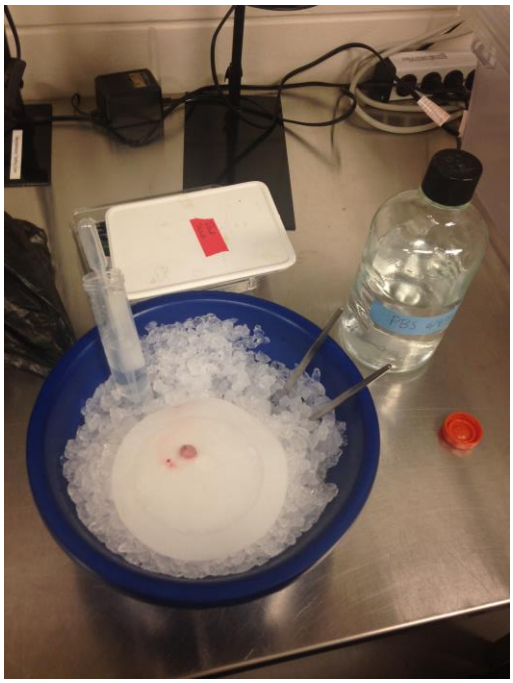

Development of IlaC as a Non-Invasive Optogenetic Tool in Examining Memory
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Advisor: Ted Abel

This past summer I worked on an optogenetic project in the Department of Biology under Dr. Ted Abel. The project was focused on the characterization and effect of IlaC on memory, specifically in the hippocampus of a mouse model. IlaC is an infrared light-activated adenylyl cyclase that converts ATP to cAMP when activated by red 700 nm light. Previous pharmacogenetic cAMP generating tools have not been ideal in terms of temporal selectivity and other current optogenetic tools have not allowed for noninvasive regulation of cAMP. IlaC is significant in its potential as the first noninvasive cAMP generating tool that can also control for both spatial and temporal expression of IlaC in a number of species. This novel tool not only has exciting implications for therapeutic treatments for psychiatric disorders, but also could be later used towards metabolic disorders, cardiac disease, and cancer.

The goal of this project was to conduct an IlaC longitudinal study in order to better characterize IlaC expression and determine the exact point at which hippocampal atrophy appears. Through contextual fear conditioning behavioral trials, subsequent activation of IlaC, and re-exposure to the context, IlaC expression and effects on freezing behavior were studied. In addition, hippocampi tissue was collected and western blotting was utilized to identify specific proteins.

Through this research experience, I learned and developed skills in DNA isolation, PCR, gel electrophoresis, western blotting, and hippocampal tissue collection. In addition, I consistently maintained two cell lines in a mouse colony by breeding and genotyping mice. This research experience was really exciting for me as I was able to connect information from the classroom to the lab, and was able to participate in the entire process from mouse to western blot. I have learned how to think critically, further developed my time management and efficiency skills, and have

recognized the importance of patience regarding slow or negative data collection. I have really enjoyed my time in the lab, and look forward to continuing throughout the academic year.