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Dynamics of Aerial Tower Formation in Bacillus subtilis Biofilms

NAVEEN SINHA, AGNESE SEMINARA, JAMES WILKING, MICHAEL BRENNER, DAVE WEITZ, Harvard University — Biofilms are highly-organized colonies of bacteria that form on surfaces. These colonies form sophisticated structures which make them robust and difficult to remove from environments such as catheters, where they pose serious infection problems. Previous work has shown that sub-mm sized aerial towers form on the surface of Bacillus subtilis colony biofilms. Spore-formation is located preferentially at the tops of these towers, known as fruiting bodies, which aid in the dispersal and propagation of the colony to new sites. The formation of towers is strongly affected by the quorum-sensing molecule surfactin and the cannibalism pathway of the bacteria. In the present work, we use confocal fluorescence microscopy to study the development of individual fruiting bodies, allowing us to visualize the time-dependent spatial distribution of matrix-forming and sporulating bacteria within the towers. With this information, we investigate the physical mechanisms, such as surface tension and polymer concentration gradients, that drive the formation of these structures.

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