Session: Emerging technologies

Vibrio cholerae biofilm dispersal regulator causes cell release from matrix through type IV pilus retraction

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The extracellular matrix is a defining feature of bacterial biofilms and provides structural stability to the community by binding cells to the surface and to each other. Transitions between bacterial biofilm initiation, growth, and dispersion require different regulatory programs, all of which result in modifications to the extracellular matrix composition, abundance, or functionality. However, the mechanisms by which individual cells in biofilms disengage from the matrix to enable their departure during biofilm dispersal are unclear. Here, we investigated active biofilm dispersal of Vibrio cholerae during nutrient starvation, resulting in the discovery of the conserved Vibrio biofilm dispersal regulator VbdR. We show that VbdR triggers biofilm dispersal by controlling cellular release from the biofilm matrix, which is achieved by inducing the retraction of the mannose-sensitive hemagglutinin (MSHA) type IV pili and the expression of a matrix protease IvaP. We further show that MSHA pili have numerous binding partners in the matrix and that the joint effect of MSHA pilus retraction and IvaP activity is necessary and sufficient for causing biofilm dispersal. These results highlight the crucial role of type IV pilus dynamics during biofilm dispersal and provide a new target for controlling V. cholerae biofilm abundance through the induction and manipulation of biofilm dispersal.