychism. One common presentation of it rests on the following three claims: (1) our conscious mental lives emerge from more basic elements of the natural world, (2) no radical emergence of novel features exists in nature, and (3) the emergence of our conscious mental lives from entirely insentient materials would be a case of radical emergence. Taken together, these three theses entail that our minds must emerge, in some continuous fashion, from more basic materials that are themselves loci of sentience.

The first two claims enjoy wide (but not universal) acceptance among philosophers. Most accept that complex minds are not part of the basic furniture of the world but rather are composed of or in some way derive from the right kinds of arrangements of more basic natural elements. Most also hold that whenever complex or novel phenomena emerge from more basic natural elements, the emerging phenomena's existence and features must flow entirely from the nature and arrangement of that from which they emerge (even if our ignorance precludes us from seeing how). Put simply, they reject the possibility of radical and inexplicable "jumps" in nature. Hence, most of the disputes about this argument center on the claim that the emergence of conscious minds from insentient materials would be a problematic case of radical emergence.

Whereas the core conviction of physicalism (and a guiding assumption in the biological and cognitive sciences) is that somehow our conscious mental lives are wholly grounded in and determined by complex arrangements of more basic nonmental elements, panpsychists see this as unintelligible. In particular, they agree with dualists that the subjective and qualitative aspects of conscious experience cannot be accounted for in terms of more basic elements that, by their very natures, entirely lack these features. By their lights, such emergence would be just as miraculous and inexplicable as it would be for the addition of two positive numbers to result in a negative number (Strawson 2006). Thus faced with the (allegedly) insurmountable divide between the sentient and the insentient, panpsychists conclude that complex mental lives such as ours must emerge in a continuous and intelligible way (even if not for us) from more basic natural elements that are themselves minded or that exhibit mind-like qualities.

Opponents respond to this challenge in various ways. Many insist that the biological and cognitive sciences already provide us with a rough picture (and some of the finer details) of how minds emerge nonradically from insentient materials. Others are willing to grant that we have little idea of how consciousness arises within the physical domain while at the same time denying that our state of ignorance has any implications for whether it is, in fact, possible for it to do so. In either case, they reject the claim that, as a purely conceptual

matter, the emergence of conscious experience from wholly nonexperiential elements is unintelligible. Rather, they insist that the question of whether such emergence is or is not possible must be answered, at least in part, through empirical investigation.

THE COMBINATION PROBLEM

In any case, panpsychism faces its own formidable challenge when it comes to the emergence of complex minds from the right kinds of interactions among multitudes of entities exhibiting microconsciousness. Simply put, there is the genuine question of how any combination of more basic minds or mind-like qualities could somehow add up to conscious mental lives like ours. This *combination problem* for panpsychism was famously advanced by the American philosopher and psychologist William James (1842–1910) in his groundbreaking 1890 *The Principles of Psychology*:

Where the elemental units [which compose complex minds] are supposed to be feelings, the case is in no wise altered. Take a hundred of them, shuffle them and pack them as close together as you can (whatever that may mean); still each remains the same feeling it always was, shut in its own skin, windowless, ignorant of what the other feelings are and mean. There would be a hundred-and-first feeling there, if, when a group or series of such feelings were set up, a consciousness belonging to the group as such should emerge ... but they would have no substantial identity with it, nor it with them, and one could never deduce the one from the others, or (in any intelligible sense) say that they evolved it.... Private minds do not agglomerate into a higher compound mind. (1950, 160)

James's objection to panpsychism (or what he calls the "mind-dust" theory) here is that it is no more intelligible to us how any number of simple subjects of experience could combine to produce a new complex subject of experience than it is for a combination of insentient materials to do so. Nor, many have noted, do we have an intelligible picture of how the qualitative aspects of microexperiences could combine so as to yield the rich and varied macroexperiences of the sort we and other sentient organisms enjoy. Consequently, the emergence of our conscious mental lives from more basic natural elements (arguably) looks to be just as miraculous and inexplicable for panpsychism as it is for competing views.

Most panpsychists agree that the combination problem is one of the most pressing challenges to their view. Even so, they insist that the emergence of macro-level conscious mental lives from micro-level elements exhibiting subjectivity and qualitativity does not, as a conceptual matter, exhibit the same kind or degree of unintelligibility as does their emergence from entirely insentient materials. Some have even offered proposals for solving the combination problem for panpsychism (Goff 2016; Seager 2010; Shani 2010). It is fair to say, however, that there remain real questions about whether any such proposal will be successful. In the eyes of most contemporary philosophers of mind, panpsychism remains a radical and extravagant answer to the problem of integration.

THE UNKNOWN ALCHEMY OF CONSCIOUSNESS

In recent years, a number of philosophers have endorsed panprotopsychism as a more promising, and less radical, answer to the problem of integration. Panprotopsychism is the doctrine that the fundamental entities described in abstract and structural terms by our physical theories possess unknown underlying natures that, while not mental themselves,

ultimately give rise to the conscious mental lives of complex creatures like us. Like panpsychism, this view maintains that the best way to find a place for minds in nature is to expand our conception of the world described by physical science. Unlike panpsychism, this view respects our ordinary, scientifically informed belief that minds are rare occurrences in nature that are not to be found on the smallest or grandest scales.

RUSSELL ON MIND AND MATTER

The chief historical inspiration for panprotopsychism is Bertrand Russell's writings on neutral monism in the early to middle part of the twentieth century. Pointing to revolutionary developments in twentieth-century physics and psychology, Russell argued that the traditional distinction between "mind" and "matter" is unfounded and that the subject matter of both physics and psychology concerns collections of causally ordered events in space-time. Some of these events, ones occurring in the brains of complex creatures like us, are the mental episodes that we are directly aware of in having conscious experience. These very same events can also be described in abstract structural terms by physics and neuroscience. Regarding the rest of the (extracranial) events in nature, Russell maintained that our knowledge of them is indirect and limited entirely to the abstract structural descriptions provided by the various physical sciences.

While Russell acknowledged that our limited knowledge of the underlying nature of most of the world opens the possibility that it is mental or mind-like, he cautioned that such a conclusion is unwarranted by the evidence. On the contrary, he argued that the radical differences in behavior between minded creatures and the rest of the natural world give us stronger (though defeasible) grounds for thinking that its hidden nature is not mental or mind-like. At the same time, he insisted that the events that make up our conscious mental lives and those that make up the rest of nonmental physical reality are not entirely discontinuous in character and so there is no unbridgeable divide between "mind" and "matter." Indeed, Russell claimed that the most reasonable hypothesis is that minds are wholly constructed from the same nonmental events that make up the rest of physical reality.

THE DUAL-ASPECT THEORY OF INFORMATION

Much of the recent interest in panprotopsychism (as well as the name itself) is due to the work of Australian philosopher and cognitive scientist David Chalmers (1966–). In his influential 1996 book *The Conscious Mind*, Chalmers presented (though stopped short of fully embracing) panprotopsychism as follows:

The strategy to which I am most drawn stems from the observation that physical theory only characterizes its basic entities *relationally*, in terms of their causal and other relations to other entities. Basic particles, for instance, are largely characterized in terms of their propensity to interact with other particles.... The picture of the physical world that this yields is that of a giant causal flux, but the picture tells us nothing about what all this causation *relates*.... [One possibility] is that the relevant properties are protophenomenal properties. In this case the mere instantiation of such a property does not entail experience, but instantiation of numerous such properties could do so jointly. (153–154)

Chalmers readily admits that he can only speculate about how protophenomenal properties might combine to jointly give rise to conscious mental lives like ours. Still, he insists that we should take such a proposal seriously, given both its promise in providing an elegant

solution to the problem of integration and our ignorance of the underlying nature of physical reality.

One intriguing possibility Chalmers considers is whether panprotopsychism could be successfully worked out within a “dual-aspect theory of information.” According to this theory, information is a fundamental aspect of the physical universe, and the laws of physics describe patterns in the transitions of its informational states “without actually saying what those states *are*” (1996, 366). If this were true, Chalmers suggests, it would be natural to suppose that the underlying natures of these dynamical informational states are phenomenal or protophenomenal properties. Put in slogan form, his proposal is that “experience [or protoexperience] is information from the inside; physics is information from the outside” (305). While it is fair to say that Chalmers’s dual-aspect theory of information has not achieved wide acceptance, it has convinced some that it is at least possible to make progress toward a detailed, scientifically respectable version of panprotopsychism.

HIDDENNESS AND REVELATION

Despite its promise, panprotopsychism faces a number of challenges. To begin with, many are hesitant to embrace any view according to which the natural world has an inscrutable underlying nature—even when this hidden nature is not presumed to be mental or mind-like in character. They argue that panprotopsychism trades the hard, but potentially solvable problem of integration for an unsatisfying view according to which physical reality has unknown and seemingly unknowable aspects. In response, proponents of panprotopsychism point out, it would be presumptuous of us to assume that our cognitive capacities are up to the task of achieving a comprehensive understanding of the nature of the universe. Furthermore, some entertain the possibility that revolutionary developments in science could eventually allow us to understand the hidden nature of physical reality.

Coming from the other direction, some have questioned whether panprotopsychism is compatible with our intimate knowledge of our conscious mental lives. While there is a great deal of ongoing controversy concerning the nature, scope, and limits of introspective knowledge, many believe that our grasp of current conscious mental episodes is especially secure and substantial. Some even suggest that our relation to our conscious experiences is so intimate that their essential nature is fully presented or revealed to us whenever we have (and attend to) them. If this is right, there is a problem for panprotopsychism because introspection by itself does not give us any evidence that our conscious mental episodes result from or are composed of more basic elements with insentient hidden natures. We can call this the *revelation argument* against panprotopsychism.

Proponents of panprotopsychism can resist this argument in at least two ways. First, they can reject the claim that facts about the composition and/or underlying basis of conscious mental events are included in their essential natures (Chalmers 2016). Such a denial would be particularly (but not only) plausible if particular kinds of conscious mental events can be realized by more than one combination of more basic elements. Second, they can deny that our introspective grasp of our conscious mental lives fully reveals to us their essential natures. While many panprotopsychists find this to be an unappealing option, others think we have good reason to doubt that our introspective knowledge of consciousness is fully transparent and reliable even under optimal conditions (Russell 1948; Feigl 1975). This has long been one of the more hotly contested issues in philosophy of mind, and it is beyond the scope of this chapter to survey the various considerations and arguments on each side of the debate.

RETURN OF THE COMBINATION PROBLEM

Perhaps the biggest challenge for panprotopsychism, however, is its own version of the combination problem: How can the right complex arrangements of natural elements with insentient hidden natures add up to subjects with conscious mental lives like our own? In his 2016 “The Combination Problem for Panpsychism,” Chalmers usefully breaks down the combination problem into at least three subproblems. First, there is the *subject combination problem*, which concerns how complex arrangements of insentient materials could result in a subject capable of having a first-person perspective on both the world and their own conscious mental life. Second, there is the *quality combination problem*, which concerns how complex arrangements of insentient materials could produce episodes with qualitative dimensions such that there is something it is like, experientially speaking, for a subject to live through them. Third, there is the *structural combination problem* (sometimes called the “grain problem”), which concerns how complex arrangements of vast numbers of discrete, spatially discontinuous insentient materials could yield conscious mental lives that are unified, multifaceted, and structured both egocentrically and in terms of objects represented as being in the environment. Each of these subproblems poses a daunting challenge for panprotopsychism, and it is uncertain that any single proposal can answer all three, if they can be answered at all.

Panprotopsychists respond to the subject combination problem in various ways. Some attempt to explain the existence of subjects of experience (and subjective awareness relations) in broadly functionalist terms—that is, in terms of a complex physical system having the right kind of access to the qualities of its own internal states and processes (see the “Functionalism” chapter). Others question whether there really are, in fact, such entities as subjects of experience or subjective awareness relations. In this view (which we will consider again later), our ordinary belief that we have a continuing “self” or “ego” distinct from our flux of causally connected thoughts and experiences is nothing more than a useful fiction. However, each of these proposals is controversial and raises issues beyond the scope of this chapter (see “The Self” chapter).

When it comes to the quality combination problem, the standard strategy is to argue that the fundamental physical entities and forces have hidden qualitative, but insentient natures, which give rise to the familiar qualitative aspects of experience when combined in the right way. However, by hypothesis we have no grasp of what these “microqualities” are really like and so have no conception of how they might combine so as to yield the qualities of our conscious experiences. Nor do we have any idea how diverse these microqualities might be. Perhaps there are only a few kinds that, in various combinations, mysteriously yield the rich variety of experiences we and other sentient beings enjoy. Given our deep ignorance of these matters, however, we also cannot rule out that there is great diversity among them. Thus, it is fair to say that it is entirely unclear, in our current state of understanding, whether or not panprotopsychists can make real progress toward solving these problems.

When it comes to the structural combination problem, the situation is only slightly more promising. The difficulty is in explaining how the right kinds of combinations of discrete microphysical entities and forces with hidden insentient natures can give rise to conscious mental lives structured in the ways ours are—ones with synchronic and diachronic cohesion, which present us with a manifold of unified objects and events standing in various egocentric relations to us and which exhibit smooth, continuous qualities in various sensory and nonsensory modalities (each with its own distinctive “quality space”).

Panprotopsyichists respond to this challenge in a number of different ways. One common suggestion is that the apparent differences between the structure of conscious experience and the structure the physical sciences attribute to the brain are merely the result of our being aware of the same complex physical system in two very different ways (Russell 1948; Lockwood 1993). Others have entertained the possibility of identifying consciousness with fluctuations in the right kinds of energy fields in the brain—ones generated by complex neurophysiological activity—on the ground that fields could have structures isomorphic to our conscious mental lives (Maxwell 1978). Still others have suggested that the structure we are presented with in experience concerns how the world is represented as being, rather than the experience's own structure (Stoljar 2001). As with the other aspects of the combination problem, there is little consensus on which, if any, of these strategies might ultimately be successful.

NEUTRAL STUFF

The final view we consider in this chapter, neutral monism, once occupied a central position in discussions of the problem of integration but has since fallen largely into obscurity. Though it has been presented in many different guises, the core commitment of this doctrine is that both physical and mental phenomena arise from a single kind of fundamental reality (*monism*) which is, in and of itself, neither physical nor mental (*neutral*). Among its most prominent proponents are Bertrand Russell, William James, and the Austrian physicist, philosopher, and psychologist Ernst Mach (1838–1916), though occasionally earlier well-known philosophers such as Baruch Spinoza (1632–1677) and David Hume (1711–1776) are also counted as neutral monists.

THE CASE FOR NEUTRAL MONISM

A number of motivations have persuaded thinkers to adopt neutral monism. The most straightforward attraction is its promise to avoid positing two radically different kinds of phenomena in the world while simultaneously skirting the long-standing (and, in their view, insurmountable) problems of accounting for minds in terms of matter or matter in terms of minds. Indeed, by positing that the fundamental nature of reality is in some sense neutral between both mind and matter, the hope is to provide a simple and elegant framework that narrows the gap for explaining each. Russell voices this sentiment as one guiding aim of his 1927 classic *The Analysis of Matter*:

To show that the traditional separation between physics and psychology, mind and matter, is not metaphysically defensible will be one of the purposes of this work; but the two will be brought together, not by subordinating either to the other, but by displaying each as a logical structure composed of what, following Dr. H. M. Sheffer, we shall call “neutral stuff.” (10)

Second, as Russell's comments indicate, neutral monists also see their view as promising to unify psychology and the physical sciences (without reducing or eliminating one in favor of the other) by giving them a shared subject matter. We have seen this already in Russell's view that psychology describes the portion of reality we are directly aware of in experience but which, at the same time, physics can abstractly describe in terms of its spatiotemporal and causal structure. For this reason, he and other neutral monists have tended to think that psychology, on one hand, and the physical sciences, on the other, are simply convenient

tools for describing one and the same reality in different ways, depending on our explanatory interests. In his 1886 *The Analysis of Sensations and the Relation of the Physical to the Psychological*, Mach conveyed this position as follows:

[The] great gulf between physical and psychological research persists only when we acquiesce in our habitual stereotyped conceptions [of “mind” and “matter”]. A color is a physical object as soon as we consider its dependence, for instance, upon its luminous source, upon other colors, upon temperatures, upon spaces, and so forth. When we consider, however, its dependence upon the retina ... it is a psychological object, a sensation. Not the subject matter, but the direction of investigation, is different in the two domains. (English translation, 1914, 17–18)

In fact, some neutral monists have entertained the possibility of our developing a new science—one more fundamental than both physics and psychology—which would describe the neutral stuff of the world directly, without any appeal to the antiquated and troublesome concepts of “mind” and “matter.” In his 1935 *Religion and Science*, Russell described his version of an imagined future science (which he elsewhere called “chrono-geography”) as one which “begins with events having space-time relations and does not assume at the outset that certain strings of them can be treated as persistent material units or as minds” ([1935] 1997, 294).

The third reason some are drawn to neutral monism is that it diminishes the need to accept aspects of reality that they find dubious and/or mysterious. One notable example of this is James’s and Russell’s skepticism, based on a lack of introspective evidence, concerning the existence of any such entity as the “self” or “subject” of experience above and beyond the psychological episodes making up a single stream of consciousness. On the same grounds, they also questioned the idea that our immediate knowledge of our mental lives is a matter of one thing, our self or ego, standing in an awareness relation to (or being presented with) something else, our thoughts and experiences. By their lights, neutral monism provided a way to avoid these problematic phenomena, and they adopted the view that what we think of as our “self” or “mind” is simply a series of causally connected episodes whose qualities are in some way self-presenting.

James and Mach (though not Russell) similarly hoped that neutral monism would enable them to dispense with the idea that physical reality has hidden and unknowable aspects by claiming that it is entirely of the same nature as the contents of immediate experience. At the same time, because they held the contents of immediate experience to be intrinsically neutral qualities, they did not thereby commit themselves to any kind of idealism or panpsychism.

THE CASE AGAINST NEUTRAL MONISM

Few today are convinced that neutral monism offers a promising way to solve the problem of integration. For one thing, the prevailing view is that neutral monism faces something of a dilemma when trying to explain both the nature of the fundamental neutral elements and in what sense they are genuinely neutral. On one hand, if the elements that make up the natural world are taken to have qualitative natures of the exact same kind as the contents of our immediate experience, then it becomes difficult to see why neutral monism would not collapse into idealism or panpsychism (despite the protests of James or Mach). On the other hand, if these elements are taken to have underlying qualitative natures that differ in some important way from those familiar from our experience, then it becomes equally difficult to see why it does not collapse into a version of panprotopsychism. Thus, many wonder whether neutral monism is an entirely stable position.

For another thing, neutral monism appears to face a particularly formidable challenge when it comes to the combination problem. For not only must it explain how the right combinations of neutral elements could somehow add up to the complex conscious mental lives we and other sentient organisms enjoy, it must at the same time explain how different combinations of these very same elements could result in the vast multitude of insentient phenomena that make up the rest of the cosmos. Thus, while panpsychism and panprotopsychism face a combination problem from only one direction (the mind), neutral monism faces two combination problems from different directions (the mind and matter). While a rare few remain unfazed by this challenge, it is fair to say that most philosophers prefer less daunting avenues for solving the problem of integration.

Summary

In this chapter, we have examined some of the of the main arguments for and against three philosophical views that hold that conscious minds, or their fundamental building blocks, are pervasive features of the cosmos. The first is *panpsychism*, which is the doctrine that at least some of the most basic elements that make up the natural world have minds or mind-like qualities. The second is *panprotopsychism*, which is the doctrine that fundamental physical entities, while not themselves minded, have unknown underlying natures that give rise to conscious minds when they are arranged into a sufficiently complex physical system. The third is *neutral monism*, which is the doctrine that both minds and matter are constructed from more basic elements of reality that are, in themselves, neither mental nor physical.

Like physicalism and functionalism, each of these views offers, in varying degrees, a simple and elegant picture of where consciousness fits into the physical universe and its (seemingly) all-encompassing causal order. All three accomplish this by embracing the view that physical theories provide only an abstract and mathematical description of the causal and spatiotemporal structure of the universe and leave us ignorant of its true underlying nature. Still, if this interpretation of the physical theories is correct, then each of these views is fully compatible with everything the physical sciences have to tell us about the cosmos.

At the same time, panpsychism, panprotopsychism, and neutral monism offer many of the attractions of dualism. They each can happily accept that the abstract and structural scientific descriptions of a sentient creature's biology, history, functioning, or relations to its environment cannot by themselves provide us with knowledge of the experiential dimensions of the creature's mental life. This is because such descriptions leave out the underlying nature of physical reality, which, under the right conditions, results in the rich conscious experiences of complex creatures like us. Similarly, each view can accept that we can coherently imagine beings physically and functionally just like us whose conscious mental lives differ from ours and vice versa, because when we conceive of physical reality, we do so entirely in terms of its abstract structural features and not in terms of its underlying nature. Still, they can insist, if we were in a position to fully grasp this hidden nature, we would not be able to coherently imagine our conscious mental lives coming apart from it in either of these ways.

As we have seen, however, each of these views has its own strengths and weaknesses. Panpsychism gets its strongest support from its simplicity, its rejection of mysterious aspects of reality, the high degree of continuity we observe in the natural world, and the intuition

that the emergence of consciousness from wholly insentient materials would be a miraculous and inexplicable “jump” in nature. However, each of these arguments is controversial, and many still see panpsychism as overly extravagant and radically counterintuitive. Panprotopsychism shares many of the virtues of panpsychism but accords much better with our commonsense view that conscious minds are a relatively rare occurrence in the history of the universe. However, one significant cost of panprotopsychism is that it commits us to the view that physical entities have hidden natures that may differ in unimaginable ways from how we experience them as being. The main promise of neutral monism is that it will dissolve the troublesome distinction of “mind” and “matter” and provide a unified subject matter for psychology and the natural sciences. It is hard to make sense, however, of the idea of a neutral stuff that is neither mental nor physical but that somehow gives rise to both. Indeed, the greatest challenge for all three of these views is the combination problem. As things stand, we have no clear idea of how any basic conscious elements, unknown insentient qualities, or intrinsically neutral elements could combine to yield complex but unified mental lives like ours, with rich subjective and experiential dimensions. So while these views are (arguably) exciting and fertile grounds for investigating consciousness and its place in the natural world, many will continue to view them as overly speculative and perhaps even fanciful unless and until they can make real progress on the combination problem.

Bibliography

- Alter, Torin, and Robert J. Howell. *A Dialogue on Consciousness*. Oxford: Oxford University Press, 2009.
- Alter, Torin, and Yujin Nagasawa. *Consciousness in the Physical World: Perspectives on Russellian Monism*. Oxford: Oxford University Press, 2015.
- Azzopardi, Paul, and Howard S. Hock. “Illusory Motion Perception in Blindsight.” *Proceedings of the National Academy of Sciences of the United States of America* 108, no. 2 (2011): 876–881.
- Banks, Erik C. *The Realistic Empiricism of Mach, James, and Russell: Neutral Monism Reconceived*. Cambridge: Cambridge University Press, 2014.
- Bekoff, Marc. *The Emotional Lives of Animals: A Leading Scientist Explores Animal Joy, Sorrow, and Empathy—and Why They Matter*. Novato, CA: New World Library, 2007.
- Brüntrup, Godehard, and Ludwig Jaskolla, eds. *Panpsychism: Contemporary Perspectives*. Oxford: Oxford University Press, 2016.
- Chalmers, David J. *The Character of Consciousness*. Oxford: Oxford University Press, 2010.
- Chalmers, David J. “The Combination Problem for Panpsychism.” In *Panpsychism: Contemporary Perspectives*, edited by Godehard Brüntrup and Ludwig Jaskolla. Oxford: Oxford University Press, 2016.
- Chalmers, David J. *The Conscious Mind: In Search of a Fundamental Theory*. Oxford: Oxford University Press, 1996.
- Chalmers, David J. “Panpsychism and Panprotopsychism.” In *Consciousness in the Physical World: Perspectives on Russellian Monism*, edited by Torin Alter and Yujin Nagasawa, 246–276. Oxford: Oxford University Press, 2015.
- Chamovitz, Daniel. *What a Plant Knows: A Field Guide to the Senses*. New York: Scientific American/Farrar, Straus, and Giroux, 2012.
- Chatton, Walter. *Reportatio super sententias*, Vols. 1–4. Toronto: Pontifical Institute of Mediaeval Studies, 2002, 2004, 2005. First published 1321–1323.
- Clifford, William. “Body and Mind.” In *Lectures and Essays*, edited by Leslie Stephen and Frederick Pollock. London: Macmillan, 1886. First published 1874.
- Coleman, Sam. “Panpsychism and Neutral Monism: How to Make Up One’s Mind.” In *Panpsychism: Contemporary Perspectives*, edited by Godehard Brüntrup and Ludwig Jaskolla. Oxford: Oxford University Press, 2016.
- Eddington, Arthur. *The Nature of the Physical World*. Cambridge: Cambridge University Press, 2012. First published 1928.
- Einstein, Albert, and Leopold Infeld. *The Evolution of Physics*. New York: Simon and Schuster, 1938.

- England, Jeremy L. "Statistical Physics of Self-Replication." *Journal of Chemical Physics* 139, no. 12 (1993): 7233–7243.
- Feigl, Herbert. *The "Mental" and the "Physical": The Essay and a Postscript*. Minneapolis: University of Minnesota Press, 1967.
- Feigl, Herbert. "Russell and Schlick: A Remarkable Agreement on a Monistic Solution of the Mind-Body Problem." *Erkenntnis* 9, no. 1 (1975): 11–34.
- Gertler, Brie. *Self-Knowledge*. New York: Routledge, 2011.
- Ginsburg, Simona, and Eva Jablonka. "The Transition to Experiencing: I. Limited Learning and Limited Experiencing." *Biological Theory* 2, no. 3 (2007): 218–230.
- Ginsburg, Simona, and Eva Jablonka. "The Transition to Experiencing: II. The Evolution of Associative Learning Based on Feelings." *Biological Theory* 2, no. 3 (2007): 231–243.
- Goff, Philip. "Experiences Don't Sum." In *Consciousness and Its Place in Nature*, edited by Anthony Freeman, 53–61. Exeter, UK: Imprint Academic, 2006.
- Goff, Philip. "The Phenomenal Bonding Solution to the Combination Problem." In *Panpsychism: Contemporary Perspectives*, edited by Godehard Brüntrup and Ludwig Jaskolla. Oxford: Oxford University Press, 2016.
- Hawking, Stephen. *A Brief History of Time*. New York: Bantam Dell, 1988.
- James, William. *The Principles of Psychology*, Vol. 1. New York: Dover, 1950. First published 1890.
- Kant, Immanuel. *Critique of Pure Reason*, translated and edited by Paul Guyer and Allen W. Wood. Cambridge: Cambridge University Press, 1998. First published 1781.
- Koch, Christof. "Is Consciousness Universal?" *Scientific American Mind* 25, no. 1 (2014).
- Landini, Gregory. *Russell*. New York: Routledge, 2011.
- Lockwood, Michael. "The Grain Problem." In *Objections to Physicalism*, edited by Howard Robinson, 271–291. Oxford: Clarendon Press, 1993.
- Lockwood, Michael. *Mind, Brain, and Quantum: The Compound "I"*. Oxford: Oxford University Press, 1989.
- Mach, Ernst. *The Analysis of Sensations and the Relation of the Physical to the Psychological*, translated by C. M. Williams. London: Open Court Publishing, 1914. First published 1886.
- Margulis, Lynn. "The Conscious Cell." *Annals of the New York Academy of Sciences* 929 (2001): 55–70.
- Maxwell, Grover. "Rigid Designators and Mind-Brain Identity." In *Perception and Cognition: Issues in the Foundations of Psychology*, edited by Wade C. Savage, 265–404. Minneapolis: University of Minnesota Press, 1978.
- Morell, Virginia. *Animal Wise: The Thoughts and Emotions of Our Fellow Creatures*. New York: Crown, 2013.
- Muir, John. *A Thousand-Mile Walk to the Gulf*. New York: Houghton Mifflin, 1916.
- Nagel, Alexandra H. M. "Are Plants Conscious?" *Journal of Consciousness Studies* 4, no. 3 (1997): 215–230.
- Ney, Alyssa. "A Physicalist Critique of Russellian Monism." In *Consciousness in the Physical World: Perspectives on Russellian Monism*, edited by Torin Alter and Yujin Nagasawa, 346–366. Oxford: Oxford University Press, 2015.
- Russell, Bertrand. *The Analysis of Matter*. London: George Allen and Unwin, 1927.
- Russell, Bertrand. *The Analysis of Mind*. London: George Allen and Unwin, 1921.
- Russell, Bertrand. *Human Knowledge: Its Scope and Limits*. London: Routledge, 1948.
- Russell, Bertrand. *Religion and Science*. Oxford: Oxford University Press, 1997. First published 1935.
- Seager, William. "Panpsychism, Aggregation and Combinatorial Infusion." *Mind and Matter* 8, no. 2 (2010): 167–184.
- Shani, Itay. "Mind Stuffed with Red Herrings: Why William James' Critique of the Mind-Stuff Theory Does Not Substantiate a Combination Problem for Panpsychism." *Acta Analytica* 25, no. 4 (2010): 413–434.
- Skrbina, David, ed. *Mind That Abides: Panpsychism in the New Millennium*. Amsterdam: John Benjamins, 2009.
- Skrbina, David. *Panpsychism in the West*. Cambridge, MA: MIT Press, 2007.
- Stoljar, Daniel. "Two Conception of the Physical." *Philosophy and Phenomenological Research* 62, no. 2 (2001): 253–281.
- Strawson, Galen. *Mental Reality*. Cambridge, MA: MIT Press, 1994.
- Strawson, Galen. "Mind and Being: The Primacy of Panpsychism." In *Panpsychism: Contemporary Perspectives*, edited by Godehard Brüntrup and Ludwig Jaskolla. Oxford: Oxford University Press, 2016.
- Strawson, Galen. "Realistic Monism: Why Physicalism Entails Panpsychism." In *Consciousness and Its Place in Nature*, edited by Anthony Freeman, 3–31. Exeter, UK: Imprint Academic, 2006.
- Stubenberg, Leopold. "Russell, Russellian Monism, and Panpsychism." In *Consciousness in the Physical World: Perspectives on Russellian Monism*, edited by Torin Alter and Yujin Nagasawa, 58–90. Oxford: Oxford University Press, 2015.

Chapter 3: Panpsychism, Panprotopsychism, and Neutral Monism

Tononi, Giulio. "The Information Integration Theory of Consciousness." In *The Blackwell Companion to Consciousness*, edited by Max Velmans and Susan Schneider, 287–299. Oxford: Blackwell, 2007.

Weiskrantz, Lawrence. "The Case of Blindsight." In *The Blackwell Companion to Consciousness*, edited by Max Velmans and Susan Schneider, 175–180. Oxford: Blackwell, 2007.

Wishon, Donovan. "Russell on Russellian Monism." In *Consciousness in the Physical World: Perspectives on Russellian Monism*, edited by Torin Alter and Yujin Nagasawa, 91–118. Oxford: Oxford University Press, 2015.

Zeki, Semir. "A Theory of Micro-Consciousness." In *The Blackwell Companion to Consciousness*, edited by Max Velmans and Susan Schneider, 580–588. Oxford: Blackwell, 2007.

WEBSITES AND OTHER ONLINE RESOURCES

Allen, Colin, and Michael Trestman. "Animal Consciousness." In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta. Summer 2015. <http://plato.stanford.edu/archives/sum2015/entries/consciousness-animal/>.

"Black Holes." NASA Science. 2016. <http://science.nasa.gov/astrophysics/focus-areas/black-holes/>.

Chalmers, David J. "How Do You Explain Consciousness?" TED Talks. 2014. https://www.ted.com/talks/david_chalmers_how_do_you_explain_consciousness.

Seager, William, and Sean Allen-Hermanson. "Panpsychism." In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta. Fall 2015. <http://plato.stanford.edu/archives/fall2015/entries/panpsychism/>.

Skrbina, David. "Panpsychism." *Internet Encyclopedia of Philosophy*. <http://www.iep.utm.edu/panpsych/>.

Stubenberg, Leopold. "Neutral Monism." In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta. Fall 2014. <http://plato.stanford.edu/archives/fall2014/entries/neutral-monism/>.

GRAPHIC NOVELS AND FICTION

Doxiadis, Apostolos, and Christos H. Papadimitriou. *Logicomix: An Epic Search for Truth*. New York: Bloomsbury, 2009. A graphic novel about Bertrand Russell's early life and work.

Pullman, Philip. *His Dark Materials*. New York: Knopf, 2007. A trilogy of novels about a fictional universe in which "dust," a conscious elementary particle, plays a central role.

FILM

Avatar. Dir. James Cameron. 2009. A major motion picture that hints at the consciousness of the natural world.

The Golden Compass. Dir. Chris Weitz. 2007. A major motion picture adaptation of the first novel of Philip Pullman's *His Dark Materials* series, featuring the mysterious conscious particle called "dust."

What the Bleep Do We Know? Dir. William Arntz, Betsy Chasse, and Mark Vicente. 2004. A New Age documentary featuring scientists and philosophers (many of whom do not endorse the central thesis of the movie) as they explore the possible connections between consciousness, quantum physics, and matter.