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Chemotaxis to Excitable Waves in Dictyostelium Discoideum[1]

ARPAN BHOWMIK, Rice Univ, WOUTER-JAN RAPPEL, University of California, San Diego, HERBERT LEVINE, Rice Univ — In recent years, there have been significant advances in our understanding of the mechanisms underlying chemically directed motility by eukaryotic cells such as Dictyostelium. In particular, the LEGI model has proven capable of providing a framework for quantitatively explaining many experiments that present Dictyostelium cells with tailored chemical stimuli and monitor their subsequent polarization. Here, we couple the LEGI approach to an excitable medium model of the cAMP wave-field that is self-generated by the cells and investigate the extent to which this class of models enables accurate chemotaxis to the cAMP waveforms expected in vivo. Our results indicate that the ultra-sensitive version of the model does an excellent job in providing natural wave rectification, thereby providing a compelling solution to the "back-of-the-wave paradox" during cellular aggregation.

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Arpan Bhowmik
Rice Univ

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