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POS-D110 – Radical pairs in the brain: xenon-induced anesthesia and lithium effects on hyperactivity

Wednesday 9 June 2021 14:07 (2 minutes)

The human brain is a magnificent system with highly complex functionalities such as learning, memory, emotion, and subjective experience. Over the past decades, it has been proposed that quantum physics could help answer unsolved questions in life science. Here we present a quantum model that could shed light on the mechanisms behind xenon-induced anesthesia and the lithium effects on hyperactivity. It has been shown that the process of xenon-induced general anesthesia involves electron transfer, and the potency of xenon as a general anesthetic exhibits isotopic dependence. It has also been observed that lithium's effects are isotope-dependent. Based on these findings, here we propose that xenon and lithium exert their effects by influencing the recombination dynamics of a naturally occurring radical pair involving oxygen. We develop a simple model inspired by the radical-pair mechanism in cryptochrome in the context of avian magnetoreception. Our model reproduces the observed isotopic dependence in the xenon anesthesia and the lithium treatment of hyperactivity. It predicts a magnetic-field dependence of the effectiveness of lithium on hyperactivity and the potency of xenon anesthetic,which provides one potential experimental test of our hypothesis. Our findings show that Nature might harness quantum entanglement for the brain's cognitive processes.

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