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Self Organized Criticality as a new paradigm of sleep regulation[1]
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— Humans and animals often exhibit brief awakenings from sleep (arousals), which are traditionally viewed as random disruptions of sleep caused by external stimuli or pathologic perturbations. However, our recent findings show that arousals exhibit complex temporal organization and scale-invariant behavior, characterized by a power-law probability distribution for their durations, while sleep stage durations exhibit exponential behavior. The co-existence of both scale-invariant and exponential processes generated by a single regulatory mechanism has not been observed in physiological systems until now. Such co-existence resembles the dynamical features of non-equilibrium systems exhibiting self-organized criticality (SOC). Our empirical analysis and modeling approaches based on modern concepts from statistical physics indicate that arousals are an integral part of sleep regulation and may be necessary to maintain and regulate healthy sleep by releasing accumulated excitations in the regulatory neuronal networks, following a SOC-type temporal organization.

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