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Can single-cell behavior predict the structure and rheology of bacterial biofilms? VERNITA GORDON, BENJAMIN COOLEY, TRAVIS THATCHER, NUMA DHAMANI, University of Texas at Austin, SARA HASHMI, Yale University, WILLIAM WALLER, ROSS TODD, HENRY LEE, DANIEL HURWITZ, University of Texas at Austin, DANIELE PROVENZANO, AHMED TOUHAMI, University of Texas at Brownsville, SHERI DELLOS-NOLAN, DANIEL WOZNIAK, The Ohio State University — Biofilms are surface-mounted, multicellular communities of microbes. Biofilms are often associated with chronic infectins that resist treatment, evade the immune system, and damage host tissue. An essential characteristic of the biofilm state is that constituent organisms are bound in a polymeric matrix. This matrix, plus the native motility of bacteria, does much to control the structure that develops in the biofilm. The matrix plus the mechanics of embedded bacteria controls the rheology of the biofilm. Biofilm structure is important for biofilm function because it controls transport; biofilm rheology is important because it controls the response to mechanical removal strategies. Understanding structure and rheology are basic challenges, and measuring rheology of biofilms is itself very experimentally challenging. We present results that show that components of the biofilm matrix influence the single-cell behavior of bacteria on surfaces in component-specific ways. These results suggest that it may be possible to develop metrics that use single-cell behaviors as predictors of biofilms structure and rheology.

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