Poster Session 2

MGH 206, Easel 175

1:00 PM to 2:30 PM

Olfactory Learning and Memory in the Mosquito *Culex quinquefasciatus*

Elizabeth Rylance, Senior, Neurobiology
UW Honors Program
Mentor: Jeffrey Riffell, Biology
Mentor: Gabriella Wolff, Biology

Mosquitoes primarily navigate using their olfactory system, and can use this system to form "memories" that influence their choice in hosts. When a mosquito encounters an odor, information is sent through the antennal lobes in the brain to the mushroom bodies, which are structures responsible for learning and memory consolidation. This odor-learning pathway is mediated by neurotransmitters like dopamine and serotonin. Recent research has shown that the mosquito *Culex quinquefasciatus* has extremely low levels of dopamine in the antennal lobes compared to other species, and is unable to learn to avoid odors associated with a negative response. This led us to predict that dopamine is essential for aversive learning in mosquitoes. We hypothesized that *Cx. quinquefasciatus* differed from other mosquitoes in learning ability because they were previously tested in the light and they are the most nocturnal of the originally tested species. To test this hypothesis, we conditioned the mosquitoes in the absence of light in an aversive learning paradigm to measure how frequently they chose to avoid the conditioned odor. An inability to learn regardless of light condition would indicate that the role of dopamine as a neuromodulator in the antennal lobes evolved partly to allow diurnal mosquitoes to avoid defensive hosts. Next, specific neurotransmitters in the antennal lobe were mapped using confocal microscopy, revealing their concentrations which may explain behavioral differences from other mosquitoes. Most mosquito species show some plasticity in host selection, which can lead to the transmission of animal diseases, like West Nile Virus, to humans. Mosquitoes are the world's deadliest disease vector, killing over 700,000 people globally each year, so understanding how and why this adaptation occurs can help us understand the framework that underlies the spread of mosquito borne diseases and bring us one step closer to solving this global issue.

Poster Session 4

MGH 206, Easel 172

4:00 PM to 6:00 PM

Evolution of Insect and Crustacean Learning and Memory Brain Structures

Mina Liao, Junior, Biology (Molecular, Cellular & Developmental)
Mentor: Gabriella Wolff, Biology

Mushroom bodies are paired structures in the brains of invertebrate phyla. They are characterized by densely packed neurons that are essential for facilitating learning and memory. Previous research using anatomical observations and immunohistology on mushroom body-like structures across arthropod species supported genealogical correspondence over convergent evolution of these learning and memory centers. The data collected so far, however, lacks representation from certain taxa, namely the crustaceans. To continue gathering evidence to further support or refute genealogical correspondence of mushroom bodies, we will examine neuroanatomical features as well as the presence of proteins required for learning and memory formation in a class of crustaceans called the malacostracans. Protein kinase A catalytic subunit alpha (PKA-Cα) is one such protein that is highly conserved in amino acid sequence and in learning and memory function across insects and mammals. Its conserved nature makes it a useful indicator for mushroom body homologs across phyla as its expression is known to be enhanced in mushroom bodies. We will be utilizing antibodies raised against PKA-Cα on brains of crustaceans closely related to insects in order to reveal structures that may genealogically correspond to mushroom bodies. Evidence suggesting that mushroom bodies are linked through homology would be supported if paired brain structures of crustaceans in multiple lineages are found to resemble mushroom bodies in morphology and protein expression patterns. By identifying mushroom body-like centers across invertebrates, we are able to make a comparison of the structures in context of the sensory environments of each animal in hopes of understanding the role of mushroom bodies in the evolution of learning and memory.