

Fall 2018 Chemistry Research Report

Throughout this semester, I have been focused on the design, coding, and construction of a fluorescence microscope(FM) for use with the newly acquired Langmuir Trough. Over the summer Brandon and I worked together to build our first FM called the Fly-Pi. It was an open source FM created by A. M. Chagas and the information and directions for the construction of it were found on the Github repository. Through the construction of this FM, we realized several flaws of the design and decided to create our own; The newly designed microscope would be for direct use with the trough allowing for the simultaneous collection of both FM and through data.

The first part of the plan was to create a design for the FM. After some deliberation, we decided upon a single unit design that was controlled via a seven-inch touchscreen. This would be controlled using a Raspberry Pi 3B+ as well as an Arduino Nano to control additional components of the FM such as the lights and motors. The camera will be attached to the Pi and a 10x microscope objective is mounted to the camera. We are using a 12 LED Ring with three wavelengths in the red, green, and blue parts of the spectrum, as well as a UV LED; all of these will be used as the excitation light needed for fluorescence microscopy. We are also automating the changing of the filter wheel via a micro servo. In order to focus the camera, we have devised a tool that will consist of a vertical, hand-turn actuator that will be mounted directly to the Kibron trough and will house the camera, filter wheel, and objective.

During the construction of the microscope, we have begun creating the front and back ends of the software that will control the FM. The front end is nearly finished and consists of an interactive graphical user interface(GUI) that shows the data in real time and allows for the control of various aspects of the data collection such as picture brightness, contrast, and frame

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rate. The back end controls what happens when buttons or sliders in the front end are used. It communicates with the Pi and the Arduino and tells them the instructions for the operations being performed.

Once completed (most likely during Christmas break or the beginning of the Spring 2019 semester) the FM will be used alongside the trough to attain additional information on each trial. Fluorescence microscopy gives insight to areas of the monolayer that are ordered or disordered and can give users additional information as to how the molecules are interacting by using differently labeled groups (head or tail labeled). The focus for next semester will be on using the FM for the visualization of the various insulin monolayers (on transition metal subphases, with additional lipids, etc.).