Abstract Submitted
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Quorum activation at a distance: spatiotemporal patterns of gene regulation from diffusion of an autoinducer signal GABRIEL DILANJI[1], JESSICA LANGEBRAKE[2], PATRICK DELEENHEER[3], STEPHEN J. HAGEN[4], University of Florida — Bacteria in colonies coordinate gene regulation through the exchange of diffusible signal molecules known as autoinducers (AI). This "quorum signaling" often occurs in physically heterogeneous and spatially extended environments such as biofilms. Under these conditions the space and time scales for diffusion of the signal limit the range and timing of effective gene regulation. We expect that spatial and temporal patterns of gene expression will reflect physical environmental constraints as well as nonlinear transcriptional activation and feedback within the gene regulatory system. We have combined experiments and modeling to investigate how these spatiotemporal patterns develop. We embed engineered plasmid/GFP quorum sensor strains or wild type strains in a long narrow agar lane, and then introduce AI signal at one terminus of the lane. Diffusion of the AI initiates reporter expression along the length of the lane, extending to macroscopic distances of mm-cm. Resulting patterns are captured quantitatively by a mathematical model that incorporates logistic growth of the population, diffusion of AI, and nonlinear transcriptional activation. Our results show that a diffusing quorum signal can coordinate gene expression over distances of order 1cm on time scales of order 10 hrs.

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