Enhancing Auditory System Analysis in *Gryllus bimaculatus* Through Advanced Statistical and Machine Learning Techniques

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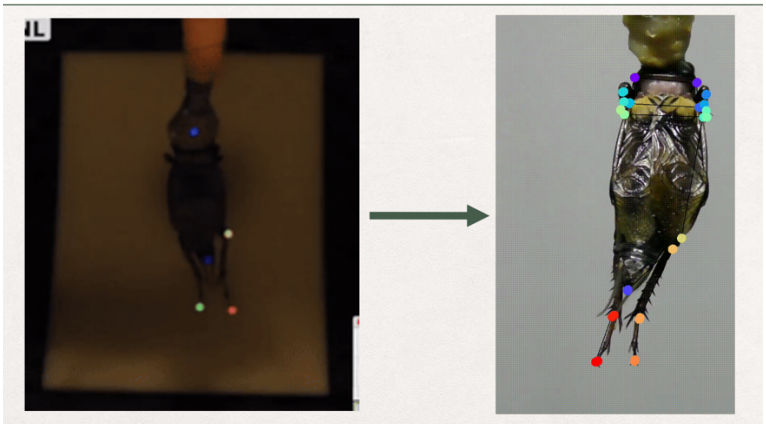
Project Summary

Crickets (*Gryllus bimaculatus*) have a simple yet intriguing auditory system with strong adaptive and regeneration ability called compensatory neuroplasticity. Cricket's ears are located on the joint of their front limbs. In their natural habitat, crickets often get injured and lose their front limbs with their ears as the results of fights between individuals for mating purposes and/or the results of predation from their primary predator, bats. Previous works in the Horch lab found physiological evidence that injured adult crickets were able to adapt to the ear loss and distinguish sound coming from different directions with one ear, and the molecular basis behind such physiological change. However, how does such adaption changes cricket's behavior in their natural habitat is not well thoughted. My research this summer is a continuation of such project, aiming to observe the change in the cricket's behavioral pattern in detail.

This summer specifically, I spend most of my time on upgrading the existing behavioral chamber and draft a protocol that is replicable and delivers consistent experiment result. This is important for behavioral experiments due to it's innate high variability, hence any reduction in random effect caused by the experimenter/equipment would significantly increase the robustness of the conclusion drawn from the experiment. The upgraded equipment now have consistent recording parameters, and better image quality for subsequent analysis with machine learning technique, as shown in the figure attached below.



Moving forward, as a part of my honors project, I would continue with data analysis using machine learning libraries like DeepLabCut and statistical software in R and Python to compare the behavioral pattern difference of uninjured and injured adult crickets with mathematical rigor, aiming to unveil the minute change in behavior, and ultimately highlight the evolutionary significance of cricket's unique compensatory neuroplasticity.

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