B23D-2106: Developing Model Benchtop Systems for Microbial Experimental Evolution

Tuesday, 12 December 2017
13:40 - 18:00
📍 *New Orleans Ernest N. Morial Convention Center - Poster Hall D-F*

Understanding how microbes impact an ecosystem has improved through advances of molecular and genetic tools, but creating complex systems that emulate natural biology goes beyond current technology. In fact, many chemical, biological, and metabolic pathways of even model organisms are still poorly characterized. Even then, standard laboratory techniques for testing microbial impact on environmental change can have many drawbacks; they are time-consuming, labor intensive, and are at risk of contamination. By having an automated process, many of these problems can be reduced or even eliminated. We are developing a benchtop system that can run for long periods of time without the need for human intervention, involve multiple environmental stressors at once, perform real-time adjustments of stressor exposure based on current state of the population, and minimize contamination risks.

Our prototype device allows operators to generate an analogue of real world micro-scale ecosystems that can be used to model the effects of disruptive environmental change on microbial ecosystems. It comprises of electronics, mechatronics, and fluidics based systems to control, measure, and evaluate the before and after state of microbial cultures from exposure to environmental stressors. Currently, it uses four parallel growth chambers to perform tests on liquid cultures. To measure the population state, optical sensors (LED/photodiode) are used. Its primary selection pressure is UV-C radiation, a well-studied stressor known for its cell- and DNA- damaging effects and as a mutagen.

Future work will involve improving the current growth chambers, as well as implementing additional sensors and environmental stressors into the system. Full integration of multiple culture testing will allow inter-culture comparisons. Besides the temperature and OD sensors, other types of sensors can be integrated such as conductivity, biomass, pH, and dissolved gasses such as CO_2 and O_2. Additional environmental stressor systems like temperature (extreme heat or cold), metal toxicity, and other forms of radiation will increase the scale and testing range.

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