Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Effect of low Reynolds number flow on the quorum sensing behavior of sessile bacteria FRANCOIS INGREMEAU, KEVIN KIM MINYOUNG, BONNIE BASSLER, HOWARD STONE, Princeton University, MECHANICAL AND AEROSPACE ENGINEERING, COMPLEX FLUIDS GROUP TEAM, MOLECULAR BIOLOGY LAB TEAM — Sessile and planktonic bacteria can be sensitive to the bacteria cell density around them through a chemical mediated communication called quorum sensing. When the quorum sensing molecules reach a certain value, the metabolism of the bacteria changes. Quorum sensing is usually studied in static conditions or in well mixed environments. However, bacteria biofilms can form in porous media or in the circulatory system of an infected body: quorum sensing in such flowing environment at low Reynolds number is not well studied. Using microfluidic devices, we observe how the flow of a pure media affects quorum sensing of bacteria attached to the wall. The biofilm formation is quantified by measuring the optical density in brightfield microscopy and the quorum sensing gene expression is observed through the fluorescence of a green fluorescent protein, which is a reporter for one of the quorum sensing genes. We measured without flow the amount of Staphylococcus aureus biofilm when the quorum sensing gene expression starts. In contrast, when the media is flowing in the microchannel, the quorum sensing expression is delayed. This effect can be understood and modelled by considering the diffusion of the quorum sensing molecules in the biofilm and their convection by the flowing media.

Francois Ingremeau
Princeton University

Date submitted: 30 Jul 2014 Electronic form version 1.4