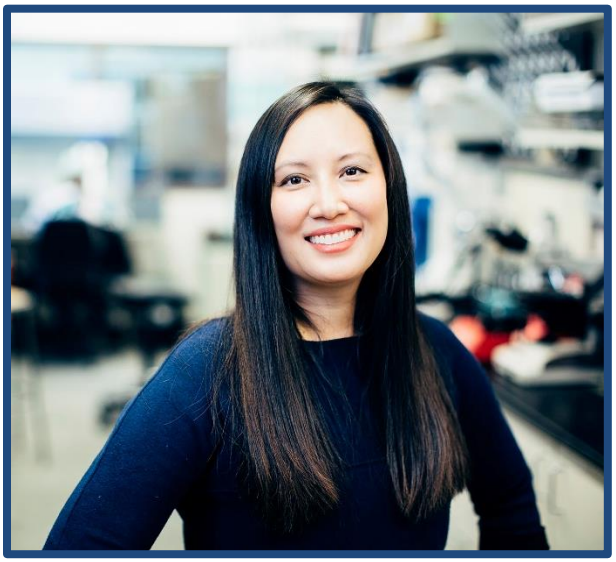
"Examining Heterogenous Populations of Microbes at the Single Cell Level Using Stabilized Emulsions"

Wednesday
October 16, 2019
3:00 pm
Wu and Chen Auditorium
Levine Hall



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Abstract

Conventional methods in microbiology can be limited by long assay execution and analysis times, large reagent volumes, and high single-use supply costs. These limitations can be overcome using drop-based microfluidics in which picoliter-sized, water-in-oil emulsions serve as independent microreactors, allowing for the compartmentalization of microbes and high-throughput assaying at the single cell level. Here, drop-based microfluidics is used to interrogate the physiological heterogeneity of *P. aeruginosa* cells in a microbial population using a technique we name DropSOAC (Drop Stabilization On A Chip). The DropSOAC method stabilizes the position and volume of monodisperse water-in-oil drops with diameters <20 μm within a monolayer array on a microfluidic chip for 24 h. The stability of drops is maintained by soaking the device in a reservoir containing both water and oil in thermodynamic equilibrium. This ensures that phase equilibrium of the drop emulsion fluids within the porous PDMS material structure is maintained during drop incubation and imaging. Continuing this work, we aim to study the rapid emergence of antibiotic resistance now observed in common bacterial strains to find effective treatments for persistent bacterial infections. This will be performed using a microfluidic chip that is capable of encapsulating in parallel, 96 barcoded assay samples in drops using fluorescent particles. Using a custom-built microscope that can read fluorescence from drops at rates of thousands per second, we demonstrate sorting for a particular barcode combination from our droplet library. The results presented here show the potential of drop-based microfluidics for high-throughput assaying of heterogeneous populations of microbes at the single cell level.

Bio

Connie B. Chang is an Assistant Professor in the Department of Chemical and Biological Engineering and Center for Biofilm Engineering at Montana State University. Dr. Chang is a graduate of Wellesley College and received her Ph.D. from the University of California, Los Angeles. Dr. Chang was a postdoctoral scholar at Harvard University in Physics and the School of Engineering and Applied Sciences. Dr. Chang's research interests include soft matter, complex fluids, biomaterials, and microfluidics. She is currently studying how subpopulations of influenza virus might be applied as a new type of therapeutic and how spatial heterogeneity of individual microbes in a bacterial biofilm community influences emergent behavior such as antibiotic resistance.

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