Online Proceedings

SESSION 1C

SENSORY INTEGRATION, LEARNING, AND MOTOR CONTROL IN ANIMAL AND HUMAN MODELS

Session Moderator: Horacio de la Iglesia, Biology
MGH 231
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Multimodal Integration in the Disease Vector Mosquito, *Aedes aegypti*
Kennedy Tobin, Senior, Neurobiology
Mary Gates Scholar, UW Honors Program
Mentor: Jeffrey Riffell, Biology
Mentor: Clement Vinauger, Biology
Mentor: Chloe Lahondere, Biology

Mosquitoes transmit diseases that affect millions of people each year. As such, there is an urgent need to explore every avenue to develop efficient tools to control them. In this context, my project aims to better understand their host-seeking behavior by exploring how visual and olfactory stimuli affect the mosquito's flight response. In the Zika and yellow fever vector, *Aedes aegypti*, exposure to CO_2 triggers a strong attraction to visual features. However, the temporal and spatial features of this olfactory-gated visual response are still unknown. For my project, I seek to dive deeper into the characterization of this phenomenon. Specifically, I am interested in determining how long the effect of CO_2 lasts, and to what extent this effect is a function of the size and shape of the visual stimulus. To investigate these factors, I utilized a flight LED arena in which a tethered mosquito was presented visual stimuli and CO_2 pulses delivered at different time intervals. I recorded wingbeat frequency and amplitude, torque, head angle, and leg movements while producing 16 distinct sensory scenarios in which the size of the visual stimulus, and the timing between the delivery of pulses of CO_2 and the visual stimulus were manipulated. From this dataset, I will be able to extract the fine scale behavioral flight response to these unique sensory combinations, deepening our understanding of the complex interplay between visual and olfactory stimuli in mosquito host-seeking behavior. These results bear the potential to lead to the improvement of mosquito control strategies that target their behavioral responses to visual and olfactory stimuli.

POSTER SESSION 2

Commons West, Easel 21
1:00 PM to 2:30 PM

Gait Assessment in Wild Type and *mdx*^4cv Mice
Indu Tejasa Vanteru, Junior, Pre Engineering
UW Honors Program
Mentor: Jeffrey S Chamberlain, Neurology
Mentor: Katrin Hollinger, Neurology

Duchenne Muscular Dystrophy (DMD) is an X linked, recessive genetic disease caused by mutations in the dystrophin gene. The disease is characterized by progressive muscle degeneration. Dystrophic mice (*mdx*^4cv) are a DMD animal model. Here, we compared *mdx*^4cv and WT mice to quantitatively assess motor performance. We hypothesized that the *mdx*^4cvmice would show differences in gait compared to WT as a result of muscle weakening. To test our hypothesis, mice were assessed at 1.5, 3 and 6 months of age using the Noldus CatWalk XT system to analyze gait. The mice voluntarily moved across an enclosed walkway on a backlit glass plate. The prints were captured by a camera and later analyzed using the CatWalk software. Our results show that there are significant differences in gait between the WT and *mdx*^4cvmice. The *mdx*^4cv mice were slower to cross the runway than WT at 1.5 (*mdx*^4cv: 3.60.8s WT: 2.80.5s) and 3 months (*mdx*^4cv: 3.80.9s, WT 2.51.2s). The distance between the front paws of the *mdx*^4cv mice were wider than WT at 1.5 months (*mdx*^4cv: 3.60.8cm WT: 2.80.5cm), 3 months (*mdx*^4cv: 3.80.9cm WT: 2.51.2cm) and 6 months (*mdx*^4cv: 1.50.2cm WT: 1.20.2cm). Print position is the distance between the position of the hind paw and the position of the previously placed front paw on the same side. In *mdx*^4cv mice the print position was larger than WT at 1.5 (*mdx*^4cv: 1.30.8cm WT: 0.40.2cm) and 3 months (*mdx*^4cv: 1.40.8cm WT: 0.50.4cm), indicating that the hind leg moved a shorter distance in a single stride. The gait analysis assay can be extended to assess gene therapy based treatments that our lab is currently developing. This will allow us to determine if the treatments are successfully able to mitigate the effects of DMD.

POSTER SESSION 3

Balcony, Easel 111

2:30 PM to 4:00 PM

The Effect of Removing the Egg Jelly Layer of *L. pictus* Eggs on Chemoattractant Release over Time

Shukri Muhyadin (Shukri) Salad, Senior, Biology (General)
Mary Gates Scholar
Mentor: Yasmeen Hussain, Department of Biology
Mentor: Jeffrey Riffell, Biology

My research sought to study the effect of removing the egg jelly layer from the eggs of the sea urchin species *Lytechinus pictus*, on chemoattractant release. Sea urchins are broadcast spawners, meaning the males and females of the species release their sperm and eggs into the water to independently find each other and form zygotes. *L. pictus* eggs release a chemoattractant peptide called speract, which binds to receptors on sperm cells in order to guide their movements toward the eggs. Little is known about the mechanism of release or the site of production for these peptides. The purpose here was to further illuminate the egg jelly layer's role in speract release. I removed the egg jelly layer in order to identify if the attractant is actively released from the egg, or simply stored in the egg jelly layer. To do this, I quantified the concentration of speract released from eggs that had their egg jelly removed and compared this to eggs with intact egg jelly as a control, both from the same female, over the course of half an hour. I used column chromatography to purify the peptides released from artificial sea water and high performance liquid chromatography (HPLC) to identify the specific peptides present. The results showed that lack of a jelly layer lowered the absolute concentration of speract but did not significantly change the rate of chemoattractant release. Understanding the workings of an important factor in fertility can give insight into urchin species' reproduction, biodiversity and evolution.

POSTER SESSION 4

Commons West, Easel 15

4:00 PM to 6:00 PM

Crowd Sensing: A Mobile Platform for Pollutant Detection

Ting Yu (Jacky) Wang, Senior, Electrical Engineering
Eric Joseph (Eric) Berquist, Senior, Electrical Engineering
Kevin Oktavian, Senior, Electrical Engineering
Mentor: Eli Shlizerman, Applied Mathematics and EE
Mentor: Jeffrey Riffell, Biology

Real-time quantification of pollutants in urban and non-urban environments has far-reaching prospective benefits for our society. Such a possibility could provide instantaneous detection of hazardous chemicals, identification of areas that require air quality restoration, or estimation of agricultural effectiveness. However, currently dynamic and efficient platforms to perform quantification do not exist and only a few static sensors are deployed in sparse locations. While several mobile devices have been constructed, they are typically large, expensive and imprecise. In our project, we address this problem by building inexpensive, mobile multi-sensor devices. Each of these devices was designed to support an array of inexpensive sensors that measure the surrounding air quality and send the information in real-time to either a mobile phone or server-side application. We designed the device such that all the parts are of the lowest cost and least energy consuming as possible. To enhance the reading performance of the device, we are implementing a neural network, based on the insect olfactory system, to calibrate, recognize, track and learn signatures of scents. Early experiments show that the neural network is capable to discriminate and track more precise values of contaminants, and we are currently working on integrating sensor data from multiple devices to show the quantification of pollutants on a heat map. Overall, this project showed many possible ways to make air quality data useful and accessible. It is expected that the scale of this project can be increased by increasing the number of deployed devices such that more data can be obtained and used to train the neural network while more communities can be informed about their surrounding air quality.