Investigating physiological sexual dimorphism in reorganization rates of injured auditory systems in the Mediterranean field cricket, Gryllus bimaculatus
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Audition is a critical process for crickets because it allows them to detect bat echolocation calls and avoid bat predation. Crickets use their auditory systems to gain a sense of the direction and distance from which the bat echolocation call is coming. The auditory system of the cricket begins at the tympanal membrane of the foreleg. Sound stimuli activate auditory sensory neurons, which subsequently send action potentials through Nerve 5 (N5) to the prothoracic ganglion. N5 projects to the midline of CNS from the ipsilateral side and forms synapses with auditory neuron 2 (AN2) dendrites on that side. Once AN2 dendrites receive auditory input from N5 afferents, action potentials are generated. This input is sent through AN2 axons and up to the brain, alerting the cricket of the sound (Counter, 1976). Any physical injury to the foreleg has the potential to disrupt auditory functioning and prevent such avoidance. However, many crickets injure a foreleg and subsequently lose this ability. The Horch lab investigates the molecular underpinnings of what happens following foreleg injury (Horch et al., 2009). After injury, AN2 on the injured side crosses the midline and forms synapses with the dendrites of N5 on the intact side (Brodfuehrer and Hoy, 1988). Pfister and colleagues (2013) determined that this compensatory reorganization changes over time and in a sexually dimorphic manner. About three days after injury, the AN2 dendrites that had previously synapsed to the ipsilateral N5 cross the midline and extend to the region where N5 axons terminate. Females displayed robust dendritic sprouting between three to five days after injury and then plateaued, whereas males demonstrated a more linear rate of sprouting that eventually surpassed females (Pfister et al., 2013).

I spent this past summer investigating whether there is a similar physiological sexual dimorphism that correlates with the morphological sexual dimorphism. Adult male and female cricket forelegs were removed, which leads to unilateral deafferentation of AN2. Male and female crickets three days after injury and eighteen to twenty days after injury were used for the recordings. I dissected the neck cavity of these crickets to expose the neck connectives through which AN2 projects. I proceeded to desheath the connective to reduce the signal to noise ratio. I then recorded extracellularly from both neck connectives to examine AN2 action potential patterns. The majority of my summer was spent perfecting my dissections and learning extracellular recording techniques. Thus, I do not have conclusive results to present, but I plan to stop practicing and start collecting data from control and experimental crickets during the current academic year.

Works Cited