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Study of Signal Detection, Integration, and Propagation in Quorum Sensing at the Single Cell Level TAO LONG, Department of Physics, BONNIE BASSLER, Department of Molecule Biology, Howard Hughes Medical Institute, NED WINGREEN, Department of Molecule Biology, Princeton University
— Bacteria respond to their environment and to each other and accordingly adjust their gene-expression levels. Accurate signal detection, appropriate signal integration, and faithful signal propagation are essential for a cell to make correct adjustments in response to various extracellular cues. To better understand this information processing by living cells, we studied a model system – the quorum-sensing circuit in *Vibrio harveyi*. Quorum sensing is a process in which bacteria communicate with each other by diffusible chemical molecules, termed "autoinducers", to commit to coordinated developmental decisions. Three types of autoinducers are detected coincidently by three parallel receptors. The signals are then integrated into the same signaling pathway and propagated by phosphorylation or dephosphorylation of the pathway components. To quantitatively measure the intracellular response, we applied a fluorescent protein reporter, whose production is regulated by a phosphorylated protein in the pathway. By single-cell microscopy, we can explore features of this information-processing circuit such as coincidence detection, signal integration, noise reduction or filtering, and especially the fidelity in signal processing achieved in the presence of inevitable fluctuations.

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