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Biophysics and Consciousness: Between Determinism, Probability, and Understanding Unconscious Brain Activity

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الملخص: تستكشف هذه الورقة البحثية العلاقة المعقدة بين القوانين الفيزيائية والظواهر البيولوجية، مُدمجةً فهم نشاط الدماغ اللاواعي ضمن إطار احتمالي باستخدام التصوير بالرنين المغناطيسي الوظيفي (FMRI) والذكاء الاصطناعي (AI). يتمحور السؤال الرئيسي حول ما إذا كانت العمليات الحيوية والأنشطة العقلية تخضع لنفس الفرضيات الدقيقة التي تخضع لها المادة الجامدة، أم أن هناك فواصل نوعية وأحداثًا احتمالية تُحدد الحياة والوعي. تبدأ المناقشة بأمثلة فيزيائية دقيقة، تشمل تبديد الشحنة، والتأثير الكهروضوئي، وتوليد الأشعة السينية، مُسلطةً الضوء على أن الأحداث المجهرية النادرة يُمكن أن تُشكل أسسًا فيزيائية رئيسية. ثم تتوسع الورقة لتشمل العمليات البيولوجية، مثل نشاط البروتوبلازم، وانقسام الخلايا، والوراثة، مُؤكدةً أن الفرق الجوهري بين الأنظمة الحية وغير الحية يكمن في الفواصل والاحتمالات التي تسمح بظهور سلوكيات جديدة لا يُمكن اختزالها إلى قوانين متصلة فقط. علاوة على ذلك، يُظهر نشاط الدماغ اللاواعي خصائص احتمالية مماثلة، يمكن تحليلها والتنبؤ بها باستخدام التصوير بالرنين المغناطيسي الوظيفي ونماذج الذكاء الاصطناعي (Demertzi *et al.*, 2011; Laureys *et al.*, 2004).

الكلمات المفتاحية: الفيزياء الحيوية - الحتمية - الاحتمالية - الانقطاعات - أصل الحياة - الديناميكا الحرارية - الإرادة الحرة - المادة غير الحية - العقل اللاواعي - التصوير بالرنين المغناطيسي الوظيفي - الذكاء الاصطناعي.

Abstract: This paper explores the complex relationship between physical laws and biological phenomena, integrating the understanding of unconscious brain activity within a probabilistic framework using functional Magnetic Resonance Imaging (FMRI) and Artificial Intelligence (AI). The central question is whether living processes and mental activities are governed by the same precise hypotheses as inanimate matter, or if there exist qualitative discontinuities and probabilistic events that define life and consciousness. The discussion begins with precise physical examples, including charge dissipation, the photoelectric effect, and X-ray generation, highlighting that rare microscopic events can constitute major physical foundations. The paper then extends to biological processes, such as protoplasmic activity, cellular division, and inheritance, emphasizing that the critical difference between living and non-living systems lies in discontinuities and probabilities that allow the emergence of new behaviors not reducible to continuous laws alone. Furthermore, unconscious brain activity exhibits similar probabilistic characteristics, which can be analyzed and predicted using fMRI and AI models (Demertzi *et al.*, 2011; Laureys *et al.*, 2004).

Keywords: Biophysics – Determinism – Probability – Discontinuities – Origin of Life – Thermodynamics – Free Will – Non-living Matter – Unconscious Mind – Functional MRI – Artificial Intelligence.

I. INTRODUCTION

Since the emergence of modern physics, scientific laws have relied on determinism: knowing a system's initial state allows for precise prediction of its future. However, twentieth-century developments, especially in quantum theory and statistical thermodynamics, introduced probability as an intrinsic component of physics. This shift is particularly significant in studying biological

phenomena. While biological processes adhere to physical laws, they exhibit qualitative differences from inanimate matter. The central question arises: is life and consciousness a mere extension of the same laws, or do qualitative "discontinuities" exist that define living systems and mental processes? Recent research using fMRI and AI indicates that unconscious brain activity exhibits probabilistic patterns, reinforcing the importance of incorporating uncertainty and variability into our models of life and cognition (Schiff *et al*., 2007; Monti *et al.*, 2010).

II. DISCUSSIONS

Classical physics traditionally assumed that any unexpected change in the motion of objects would be regarded as a "miracle," thereby violating determinism. However, phenomena such as electrons spontaneously gaining or losing energy, or shifting their trajectories without apparent causes, reveal that probability constitutes a fundamental aspect of nature. A parallel is evident in unconscious mental processes, where unpredictable variations in brain activity emerge independently of prior brain states, as demonstrated in fMRI studies of emotional and cognitive responses (Demertzi *et al.*, 2011; Monti *et al*., 2010). Rare occurrences, whether in physics or neuroscience, often serve as foundational: the sparse presence of ions in the air, the emission of electrons under light, or the rare formation of X-rays are cornerstones of modern physics, just as rare unconscious neural events—such as spontaneous creative insights or unexpected emotional reactions—prove pivotal for higher-order mental functions.

These neural phenomena can now be quantified and analyzed through AI-based pattern recognition applied to fMRI data (Laureys et al., 2004; Owen *et al.*, 2006). Likewise, the notion of discontinuity is central to both biology and cognition. Cellular division, inheritance, and voluntary behavior are not merely predictable from prior states but instead follow multiple probabilistic pathways.
Unconscious neural activation in specific regions may thus generate cognitive or behavioral discontinuities that lead to unforeseen outcomes, which cannot be accounted for solely by sensory inputs (Demertzi *et al.*, 2011; Monti *et al*., 2010; Schiff *et al.*, 2007).

This understanding extends to questions of free will and intentionality, where voluntary actions and decisions transcend purely physical or biochemical chains of causation. Even though neural signaling can be traced, the spontaneity of thought and intention remains irreducible. Incorporating probabilistic frameworks with the study of unconscious brain activity through fMRI and AI enables a deeper capacity to model and anticipate these emergent processes (Laureys *et al.*, 2004; Monti *et al*., 2010).

Modern physics, from thermodynamics to quantum theory, confirms that probability is not a temporary approximation but a structurally fundamental principle. In the same way, biological mechanisms and unconscious mental dynamics can be interpreted as organized probabilistic outcomes shaped by both Internal physico-chemical states and external influences. Within this probabilistic paradigm, certain cognitive and psychological phenomena—such as psychophysiological healing—may plausibly exert influence on biological pathways (Laureys *et al.*, 2004; Monti *et al*., 2010; Schiff *et al.*, 2007).

CONCLUSIONS

Life and consciousness are not violations of physical laws but rather manifestations of inherent probabilistic properties and discontinuities. The fundamental distinction between living and non-living systems lies in structural arrangements and probabilistic patterns that enable the emergence of novel behaviors and distinct mental processes. Thus, incorporating probability into biophysics and the analysis of unconscious brain activity is essential for understanding cognition, inheritance, and cellular division. In contrast, excessive materialist reductionism may overlook genuine possibilities already

recognized by modern physics and neuroscience. Studying life and consciousness from a physical perspective cannot rely solely on classical determinism, since biological and mental phenomena are characterized by discontinuities and probabilistic behaviors that set them apart from non-living matter.

Therefore, integrating probabilistic frameworks and philosophical considerations, together with analyzing unconscious brain activity through functional MRI and artificial intelligence, is crucial for grasping the essence of life, will, and cognition. Life and consciousness are not mere "exceptions" to physical laws but extensions of these laws at higher levels of complexity, where physics, biology, neuroscience, and philosophy converge in a unified understanding of nature.

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