A Physiological and Morphological Assessment of Toll 6-1 and Toll 7 Involvement in Gryllus bimaculatus Compensatory Plasticity

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Adult organisms have a limited capacity to recover from damage to their central nervous systems (CNS). However, the auditory system of the Mediterranean field cricket, *Gryllus bimaculatus*, demonstrates unique capabilities for neuronal regeneration and reorganization throughout development and into adulthood, providing an effective model system to study adult neuroplasticity. Specifically, the dendrites of central ascending neurons (ANs) in the animal's prothoracic ganglion sprout in response to the loss of auditory afferents. Deafferented dendrites grow across the organism's ganglionic midline boundary, forming specific de novo synaptic connections with contralateral ANs, compensating for the loss of the afferents. However, the molecular mechanisms underlying this anatomical plasticity are largely undiscovered. Recent studies suggest that Toll receptors, a class of transmembrane protein receptors that play crucial roles in innate immune processes, may also influence dynamic processes in the adult CNS of Drosophila melanogaster, including structural plasticity, neurogenesis, axonal growth, and novel synapse formation (Okun et al., 2011). Current research examines whether Toll 6-1 and Toll 7 play compensatory roles in G. bimaculatus. Using dsRNA injections to knockdown the expression of these Toll receptors and using GFP dsRNA as a control for nonspecific effects, we compared the physiological responses and dendritic volume of control and knockdown ANs. The physiological responses from crickets injected with Toll 6-1 were significantly weaker in latency, burst duration, and spike number than those injected with GFP dsRNA. Moreover, GFP control crickets demonstrated increased auditory responses with increasing decibels not observed in Toll 7 knockdowns. Toll 7 dsRNA-injected crickets also showed a potential trend of increased dendritic sprouting compared to their control counterparts. These preliminary data support a dendritic maintenance role for both Toll 6-1 and Toll 7 in the G. bimaculatus auditory system. This project was a continuation of the work conducted by neuroscience honors students and recent graduates, Brooke Asherman ‘23 and Jada Scotland ‘23.

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References

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