The Effects of Semaphorins on Compensatory Neurite Growth in *Gryllus bimaculatus*

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Typically if an injury to the central nervous system (CNS) results in the loss of electrical impulses, deafferented dendrites will retract and die. This retraction and death makes it particularly difficult to treat and heal central nervous system injuries, because functional synapses do not reform. However, the auditory system of the cricket *Gryllus bimaculatus* displays a unique response to such deafferentation. In an uninjured system the auditory interneuron AN2 in the prothoracic ganglion receives synapses from its ipsilateral nerve 5, which carries incoming auditory information. Upon cutting nerve 5, AN2’s deafferented dendrites cross the midline and form new functional synapses with the simultaneously branching contralateral nerve 5 axons.

One group of proteins speculated to be involved in this growth is the semaphorin family, which is known to play a role in neuronal growth and guidance. Previous research supported this hypothesis and found that sema1a and sema2a are downregulated post-deafferentation. The goal of my research this summer was to understand if this downregulation of semaphorins was responsible for the cricket’s compensatory growth.

In order to deduce if semaphorins are sufficient to cause the neurite growth, I injected crickets with two types of double stranded RNA that targeted two separate regions of Sema2a. I assessed the successes of these knockdowns by performing qPCRs on the prothoracic ganglia, terminal ganglia, and brain. I then backfilled the nerves of interest with two different colored dyes to ascertain if either nerve showed increased growth or branching. I have not had a chance to analyze the backfills under the confocal microscope yet, but when I do I expect to see increased neurite growth within the auditory system, because the experiment mimicks the environment within the prothoracic ganglia post deafferentation. If this knockdown causes neurite growth it will show that the down regulation of semaphorins is sufficient to cause growth and will help us understand the mechanism by which crickets are able to recover from central nervous system injuries. Although these experiments are performed on crickets, semaphorins are proteins that are highly conserved throughout all species. Therefore, the proteins involved in the cricket’s system could provide insights on how to treat CNS injuries in higher-level animals such as humans.

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