

PRIMARY CONSCIOUSNESS

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Primary Consciousness

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1. Core Definition

Primary consciousness, as conceptualized by Nobel laureate and neurobiologist Gerald Edelman, refers to the fundamental level of awareness shared by humans and certain higher animals. It is defined specifically as the ability to construct a mental scene in the present moment by integrating ongoing sensory observations with immediate, non-verbal memory. This integration allows an organism to relate its current sensory input to events that occurred in the recent past, establishing a rudimentary form of continuous experience often termed the "remembered present." This state does not require language or complex symbolic reasoning; rather, it is purely perceptual and affective.

This level of consciousness is responsible for the feeling of instant recognition, such as the ability to perceive a pattern, track movement, or immediately recognize a familiar environment--a cognitive process encapsulated by the simple internal statement, "I've seen this before." It constitutes the organism's capacity to form initial, time-bound conscious constructs that are highly dependent on immediate bodily interactions with the environment. Critically, primary consciousness lacks the capacity for self-reflection, linguistic reference, or the construction of an explicit personal history extending far into the past or future.

Edelman positioned primary consciousness as the necessary evolutionary precursor to the more advanced state of **higher-order consciousness**. It provides the essential, unified perceptual field--a basic awareness of the world and the body within it--upon which more complex cognitive functions, such as symbolic thought, language, and metacognition, are built. Without this initial integration of perception and memory, a stable, coherent sense of the immediate environment, vital for survival behaviors, would be impossible. The mechanisms underpinning this state are deeply rooted in the functional architecture of the brain, specifically involving the dynamic interplay between the thalamus and the cortex.

2. Etymology and Historical Development

The concept of **primary consciousness** was first introduced by Gerald Edelman in the late 1980s and early 1990s as part of his comprehensive theoretical framework concerning brain function, known as the Theory of Neuronal Group Selection (TNGS), or Neural Darwinism. Edelman, originally an immunologist who won the Nobel Prize for his work on antibody structure, applied evolutionary principles--selection, variation, and retention--to the development and function of the central nervous system. He argued that consciousness is not generated by a central computational

program but emerges from the large-scale, dynamic interactions of specialized neuronal populations.

TNGS posits that during development and experience, neuronal groups compete and cooperate, leading to the selection and strengthening of those groups whose activity patterns successfully map the sensory and motor world. Primary consciousness arises when the brain integrates the activity of these established sensory maps with memory systems (particularly those related to the hippocampus and surrounding cortices). This integration required Edelman to introduce a distinction between two types of consciousness to adequately explain the evolutionary step from basic awareness to human self-awareness.

The formalization of primary consciousness was instrumental in providing a neurobiological basis for awareness that could be tested and modeled, moving the study of consciousness away from purely philosophical speculation toward empirical neuroscience. Edelman's later collaboration with physicist Giulio Tononi further developed these ideas, leading to the **Dynamic Core Hypothesis (DCH)**, which identifies the physical substrate of consciousness as a highly integrated and differentiated subset of thalamocortical neurons. This historical trajectory established primary consciousness as a key milestone in cognitive evolution, marking the point at which an organism can utilize its learned past to inform its immediate actions.

3. Key Characteristics and Mechanisms

Primary consciousness possesses several defining characteristics rooted in its neural mechanisms. The most important characteristic is the formation of a unified **perceptual scene**. Although sensory inputs (sight, sound, touch) are processed by separate areas of the brain, primary consciousness requires the simultaneous binding of these inputs into a single, cohesive experience of the external world. This binding mechanism is hypothesized to occur through synchronous neural activity across disparate cortical regions.

The core functional mechanism enabling primary consciousness is **reentry**, or reentrant signaling. Reentry involves the ongoing, parallel, and reciprocal exchange of signals between anatomically segregated brain regions, particularly those linking the posterior sensory and association areas with the memory structures of the limbic system. This constant, dynamic communication allows the present sensory data to be immediately and effectively cross-referenced with recent memories. Without this rapid, parallel feedback loop, the continuity of experience would break down, and the organism would be reduced to reacting only to discrete, disconnected sensory stimuli.

Furthermore, primary consciousness is characterized by its **present-centered temporality**. The memories utilized in this state are not explicit, autobiographical recollections; rather, they are short-term, associative, and non-symbolic. This cognitive mechanism ensures that the organism is immediately aware of changes in its environment and can rapidly initiate appropriate survival

responses, such as identifying a predator or locating a food source based on recent memory cues. It is a necessary functional state for complex, learned behavior that transcends simple reflexes but does not yet involve abstract planning or self-referential thought.

4. The Neural Substrate: Primary Consciousness and the Dynamic Core

The neuroanatomical basis for **primary consciousness**, according to Edelman and Tononi's work, is largely confined to the posterior cortical areas and the thalamus, forming what they termed the **Dynamic Core**. The Dynamic Core refers to a large cluster of neural circuits, mainly within the thalamocortical system, that achieves momentary high integration (interconnectivity) and high differentiation (a large repertoire of distinct functional states). This dynamic interplay is what gives rise to conscious experience.

The brain regions crucial for this foundational awareness include the sensory cortices, the parietal and temporal association areas, and key subcortical structures like the hippocampus and amygdala, which mediate short-term memory and affective responses, respectively. The intense, rapid, and recurrent signaling within this core allows for the integration of multiple sensory modalities with value-laden memories, generating a comprehensive, feeling-toned "now." Damage to critical parts of the Dynamic Core often results in profound deficits in awareness, ranging from sensory loss to global unconsciousness.

The functional integrity of the Dynamic Core is what distinguishes a conscious state (primary consciousness) from a non-conscious state (such as deep sleep or a coma). While the entire brain is active, only those neural circuits participating in the highly differentiated and integrated activity of the core contribute directly to conscious experience at that moment. This focus on global, integrated processing, enabled by reentrant circuits, provides a concrete biological mechanism for explaining how scattered electrical signals transform into a unified, phenomenal experience of the immediate world.

5. Primary Consciousness Versus Higher-Order Consciousness

A central component of Edelman's theory is the sharp distinction drawn between **primary consciousness** and **higher-order consciousness (HOC)**. While primary consciousness is rooted in the immediate perceptual world and the non-linguistic "remembered present," HOC is defined by the incorporation of language, semantics, and symbolic thought.

Key differences include:

Temporal Scope: Primary consciousness is restricted to the near past and immediate present, offering no capacity for complex prediction or long-range planning. HOC, by contrast, relies on symbolic systems (like language) to construct elaborate models of the self across extended

timelines, enabling planning for the distant future and explicit recollection of the distant past.

Self-Awareness: Primary consciousness generates simple awareness of the environment but lacks explicit self-reflection. An animal in this state knows it is perceiving, but likely does not contemplate its own existence or mental state. HOC, involving reflective thought and access to autobiographical memory, allows for the emergence of the explicit "self" and metacognition (thinking about thinking).

Neural Basis: While primary consciousness relies heavily on posterior cortical areas and the limbic system, HOC requires the extensive involvement of the frontal and prefrontal cortices, the areas responsible for executive function, planning, and language processing. The development of HOC is strongly linked to the evolution of complex neural circuits connecting these frontal regions with the primary Dynamic Core.

The shift from primary to higher-order consciousness is considered an evolutionary leap, unique (or far more developed) in humans. HOC allows for culture, science, law, and morality, enabling human societies to transcend the immediate ecological limitations that constrain organisms possessing only primary consciousness.

6. Significance and Impact in Neurobiology

The introduction of the term **primary consciousness** and its detailed neurobiological modeling profoundly impacted the scientific study of consciousness. Prior to Edelman's work, many approaches were either highly computational (viewing the brain as a computer) or purely philosophical. Edelman provided a robust, biologically grounded framework that accounted for the subjective nature of experience while adhering to evolutionary principles.

The concept legitimized the comparative study of consciousness by providing a theoretically defined state that could be attributed to non-human species. By defining primary consciousness as an awareness based solely on perceptual integration and memory, researchers gained a tool to analyze the cognitive abilities of various animals, allowing for nuanced differentiation between basic sentience and complex, human-like self-awareness. It provided a metric for understanding where complex cognitive abilities, such as theory of mind or linguistic communication, begin to emerge.

Furthermore, Edelman's emphasis on neuronal selection and reentrant signaling provided powerful alternatives to traditional, localizationist models of brain function. The theory suggests that consciousness is not located in a single spot but is an emergent property of massive, distributed, and highly interactive neural networks. This perspective has been crucial in developing modern neuroimaging and computational models that seek to measure integration and differentiation in brain activity, supporting the fundamental idea that consciousness is a dynamic, process-based phenomenon rather than a fixed structure.

7. Further Reading

[Gerald Edelman - Wikipedia](#)

[Edelman, G. M. \(1992\). Bright Air, Brilliant Fire: On the Matter of the Mind. Basic Books.](#)

[Edelman, G. M., & Tononi, G. \(2000\). A universe of consciousness: How matter becomes imagination. Basic Books.](#)

[Stanford Encyclopedia of Philosophy: Consciousness](#)

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