Explore the space: the behavioral effects of semaphorin-induced neuroplasticity in the nervous system of *Gryllus bimaculatus*

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Scholars have long examined the phonotactic behavioral response of crickets induced by sudden neurological changes resulting from sound stimuli. This research has led neuroethologists (scientists studying animal behavior) to an intensive exploration of the varying functions of the cricket auditory system. The relevant literature has elucidated the two integral functions of crickets' acoustic response necessary for their survival: sexual partner identification and avoidance of predators (Huber et al., 1989). The predator-prey interactions between bats and crickets have shaped the evolutionary adaptations forming the unique auditory system of crickets. Observational studies have concluded that crickets typically initiate flying activity at night and are preyed upon by bats (Ulagaraj, 1975; Jacobs & Bastian, 2016). While hunting, bats utilize echolocation via high-frequency ultrasonic sounds to identify the location of crickets in complete darkness (Jacobs & Bastian, 2016). In response to the high-frequency pulses generated by bats, crickets turn away from the sound stimuli in an attempt to fly away from predators (Moiseff et al., 1978). This behavioral response is known to be negative phonotaxis.

To produce effective behavior, the cricket auditory system displays rare neuronal regeneration in adults that allows them to recover their behavioral response post-injury. Prior to injury, cricket auditory neurons are confined to one side of the prothoracic ganglia (PTG) midline, sending auditory signals from one side of the body to the same side of the brain. Crickets that are deafferented— removing the foreleg containing the cricket auditory organs —lose synaptic connections that allow for the relay of signals from the ear to the brain (Horch et al., 2011). This neural degeneration significantly impairs neural communication, affecting crickets' behavioral response and survival. However, past research in the Horch lab has identified the *semaphorin1a.2* (*sema1a.2*) protein as a possible molecule involved in the regrowth of neurons across the midline post-injury, which in turn helps crickets recover their behavioral response.

This project sought to correlate the axon guidance nature of *sema1a.2* with a unique cricket behavioral response to predatorial sound stimuli. Over the course of this summer, I worked to analyze extensive past data obtained in the Horch Lab. Crickets analyzed in this data were 7^{th} instar larval stage crickets injected with double-stranded RNA

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