Abstract Submitted
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The fluid mechanics of nutrient transport within biofilms MICHAEL BRENNER, AGNESE SEMINARA, NAVEEN SINHA, JAMES WILKING, Harvard University, TOMMY ANGELINI, University of Florida, ROBERTO KOLTER, DAVID WEITZ, Harvard University — Bacterial biofilms are interface-associated colonies of bacteria embedded in an extracellular matrix that is composed primarily of polymers and proteins. During the growth of a biofilm, nutrient is taken up by the surface of the biofilm, and contained by cells in the bulk. A critical problem is that above a critical size there is necessarily a growth bottleneck, in which the biofilm cannot take up enough nutrients to feed all of the cells within it. We discuss, through theory and experiments, several strategies that are employed by biofilms of Bacillus subtilus to avoid this growth bottleneck. These include clever use and control of osmotic pressure (through the expression of polymeric extracellular matrix); the excretion of surfactants and the use of associated marangoni stresses; and the distribution of flagella (used as mixers) within the bulk of the biofilm. Some speculations about other potential mechanisms (for which there is no current experimental support) will also be presented.

Michael Brenner
Harvard University

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