**Manipulating Neural Growth in Crickets**

**Jose Avila, 2023**

The aim of my summer research, which I conducted with Hannah Scotch and Emanuel Coleman, was to investigate the MAGUK family, a specific family of proteins that Dr. Horch, my mentor, believes may play an important role in the neuronal regeneration of the cricket following an injury (having its leg cut off). It should be noted that this was not the original plan for my summer research as adjustments had to be made in response to most students, including myself, not being allowed on campus to conduct research this summer.

Dr. Horch’s research is focused on the cricket’s (specifically *gryllus bimaculatus*) ability to adapt its nervous system in response to having its leg cut off. The auditory nervous system of the cricket is connected to its front legs as its ears are placed on these same front legs. Incredibly, following the removal of one of these legs, the cells making up the auditory nervous system on that side will not quickly die out as one might expect. Instead, the cells will rebound by growing across the midline of the cricket a few days after the removal of its ear. This incredible neuroplasticity is at the heart of this research; the actual biological processes underlying this neuroplasticity in the cricket are not well understood. MAGUKs may be part of a piece to this puzzle.

The MAGUK (membrane-associated guanylate kinase) protein family encompasses many members, whose functions consist of forming synaptic junctions (spaces in between neurons) and cell-cell adhesion. MAGUK proteins are a well-conserved group of proteins that can be found throughout the animal kingdom, vertebrates and invertebrates alike. To get a better idea of what each member does and how it may connect to the overall purpose of the research, we researched papers focused on *drosophila melanogaster* (fruit fly) on the Pub Med Central database. Although *D. melanogaster* was not our organism of interest, several papers centered on MAGUK function have focused on it while few to none have focused on *G. bimaculatus*.

Just as few papers have focused on MAGUK function in *G. bimaculatus*, few MAGUK sequences (“blueprints” of protein assembly) have been identified in *G. bimaculatus*. In order to locate these sequences, we used MAGUK sequences from *D. melanogaster*, which we acquired through the NCBI protein database, and a program named Geneious. Geneious allowed us to compare the transcriptome of our cricket with specific MAGUK protein sequences, a process called “BLASTing.” Through this process, we were able to find the sequences of MAGUK proteins, or BLAST hits, in our cricket. These BLAST hits allowed us to make a phylogenetic tree that shows the specific relationships in the MAGUK family in *G. bimaculatus*.

We used to believe that our brains did not have much room for change. We now know that this is false, and our brains possess the ability of neuroplasticity. The neuroplasticity observed in the cricket after losing its ear is especially remarkable. Learning more about the mechanisms behind the cricket’s extensive neuroplasticity will lend more insight into how organisms with complex nervous systems, such as humans, undergo neuroplasticity. This may, in turn, allow for better therapies and medical interventions in treating patients who have suffered severe brain injury.

**Faculty Mentor: Hadley Horch, PhD**

**Funded by the Life Sciences Summer Fellowship**