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Measurement of fluid dynamic loading on staphylococci bacteria bio-film structures using μPIV ERICA SHERMAN, University of Nebraska - Lincoln, DEREK MOORMEIER, KENNETH BAYLES, University of Nebraska Medical Center, JOHN DAVIDSON, SANGJIN RYU, TIMOTHY WEI, University of Nebraska - Lincoln — Staphylococci bacteria are recognized as the most frequent cause of biofilm-associated infections. Although humans are regularly exposed to these bacteria without consequence, a localized infection can enter the bloodstream and lead to serious infections such as endocarditis, pneumonia, or toxic shock syndrome. The mechanics of staphylococci biofilm formation and dispersion through the bloodstream are not well known. It has recently been observed that under certain flow conditions, bacteria organize in tower-like structures which break and are transported downstream by the flow. The fundamental questions of interest are i) whether or not fluid mechanics plays a role in differentiating between film or tower formation and ii) whether or not the faulty towers are a bio-film propagation mechanism. This talk focuses on the application of μPIV to study this problem. Staphylococcus aureus bacteria were cultured in the Bioflux Fluxion square microchannel of a 65 by 65 um cross section, and subjected to a steady shear rate of 0.5 dynes. μPIV measurements were made to map the flow over and around a biofilm tower structure which occluded approximately 66% of the channel width. Data were recorded around the structure at a series of two dimensional planes, which when stacked vertically show a two dimensional flow field as a function of tower height. Measurements and control volume analysis will be presented quantifying forces acting on these structures.

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