Letter to Editor

What Enables Our Brain to Dream? A Bio-Cybernetics View

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There are several lines of evidence that human dreams depend on the brain's properties in terms of dream structure and its meaning alike (1). The human brain has specific features such as self-organization, memory, self-adaptation, feedback, disorder and diversity, non-equilibrium, etc., which enable the brain to create complex cognitive and behavioral functions the most interesting of which must be "dreaming" (2, 3). It can be inferred that the dreaming brain works with weakened volition, reduced logic, and diminished self-reflection which yields a reduction of neuromodulatory inhibition. These features can only exist in a complex system (4-7). In this letter, I am going to explain the process of dreaming from a bio-cybernetics point of view.

Biocybernetics, which explores information flow and processing in a biological system, e.g., the brain, has recently attracted a great deal of attention. From a biocybernetic point of view, the brain as a complex dynamic system intermittently keeps moving between numerous states in its phase space with several attractors each of which representing a specific function (2, 3). Therefore, our brain follows its patterns of interactions between the attractors. Each attractor is boosted or weakened according to the dynamics determined by the brain's functions at the time (2, 3). Attractors are interconnected according to their dynamic weights. This interconnection between the brain's attractors provides it with high degrees of freedom resulting in a wide variety of abilities such as dreaming (4, 5).

In dreaming, our brain enters its specific state with specific patterns of interactions between its attractors. In a dreaming brain, recurrently connected neural circuits change their dynamics, attractors, and interaction patterns which consequently results in different brain states producing a strange experience called dreaming (4-7).

On the other hand, there is a belief suggesting that dreams probably occur when the brain is almost closed to the external world, is highly sensitive to internal influences, and becomes (to a large extent) insensitive to external stimuli as it gates out them (4, 5). Based on what was mentioned, a dreaming brain can be considered a closed system with inner neural loops resulting in memory retrieval. The brain employs numerous feedback loops to stabilize its states in awakening which are somehow weakened in dreaming (6, 7). These inner neural loops between brain networks change their dynamics and help us dream. Several studies have represented that neural circuits in dreaming are different from those in an awakening brain (8-10).

Therefore, the main reasons why we dream can be summarized as: 1) our brain's properties as a complex biological system, 2) the constant brain changes in neuroanatomical and functional attractors of neural circuits in dreaming, 3) our brain's being insensitive to external stimuli, and 4) the brain inner loops and feedback resulting in memory retrieval. All of the above-mentioned reasons originate from the brain's complex interactions. Current reasons are based on recent neuroscientific and complex systems studies. It would be interesting to view dreaming from different aspects in future studies to give the world a comprehensive and generalized insight into dreaming.

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Conflict of Interests

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