Investigating the impact of Semaphorins on the morphology and physiology of AN-1 and AN-2 neurons in the *Gryllus bimaculatus*

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The cricket auditory system is a great model for adult compensatory plasticity. The dendrites of the auditory neurons AN-1 and AN-2 typically respect the midline of the prothoracic ganglion (Horch et al., 2017). However, upon removal of the foreleg which is where the cricket ear is located, the ANs are disconnected from their major source of input, or deafferented (Horch et al., 2017). After unilateral deafferentation, ipsilateral dendrites grow across the midline boundary and synapse with auditory afferents from the contralateral side. (Horch et al., 2017). Furthermore, when the dendrites cross over the midline they maintain frequency-specific responses (Horch et al., 2017), as AN-1 responds to 5 kHz sound, which is the frequency of cricket calls, while AN-2 responds to 15 kHz or higher sound, which corresponds to the frequency of bat ultrasound (Kostarakos and Hedwig, 2017). Semaphorins, developmental guidance molecules, were implicated as a potential factor in this phenomenon as Sema1a.2 is downregulated after deafferentation (Horch et al., 2019).

My partner Jada Scotland and I investigated if this downregulation is causative or correlative to the dendritic crossing of the midline. To do this we injected dsRNA into the crickets to knockdown the expression of sema1a.2 and sema2a. Crickets were also injected with dsRNA against GFP as a control. Then we used a backfill technique to iontophorese in a neuronal tracer dye to visualize AN-1 and AN-2. We also took physiological recordings from the auditory neuropil of the cricket brain. Due to technological difficulties we were not able to obtain morphological or physiological data from injected crickets. We did obtain physiological data from un-injected crickets from the colony and compared their physiological data to dsRNA injected crickets from past Honors student Alicia Edwards. We found that a singular cricket injected with dsRNA against sema2a had a decreased firing rate compared to a singular cricket injected with dsRNA against GFP and un-injected crickets. A previous study found that in the *Drosophila melanogaster* Sema1a was necessary pre and post-synaptically for giant fiber synapse formation (Godenschwege et al., 2002). Therefore, we hypothesized that our physiological results suggest that Semaphorins may be integral to synapse maintenance in the cricket auditory system.

Faculty Mentor: Hadley Horch

Funded by the Maine IDeA Networks of Biomedical Research Excellence from the National Institute of Health grant "Comparative Functional Genomics INBRE in Maine" (PI: Patsy Dickinson)

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