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Biofilm growth program and architecture revealed by single-cell live imaging JING YAN, Princeton Univ, BENEDIKT SABASS, HOWARD STONE, NED WINGREEN, BONNIE BASSLER, Princeton University — Biofilms are surface-associated bacterial communities. Little is known about biofilm structure at the level of individual cells. We image living, growing *Vibrio cholerae* biofilms from founder cells to ten thousand cells at single-cell resolution, and discover the forces underpinning the architectural evolution of the biofilm. Mutagenesis, matrix labeling, and simulations demonstrate that surface-adhesion-mediated compression causes V. *cholerae* biofilms to transition from a two-dimensional branched morphology to a dense, ordered three-dimensional cluster. We discover that directional proliferation of rod-shaped bacteria plays a dominant role in shaping the biofilm architecture, and this growth pattern is controlled by a single gene. Competition analyses reveal the advantages of the dense growth mode in providing the biofilm with superior mechanical properties. We will further present continuum theory to model the three-dimensional growth of biofilms at the solid-liquid interface as well as solid-air interface.

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