Summer 2021 Research Summary: Electrophysiological Insight into Neuronal Plasticity and Online Gene Sequencing Project

By Lucia O'Sullivan, '23

This summer, I divided my time between two different projects. Both projects were within Professor Hadley Horch's lab, which studies the effects of auditory organ amputation on the nervous system of a cricket. Initially, my fellowship was supposed to be remote and centered around collecting data on a gene candidate called "hexamirin-like protein", which is potentially responsible for the post-amputation changes in the nervous system. However, the opportunity to live on campus rerouted my plan. I spent half of the week working in-person with Hannah Scotch ('22) on her honors project that collects electrophysiological recordings from newly amputated crickets. I spent the other half online organizing a project on bioinformatics, a rapidly developing field that uses various computer softwares to collect and interpret an organism's genetic information. These two projects were fairly different, and allowed me to grow as a researcher in unique ways.

For a few days each week, I assisted Hannah Scotch with setup and data analysis for her honors project. Hannah's project centered around the immediate effects of amputation on the cricket's nervous system. Specifically, Hannah collected electrophysiological recordings in the "AN-2" auditory neuron both pre and post-cooling, which numbs the cricket limb and simulates amputation. We compared characteristics of impulses in the auditory neuron both with and without cooling. Eventually, we observed a unique type of neurological signal in this neuron following amputation, known as the DOPE response. This year, Hannah will be conducting experiments to further study the DOPE response. A large portion of my collaboration involved mastering the cricket dissection. I had to identify "good" cricket subjects, prepare electrophysiological equipment, and work closely under the microscope to isolate a specific part of the cricket's nervous system. Though I had difficulty with this dissection at first, I can now perform the fine work comfortably. This skill will help me for future experiments in the Horch lab that require cricket dissection, as well as fine dissections in general. In addition to cricket dissection and other preparatory duties, I also had the opportunity to analyze data on Spike. This analysis required familiarity with the Spike program, as well as proficiency in Excel. Over time, I gained insight into efficient and effective analysis.

My second project was done remotely. I started preparing to lead this project in May, and have had meetings and email collaboration for it up to this past week. This project was a continuation of a virtual lab done in Professor Horch's spring course. Over several weeks, students worked with researchers from MDIBL to gain proficiency in various computer programs and understand their intersection with biological gene sequencing. Ultimately, the goal of this sequencing is to understand the genetic information and proteins that are responsible for various characteristics in the cricket. This course, in addition to a summer data intensive run through Bates, gave me an understanding of how to organize the project at hand. I met with two MDIBL researchers consistently to locate and organize data necessary for this project. Together with six other students from Professor Horch's class, we noticed that the existing cricket genome, or collection of genetic information, had several flaws. This project sought to compare the efficacy of several popular sequencing softwares in reducing those flaws. I learned a lot about the challenges and benefits of virtual group work, as well as the unique benefits of each software. I also experienced first-hand the frustrations of work in computer science— permissions errors, bugs, and technological delays were myriad. This project will extend into the fall as we continue to compare various sequencing softwares.

Overall, I am very grateful for the opportunity to research in the Horch lab this summer. I am hopeful that, in the future, I am able to look further into the DOPE response, and the unique nervous system of *G bimaculatus* in general.