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EDITORIAL

The Möbius Mystery of Being: Are Life and Consciousness Entwined?

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Few questions have captivated modern science—and the human imagination—more than the riddle of 'consciousness'. Long confined to philosophy or speculative psychology, the domain of consciousness studies has now surged into mainstream inquiry, galvanizing neuroscientists, physicists, computer scientists, and philosophers alike. What was once dismissed as metaphysical musing is now a central puzzle in our quest to understand mind, matter, and meaning. From the allure of Chalmers' (1995, 2007) 'hard problem' (or "how does mindless matter produce matterless mind?"; Cunningham, 2024, p. 24), to the promises of brain-imaging technologies and artificial intelligence, consciousness has emerged as both a scientific frontier and an existential mirror (e.g., Wahbeh et al., 2022). It is not merely a problem of mechanism, but of identity—and its resolution may unlock not only new knowledge, but new ways of being.

At the same time, the equally profound, and arguably more elemental, mystery of 'life' itself has seemingly receded from the spotlight. In many academic circles, this question now lingers in the background—assumed, bracketed, or treated as a lesser problem—while inquiry rushes ahead to tackle the phenomenology and mechanisms of mind. This shift might nonetheless obscure the deeper foundation on which consciousness rests. *But have we been too eager to explore the mind without first understanding the conditions that make it possible?* Before there is awareness, there is organization, persistence, metabolism—there is life. And perhaps we have been too quick to assume that we understand it, much less its connection to consciousness. It could be argued that life and consciousness may not be separable mysteries but mutually implicating processes—co-arising, co-sustaining, and perhaps co-explanatory.

REVISITING FIRST PRINCIPLES

What is life? And what is consciousness? These are not merely adjacent problems within biology or cognitive science, but existential riddles that seem to underlie much of our inquiry into the nature, limits, and meaning of reality itself. Each question has been declared the 'greatest mystery' by thinkers across traditions, and each currently resists definitive explanation. Yet their relationship is not merely parallel. They might well be entangled: conceptually, empirically, and perhaps ontologically. The question we now face is whether one is more foundational than the other—and what such a distinction would even mean.

To evaluate whether consciousness is more fundamental, we must first consider its current scientific status. At first glance, the case for consciousness as the deeper mystery

is compelling. Consciousness is epistemically prior: it is the medium through which all questions—including that of life—are framed. We must be conscious to observe, reflect, and ask. Despite advances in mapping neural correlates (Dehaene et al., 2017), no empirical theory explains why brain states generate subjective experience. This explanatory gap persists despite advances in models like Integrated Information Theory (Tononi, 2008) and Global Workspace Theory (Baars, 1988/1990). The former posits that consciousness arises from the degree of integrated information within a system, emphasizing internal structure and causality. In contrast, the latter views consciousness as the result of information being broadcast across a network to enable coordinated access by various cognitive processes.

More recently, attempts to quantify consciousness via information-theoretic measures such as Φ (phi) have encountered both enthusiasm and skepticism. Critics distinguish between strong and weak interpretations of IIT (Mediano et al., 2022), while others advocate for pluralistic models that integrate various metrics—such as the perturbational complexity index, Lempel–Ziv compression, and multivariate mutual information (Seth & Bayne, 2022). These efforts underscore the provisional nature of current metrics and the theoretical humility needed when addressing the nature of awareness. Consciousness also may not exist in a vacuum, so we must also account for the biological context in which it emerges.

BEYOND THE GREAT DIVIDE

Could consciousness exist independently of life, or does it always emerge within living systems? As research advances on the mind's deepest mysteries, we risk neglecting the more fundamental question: what scaffolds experience itself? In particular, privileging consciousness risks overlooking the deeper ontological context from which it arises: life. Consciousness, as we currently observe it, arguably exists only within living systems. Several authors likewise contend that, evolutionarily speaking, 'life' precedes 'mind' by billions of years (e.g., Ginsburg & Jablonka, 2019; Godfrey-Smith, 2016; Lane, 2015; Maynard Smith & Szathmáry, 1995). The transition from non-life to life (i.e., abiogenesis) remains one of the most profound and unresolved issues in science. *How does inert matter become self-organizing, adaptive, and self-replicating? And what does it mean, philosophically or physically, for matter to cross that boundary into life?* Despite progress in prebiotic chemistry and synthetic biology, we have no definitive account of how 'life' begins (Szostak, 2012; Walker, 2017).

The thermodynamic perspective introduced by Schrödinger (1992), in which life is seen as a system that maintains order by feeding on negative entropy, remains one of the earliest and most influential attempts to frame this question in physical terms. Gonçalves (2024) has recently expanded this model with a physically principled definition of life centered not on structure but on dynamic behavior—specifically, the self-constrained dissipation of chemical disequilibria. Such approaches recast life as a dynamical system governed by constraint-generation, not merely a biochemical collection of parts.

Moreover, consciousness may be more entangled with life than is typically assumed. Mainstream biology holds that all known conscious entities are alive, yet many living organisms (e.g., bacteria, fungi) exhibit no signs of subjective awareness. This asymmetry hints at life as a necessary—but not sufficient—condition for consciousness. The evolutionary emergence of sentience from non-sentience remains deeply puzzling. Feinberg and Mallatt (2016) suggested that unified mental experience arose alongside complex centralized nervous systems roughly 500 million years ago. Godfrey-Smith (2020), in his *Metazoa* book, extended this view by emphasizing octopus cognition and decentralized intelligence as a challenge to cortex-centric or anthropocentric models.

UNFOLDING THE PATTERNS OF BEING

The thermodynamic reframing of life indeed opens new conceptual territory. By shifting the focus from biological substrates to energetic and informational dynamics, such accounts invite a deeper convergence between the puzzles of life and mind. Consciousness may be one expression of a broader class of systems that evolve through constraint-generation; systems that are not merely complex, but intrinsically self-modifying. This invites us to reconsider whether our deepest questions—about experience, agency, and existence—might find their roots not in neural networks alone, but in the thermodynamic logic of living systems.

Complementing this view is the enactivist framework, which holds that mind arises from the dynamic coupling between organism and environment. Rather than isolating awareness to an internal computational process, enactivism sees consciousness as co-emergent with autopoietic life processes, that is, systems capable of maintaining and

generating themselves. Thompson (2007) and Di Paolo et al. (2018) emphasized the centrality of sense-making and participatory agency in the emergence of mind. Maturana and Varela's (1980) notion of recursive self-production—autopoiesis—offers a compelling link between self-organizing life and the phenomenology of conscious selfhood. From this vantage, life and consciousness are not separate layers but entwined in a mutually specifying loop.

Even more provocative are findings at the edge of life and death. Studies of near-death experiences (NDEs) certainly challenge simplistic life–consciousness linkages. For instance, Parnia et al. (2022) have documented structured brain activity, including gamma bursts, during cardiac arrest—suggesting that some form of awareness may persist beyond clinical death. Indeed, NDEs often occur during severely compromised brain activity states (Kelly et al., 2007; Parnia et al., 2023) that cannot readily account for the vivid, realistic, and veridical perceptions reported. These patterns invite critical examination of reductionist neural explanations and perhaps lend credence to dualistic or nonlocal models of consciousness (e.g., Baker-Hytch, 2025; Barušs, 2023; Greyson, 2000; Weiler & Acunzo, 2024), At the very least, such findings imply that there are blurred lines between biological viability and conscious presence, adding urgency to the life–mind question.

Quantum biology also enters the debate. Hameroff and Penrose's (2014) Orch OR theory controversially posited that consciousness arises from quantum coherence within neuronal microtubules. Though heavily debated, this view is buoyed by evidence of coherence in other biological systems, such as photosynthesis (Lambert et al., 2013) and microtubular resonance (Craddock et al., 2017). These findings suggest that biology may exploit quantum-classical dynamics in ways that potentially support moments of conscious awareness, thus complicating traditional physicalist models.

This question also takes on added significance in the era of astrobiology. If life arises from universal physical or informational principles, might radically different biochemistries—silicon-based life, cryogenic extremophiles, or even plasma-based cognition—be possible elsewhere in the cosmos? As we seek biosignatures and technosignatures beyond Earth, we may soon confront not just new forms of life, but perhaps new forms of awareness—ones that strain or shatter our current frameworks (e.g., Cleland & Chyba, 2002; Davies, 2019).

What might it mean to encounter a consciousness radically unlike our own? Could we even recognize it? The boundaries between living and non-living, conscious and unconscious, may be further blurred by the emergence of synthetic intelligences (e.g., Dennett, 2017). *Could a machine that maintains and evolves its internal constraints—akin to Gonçalves's (2024) 'self-constrained dissipative systems'—qualify as alive?* If so, might such systems eventually support consciousness, not as an imitation, but as a parallel instantiation?

Still, some theories invert this logic entirely. Panpsychism (i.e., the idea that everything in the universe—even tiny particles—has some form of consciousness or awareness) and cosmopsychism (i.e., the notion that the entire universe is one big conscious mind, and our individual minds are like small parts of that cosmic mind) contend that consciousness does not emerge from life—but precedes it (e.g., Goff, 2019). Hunt and Schooler (2019) provided formal models of panpsychism, in which consciousness is a fundamental feature of all matter. Spira (2017) went further, suggesting that the cosmos itself may be a unified conscious entity—a highly provocative view that challenges the assumption that mind arises only from life. These perspectives compel us to consider a distributed, embedded ontology of awareness—where consciousness permeates, rather than emerges.

ONE ENIGMA, TWO FACES

Ultimately, we are left with a deceptively simple question: which mystery runs deeper—life or consciousness? The answer may seem to hinge on one's philosophical vantage. If we ask what renders meaning, perception, and inquiry possible, then consciousness appears fundamental—the very medium of all knowing. But if we ask what gives rise to organization, complexity, and the conditions from which consciousness arises, then life asserts its primacy. Yet this framing may obscure more than it reveals. Rather than ranking these enigmas, we must ask whether they are truly separable at all. *Are we confronting two distinct mysteries—or circling a single, recursive truth still waiting to be fully seen?*

In the end, life and consciousness may not be separate riddles at all, but one bifurcated enigma—an ontological Möbius strip where mind and matter, process and presence, exterior and interior endlessly loop into one another. To untangle one without the other may not simply be difficult; it could be a category error. These are not just scientific puzzles; they are the twin thresholds of understanding, each casting light on the other, each inviting us to rethink what it means to exist.

If we are to take the next leap in understanding, it will not be through narrower theories but through a bolder imagination and broader vision—potentially a framework that dares to unite life and mind, biology and phenomenology, matter and meaning. The task is not only about explaining a mystery, but also about recognizing that we are already inside it. And if we look closely, we may find that the universe is not merely something we observe but something that is also, in some unfathomable way, observing us back.

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