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Quorum sensing and biofilm formation investigated using laser-trapped bacterial arrays VERNITA GORDON, JOHN BUTLER, IVAN SMALYUKH, MATTHEW PARSEK, GERARD WONG, University of Illinois, Urbana-Champaign — Studies of individual, free-swimming (planktonic) bacteria have yielded much information about their genetic and phenotypic characteristics and about "quorum sensing," the autoinducing process by which bacteria detect high concentrations of other bacteria. However, in most environments the majority of bacteria are not in the planktonic form but are rather in biofilms, which are highly-structured, dynamic communities of multiple bacteria that adhere to a surface and to each other using an extracellular polysaccharide matrix. Bacteria in biofilms are phenotypically very different from their genetically-identical planktonic counterparts. Among other characteristics, they are much more antibiotic-resistant and virulent. Such biofilms form persistent infections on medical implants and in the lungs of cystic fibrosis patients, where Pseudomonas aeruginosa biofilms are the leading cause of lung damage and, ultimately, death. To understand the importance of different extracellular materials, motility mechanisms, and quorum sensing for biofilm formation and stability, we use single-gene knockout mutants and an infrared laser trap to create a bacterial aggregate that serves as a model biofilm and allows us to measure the importance of these factors as a function of trapping time, surface, and nutritional environment.

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