

Droplet microfluidic chemostat for cell-free synthetic biology

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Context: Droplet microfluidics has emerged as a powerful technology for conducting high-throughput cell-free assays and experiments. This master thesis project aims to develop an advanced droplet microfluidic system for enabling long-term cell-free reactions in nanodroplet chemostats in a robust manner.

Project overview: At LBNC, we are developing a microfluidic system for running long-term cell-free protein synthesis in nanodroplet chemostats. We are currently testing the capability to conduct other cell-free reactions within this system and link droplets on demand. The project will encompass design, fabrication, and characterization of droplet microfluidic platforms built using multilayer soft(PDMS) lithography.

Objectives: The goal of this project would be to test implementation of dialysis and various cell-free reactions, such as DNA replication and RNA synthesis, in droplets.

Student gain: Upon completion of this project, the student can be expected to have a comprehensive background in Droplet Microfluidic technologies, microfabrication technologies relevant to microfluidics, a basic background in cell-free biology and development in collaborative and problem-solving skills.

Requirements: The student is expected to have basic knowledge of microfluidics and droplet microfluidic technologies. Previous hands-on experience would be a plus. Basic programming knowledge in Python is required to develop the app built for the in-house setup.