Utilizing RNA interference (RNAi) methods to investigate whether the guidance molecule semaphorin-2a is necessary for compensatory dendritic growth in the cricket Gryllus bimaculatus

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The cricket exhibits a highly unusual pattern of compensatory dendritic growth in the adult central nervous system, and serves as an excellent animal model for the study of successful neuronal recovery following injury. In normal crickets, neurons that receive auditory input from one cricket “ear” project up to the brain unilaterally, without crossing the cricket’s “midline.” Removal of an ear by amputation of a foreleg, however, results in neurons crossing over to form new connections with the existing auditory neurons on the opposite side of the body, leading, in turn, to recovery of neuronal function. The Horch lab previously correlated upregulation of sema2a—the gene that codes for a diffusible semaphorin protein in invertebrates— with this compensatory growth. Semaphorins are a class of proteins that have been shown to play a role in dendritic growth in a wide variety of species, working as either a chemoattractant or chemorepellent in guiding growth of dendrites during development. As a result, this study aims to test the hypothesis that sema-2a’s upregulation is necessary for the compensatory growth seen following denervation. Utilizing a method of RNA interference (RNAi) in which double-stranded RNA corresponding to the sema-2a gene is injected into the cricket to induce knockdown of sema-2a, and then comparing dendritic growth in these sema-knockdown crickets following denervation to that seen in control denervates, this study will investigate sema-2a’s causative role in the cricket’s compensatory dendritic growth.

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