Comment on "Quantum Coherence and Sensitivity of Avian MagnetoreCEPTION"

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Comment on “Quantum Coherence and Sensitivity of Avian Magnetoreception”

Several papers [1–3] have studied the quantum physics of the radical pair mechanism hypothesized to underlie the avian compass. Our 2011 Letter [2] analyzed the coherence time of the electron spin pair and found that it must be surprisingly long. To be consistent with behavioral studies on European Robins involving weak radio frequency (rf) fields [4,5], the coherence time should be of order 100 μs or more. Interestingly, this is considerably longer than the reported 6 μs radical pair lifetime from in vitro experiments on cryptochrome [6], widely considered a potential factor of four either the time axis or the spins’ g-factors.

In deriving lifetime estimates, both our original Letter and BKP’s vitally depend on the effect of weak rf fields in disrupting the birds’ compass sense. Our 2011 Letter [2] and in Ref. [3]; the latter specifically examined the cases where noise is beneficial. Notwithstanding the puzzle of why the bird should evolve an unnecessarily long lifetime [11], the available data [4,5,12] applied to a proper quantum mechanical model of the radical pair mechanism nevertheless indeed imply that the life- and coherence time is of order 100 μs or more.

To test the validity of Bandyopadhyay-Paterek-Kaszlikowski’s (BKP) numerical calculation, we regenerating their simulation results using exactly the model and the parameters which they select. After an exhaustive series of simulations, we conclude that it is not possible to reproduce BKP’s results without artificially scaling the model parameters [10]. Evidently, there is an error in the numerical code employed by BKP.

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