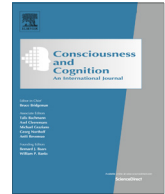




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Review article

The *nature* of primary consciousness. A new synthesis

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ABSTRACT

While the philosophical puzzles about “life” that once confounded biology have all been solved by science, much of the “mystery of consciousness” remains unsolved due to multiple “explanatory gaps” between the brain and conscious experience. One reason for this impasse is that diverse brain architectures both within and across species can create consciousness, thus making any single neurobiological feature insufficient to explain it. We propose instead that an array of general biological features that are found in all living things, combined with a suite of special neurobiological features unique to animals with consciousness, evolved to create subjective experience. Combining philosophical, neurobiological and evolutionary approaches to consciousness, we review our theory of neurobiological naturalism that we argue closes the “explanatory gaps” between the brain and subjective experience and naturalizes the “experiential gaps” between subjectivity and third-person observation of the brain.

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1. Introduction: What makes consciousness unique? The explanatory gap, the hard problem, and neurobiological naturalism

In his book *What Makes Biology Unique?* evolutionary biologist Ernst Mayr (2004) argues that while modern biology has disproved theories of *vitalism* – the idea that living organisms are animated by virtue of some fundamental force (*vis vitalis*) – nonetheless life is characterized by principles and functions that are in fact unique to biology among the sciences. Mayr cites among these unique features the great complexity of living systems, the refractoriness of biological systems to purely reductive approaches, the rampant emergence of novel features in biological systems, and the evolution of teleonomic (goal-directed) processes.

However, despite life's special and unique features, all its processes are explainable by natural principles: the heart is a pump; digestion is the physical and enzymatic breakdown of food; quadriplegia results from interrupted neural transmission through the upper spinal cord; ecosystems arise from the interactions of populations of living organisms with each other and the physical environment. The scientific basis life is not a conceptual mystery (Fry, 2000; Ginsburg & Jablonka, 2015). Mayr concludes that while a full understanding of biology does not require the positing of novel physical forces beyond those already known to physics, it does require an analysis of natural features and principles that are *unique* to biological systems.

Mayr's view is now the accepted dogma in biology. But when it comes to consciousness studies, many scholars from different disciplines have proposed that there is something fundamentally “different” about the biology of consciousness when compared to other biological phenomena (Chalmers, 2010; Koch, 2012; Schrödinger, 1967; Sperry, 1977). These scientists and philosophers agree with Mayr that while biology in general and the non-conscious brain functions can in fact be wholly explained by the known laws of physics and chemistry, consciousness presents a mysterious “explanatory gap” (Levine, 1983) between the physical properties of the brain and the subjective experiences that the brain thereby creates. They claim that whenever one attempts to explain subjective experience in terms of physics, chemistry or even neurobiology, there is always something “left out” of the equation, and something more is needed beyond the unique biological principles enumerated by Mayr. David Chalmers (1995) relates the explanatory gap to the “hard problem of consciousness”, which is the problem of how and why conscious experiences exist. John Searle traces the gap to the mutual irreducibility of subjective and objective points of view.

... consciousness has a first-person or subjective ontology and so cannot be reduced to anything that has third-person or objective ontology. If you try to reduce or eliminate one in favor of the other you leave something out ... biological brains have a remarkable biological capacity to produce experiences, and these experiences only exist when they are felt by some human or animal agent. You can't reduce these first-person subjective experiences to third-person phenomena for the same reason that you can't reduce third-person phenomena to subjective experiences. You can neither reduce the neuron firings to the feelings nor the feelings to the neuron firings, because in each case you would leave out the objectivity or subjectivity that is in question.

[Searle, 1997, p. 212]

Most problematically, the discontinuity is such that it seems unbridgeable when compared to the seamless unification of biology with the physical sciences. The challenge for a science of consciousness is to bridge or close the gap with a natural explanation.

To address this problem, we have formulated a theory called *neurobiological naturalism*. It was inspired by the earlier theory of *biological naturalism*, which Searle (1984, 2007) presented as a philosophical solution to the mind-body or mind-brain problem. *Biological naturalism* stated that mental phenomena are strictly biological, “caused by neurophysiological processes in the brain and are themselves features of the brain.” While we agree with Searle that consciousness arises exclusively through biological principles, we felt that more must be said about the special nature of consciousness in the natural world, so we extended the theory to include the neurobiological features that only consciousness has (Feinberg, 2012; Feinberg & Mallatt, 2016a).

Our theory of neurobiological naturalism is based on three tenets. First, in using natural science to solve the mind-brain problem one must begin with the biological features described by Mayr and others. Second, while consciousness is built upon the features shared by all life, it also depends on additional special neurobiological features. Third, because consciousness is so complex and multifaceted, a complete theory of consciousness that closes the explanatory gaps must use multiple approaches that integrate philosophical, neurobiological, and evolutionary principles. By using these principles, a natural elucidation of consciousness, the subjective mind, and the hard problem is possible.

2. Multiple explanatory gaps exist, not one: the neuroontologically subjective features of consciousness

We focus on the most basic kind of consciousness rather than on higher kinds of awareness. That is, we seek the neurological basis and evolutionary origins of *phenomenal consciousness* (Revonsuo, 2006, 2010), which is also called *primary consciousness* (Edelman, 1989) or *subjectivity* (Feinberg, 2012; Metzinger, 2003; Nagel, 1989; Searle, 1992, 1997; Tye, 2000; Velmans, 2000). As defined by Revonsuo:

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