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Towards Predictive Modeling of Information Processing in Microbial Ecosystems With Quorum-Sensing Interactions TAHIR YUSUFALY, JAMES BOEDICKER, University of Southern California — Bacteria communicate using external chemical signals in a process known as quorum sensing. However, the efficiency of this communication is reduced by both limitations on the rate of diffusion over long distances and potential interference from neighboring strains. Therefore, having a framework to quantitatively predict how spatial structure and biodiversity shape information processing in bacterial colonies is important, both for understanding the evolutionary dynamics of natural microbial ecosystems, and for the rational design of synthetic ecosystems with desired computational properties. As a first step towards these goals, we implement a reaction-diffusion model to study the dynamics of a LuxI/LuxR quorum sensing circuit in a growing bacterial population. The spatiotemporal concentration profile of acyl-homoserine lactone (AHL) signaling molecules is analyzed, and used to define a measure of physical and functional signaling network connectivity. From this, we systematically investigate how different initial distributions of bacterial populations influence the subsequent efficiency of collective long-range signal propagation in the population. We compare our results with known experimental data, and discuss limitations and extensions to our modeling framework.-/abstract-

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