Online Proceedings

POSTER SESSION 2

MGH 206, Easel 171

1:00 PM to 2:30 PM

Using Optogenetics to Induce Grooming Behaviors in *Drosphila melanogaster*

Leyssandra (Wesley) Gaskill, Senior, Physics: Biophysics, Mathematics (Philosophy)
Mentor: John Tuthill, Physiology and Biophysics
Mentor: Anthony Azevedo, Physiology and Biophysics

In fruit flies (*Drosophila melanogaster*), grooming is an innate behavior comprised of sequential movements of particular legs over specific regions of the body. However, we know little about the neural circuits that control the locations, durations, or behavioral transitions of grooming. We sought to identify neurons in the central nervous system that control these aspects. To investigate this, we used optogenetics, which involves expressing light sensitive ion channels in defined neurons, allowing us to activate them with red light. We then recorded videos of the flies as we stimulated them with red (625nm) light for various durations (0.5, 1, 5 seconds). Finally, we manually annotated the videos by assigning binary tags to specific behaviors and aggregated the results to see trends across flies. We were able to identify neurons in the brain that influenced head grooming, neurons in the ventral nerve cord that influenced hind leg grooming as well as additional neurons that influenced other behaviors. Identifying these neurons opens up new opportunities to dissect neural circuits controlling grooming behaviors and, in the future, to understand how these circuits interact to control sequential behaviors.

POSTER SESSION 2

Commons West, Easel 10

1:00 PM to 2:30 PM

Development of an Advanced Water Sensor Using Carbon Nanotube Enriched Cellulose Papers

Sydney Fry, Senior, Bioresource Science and Engr: Business
Mentor: Anthony Dichiara, Bioresource Science & Engineering
Mentor: Kurt Haunreiter, Bioresource Science and Engineering

Paper has been utilized for centuries by humans for writing, printing, and packaging. It has properties of being flexible, biocompatible, and biodegradable which make it a valuable low cost and environmentally friendly alternative to petrochemical-based materials for applications in robotics, electronics, and microfluidics. In particular, electrically conductive materials, which possess the merits of minimal weight and good processing ability, can be integrated into the manufacturing process of structural parts, allowing the implementation of a sensor function. By mixing multi-walled carbon nanotubes (MWCNTs), sheets of hexagonally packed carbon atoms rolled into concentric seamless cylinders, with insulating cellulose fibers, we were able to produce a conductive paper that retains its strength and exhibits sensitive resistive changes when exposed to water and humidity. The fabrication process was based on traditional papermaking methods and included the refining of unbleached softwood Kraft fibers, the suspension of cellulosic fibers in MWCNT–cationic polymer mixtures, and the filtration, pressing, and drying of the resulting pulp to prepare handsheets with grammage of 60 g/m$_2$.$Theas - preparedMWCNT - -cellulosecompositepaperswereanalyzedbyelectronmicroscopyandt$
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POSTER SESSION 2

Commons West, Easel 11

1:00 PM to 2:30 PM

Strain-Dependent Electrical Resistance of Carbon Nanotubes–Cellulose Composite Papers

Zoie Tisler, Junior, Bioresource Science and Engineering
Mentor: Anthony Dichiara, Bioresource Science & Engineering
Mentor: Kurt Haunreiter, Bioresource Science and Engineering

For 4,000 years, paper has served the purpose of recording information and in this work, it's uses are being expanded upon. Within the advancing field of flexible electronics and wearable devices, paper has recently been investigated as an environmentally friendly alternative to the traditional petrochemical-based polymeric materials. In this work, carbon nanotubes (CNTs) were employed as fillers to produce electrically conductive papers using a universal papermaking

process. Lignin, an underutilized byproduct of the pulp and paper industry typically treated as a waste and burned for energy recovery, was utilized as a renewable surfactant to prepare aqueous dispersions of CNTs and softwood fibers, which served as precursors for the manufacturing of conductive paper (60 g/m^2). CNTs were functionalized to increase the presence of hydroxyl groups and further improve the interfacial strength between CNTs and cellulose fibers through hydrogen bonding. The microstructure of the CNT–cellulose composite papers was analyzed by electron microscopy and Fourier transformed infrared spectroscopy. Both tensile strength and internal bonding of the papers greatly increased with CNT loadings as low as 2.5 wt%, and the volume resistivity was in the range of 1.5 kΩ.cm. The piezoresistive behavior of the composites revealed through examination that the relative resistance first increased linearly at low strains followed by an exponential growth at larger strains. When employed as a stress/strain sensor, the conductive papers exhibited higher sensitivity compared to conventional strain gauges. These novel CNT-cellulose composite papers have outstanding multifunctional properties that can revolutionize the way smart materials and electronic devices are manufactured and used.

POSTER SESSION 2

Commons West, Easel 12

1:00 PM to 2:30 PM

Chehalis River Basin 2016 Phytoplankton Study

Alexander (Alex) Islas, Sophomore, Forestry, Grays Harbor Coll
Mentor: Anthony Odell, Olympic Natural Resources Center, SEFS, Olympic Region Harmful Algal Bloom Monitoring Program
Mentor: Amanda Lyn Gunn, Science and Math Division, Grays Harbor College

The phytoplankton assemblage around the Olympic region is well described, but due to the various hydrologic and oceanographic features that affect water conditions, little is known about the phytoplankton assemblage in the Chehalis River Basin. This research seeks to provide an outline of common species of different locations, the environments in which they were found, and the obstacles that block their movement. To do this, sampling sites around the basin that would cover various different geographic features of the Chehalis River Basin were selected, along with the phytoplankton sample, salinity and temperature were taken, and wind direction and strength were taken to determine if an upwelling or downwelling phase could be predicted. When back at the lab, toxin and chlorophyll samples were filtered for future analysis and saved. Microscopy was performed to identify species, if a harmful algal bloom species was identified, a whole water cell count was performed. Species that were found ranged from freshwater to marine; however, frequently species that are marine were found in low salinity environments. These results can be used to identify locations of interest in further studies and could be used to identify areas that may be useful for shellfish harvesting.