

Abstract Submitted
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Controlling Collective Behaviors of Dictyostelium DAVID SCHWAB, PANKAJ MEHTA, THOMAS GREGOR, Princeton University — We study the collective dynamics of a population of Dictyostelium cells, focusing on how single cell dynamics influence, and give rise to, the behavior of the aggregate. Through analysis of quantitative single cell experiments, we develop a simple model of the single cell response to time-dependent pulses of the extracellular signaling molecule cAMP, characterized by a particular type of excitable system. We then use this model to study collective multicellular dynamics mediated by diffusion coupling. We first consider the mean-field case where we find an intriguing “dynamical quorum sensing” transition in which all cells simultaneously transition from quiescent to oscillating across the phase boundary. Then we include spatial dynamics and study pattern formation, both with and without the cells capable of chemotactic response to signal gradients. Finally, we highlight how modification of single cells can alter the collective dynamics.

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