Isolation and Study of Bacteria Using Physical Constrictions

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This thesis proposes methods for the isolation and study of bacterial cells by using physical constrictions. Using a conceptually simple microfluidic device with nano-scale constrictions, it is possible to isolate individual bacterial species from infinitely complex mixtures. To demonstrate this principle, we sorted red and green fluorescently labeled *E. coli* and *P. aeruginosa* from *E. coli*. Two *E. coli* strains that were labeled with different fluorescent colors were also sorted to show that trapping a single species within the constriction blocks other species, and even other strains of the same species, from reaching the isolation chambers. In addition, a polycarbonate membrane will be integrated to PDMS microfluidic devices to adapt this platform to in-situ studies to culture uncultivable microorganisms. The third aim of this project will focus on bacterial behavior. Microfluidic devices will be used to provide new insights about biofilms. Finally, as a fourth aim, the ability of common and pathogenic bacteria to migrate through porous media as a function of pressure and material will be investigated. This study will provide valuable new information regarding the effectiveness of water filtration and sterilization processes.