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Biofilm formation and surface exploration behavior of P. aeruginosa[1] BERNARD BECKERMAN, Northwestern University, KUN ZHAO, GERARD WONG, University of California at Los Angeles, ERIK LUIJTEN, Northwestern University — Despite extensive studies, the early stages of biofilm formation are not fully understood. Recent work on the opportunistic pathogen Pseudomonas aeruginosa has shown that these bacteria deposit the exopolysaccharide Psl as they move across a surface, which in turn attracts repeat visits of bacteria to the sites of deposition. Using a massively parallel cell-tracking algorithm combined with fluorescent Psl staining and computer simulations, we show that this behavior results in a surface visit distribution that can be approximated by a power law. The steepness of this Zipf's Law is a measure of the hierarchical nature of bacterial surface visits, and is (among other parameters) a function of both Psl secretion rate and sensitivity of the bacteria to Psl. We characterize the bacterial distributions using various computational techniques to quantitatively analyze the effect of Psl on microcolony organization and to identify the key stages of microcolony growth.

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