Undergraduate Research Symposium May 18, 2018 Mary Gates Hall

Online Proceedings

Poster Session 1

Commons East, Easel 77

11:00 AM to 1:00 PM

The Effect of Reversed Rotation on Earth's Climate

Mason Aaron Friedman, Senior, Atmospheric Sciences: Meteorology
Mentor: Dargan Frierson, Atmospheric Sciences
Mentor: Rachel White, Atmospheric Sciences

Using a climate model, we changed the Earth's rotation direction from counter-clockwise to clockwise, keeping the period of 24 hours the same. The purpose of this experiment was to better understand how various climate variables are affected by Earth's rotation. The results give insight into patterns of today's climate, and help to frame discussion of future climate changes. The model used was GFDL CM2c, a course climate model that utilizes coupled ocean-atmosphere physics. The model was run for a 100-year control simulation, followed by a 700-year reverse rotation simulation. Model output revealed drastic changes in many of Earth's climate variables. The main effect was that atmospheric flow pattern switched directions, with westerlies becoming easterlies, and vice versa. Because of this, ocean currents switched to opposite sides of ocean basins and there was a new distribution of sea surface temperature. As a result of these changes, global precipitation and temperature patterns were greatly affected. Some dry areas, such as the Sahara Desert, were now wetter, and some wet areas, such as the southeastern U.S., were now deserts. Albedo and ice coverage increased in the Northern hemisphere, possibly due to the ocean circulation changes. Unexpectedly, the thermohaline circulation weakened significantly in the Atlantic Ocean while a similar circulation developed and strengthened in the Pacific Ocean. These results are fascinating and important for testing current knowledge of the climate system.

Poster Session 1

MGH 206, Easel 165

11:00 AM to 1:00 PM

A Neurostructural, Neurochemical, and Genetic Analysis of the Pathogenesis of Autistic Spectrum Disorder

Melissa L (Melissa) Howerton, Junior, Extended Pre-Major, UW Bothell
Mentor: Bryan White

Autistic Spectrum Disorder (ASD) is a heterogeneous disease characterized by varying degrees of social dysfunction. Several studies by the CDC show that 1 in 68 children in the United States are affected by ASD, this number could be 1 in 45 according to the newest studies by various government resources. So far pharmacological treatments are not effective in most cases, only treating a few symptoms at best rather than the whole. Several theories exist for the pathogenesis of ASD; however, much is still unknown despite multiple studies. Investigators often tend to research the pathology of ASD based primarily within their scientific discipline, and we feel this narrow view limits a deep understanding of the disorder. This literature review explores neurostructural, neurochemical, and genetic disciplines, synthesizing an overall hypothesis of the pathogenesis of the disease. Specifically, we explore specific groups of genes known to have a causal effect in ASD and focus on how they might interact to produce the disorder. We analyze these genes to see how they affect different neurotransmitter systems and impact different structures of the brain. We are restricting our database search using terms such as "genes", "synaptic transmission", "brain areas" and "homeostatic/compensatory mechanisms" associated with ASD. The literature suggests that genetic aberrations in ASD are quite numerous and cause cascading effects throughout the brain, affecting synaptic transmission in many regions. Our analysis suggests that ASD is a polygenetic disorder where numerous small changes in protein function occur in multiple brain regions. Homeostatic and compensatory mechanisms cannot correct these cellular and connectivity deficits, and ASD develops. We hope this review helps researchers take a broad view of the various genes, neurotransmitter systems, and anatomical structures implicated in ASD as they embark on future studies.

Poster Session 2

Commons East, Easel 76

1:00 PM to 2:30 PM

Baseline Characterization of Testes Co-Culture System
Youjun Suh, Senior, Biochemistry
Elijah Marsh Jung, Senior, Biology (Molecular, Cellular & Developmental)
UW Honors Program
Joan Lee, Junior, Public Health-Global Health
Mentor: Elaine Faustman, Environmental & Occupational Health Sciences, Institute for Risk Analysis and Risk Communication
Mentor: Sung Woo Hong, Environmental & Occupational Health Sciences
Mentor: Collin White, DEOHS
Mentor: Ji Hyun Lee, DEOH

As demand for accurate evaluation of chemicals and their potential to cause effects on humans increases, we have designed in vitro methods to facilitate such assessments. However, models of in vitro cell cultures are limited in their approach typically using a monoculture of limited cell types. Using a 3 dimensional organotypic approach to culture multiple cell types more reflective of a functioning organ can provide a framework for evaluating systematic interactions minimizing the need for in vivo assessment. We utilized a novel organotypic, in vitro model of testicular development that mirrors the development shown by in vivo studies. Our baseline study isolated testes that were harvested from C57BL/6 male mice on post-natal day 9. Testicular co-cultures were maintained for up to 16 days in 24 well plates with data collections occurring at days in vitro (DIV) 3, 7, and 16. Plates were stained with antibodies providing markers that correspond to morphological features of specific cell type markers. Five different primary antibodies were used as markers to visualize the change in cell populations. Markers for Sertoli cells corresponded to Vimentin, Leydig cells with 3b-HSD, Germ cells to DAZL and c-kit, and proliferation with PCNA. For each well, we used an immunofluorescence dual staining technique with Scanning Laser Image Cytometery (iCys) to observe the percentage of cell types and to determine change in phenotypic distribution of the cell population. From our preliminary observations, we were able to observe changes in Sertoli cells, Leydig cells and Germ cells throughout testicular development. Future studies would further develop and confirm the population and morphological changes observed with the testicular cell cultures. With a baseline model created, this in vitro model can be used to test the lethality of chemicals without the need of in vivo alternatives.

SESSION 2F

PLANT FORM AND FUNCTION: FROM MOLECULES TO FOSSILS

Session Moderator: Caroline Stromberg, Biology
MGH 242
3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

***Arabidopsis thaliana* F-box Proteins Interact with 14-3-3 Proteins in the Ubiquitin 26S Proteasome System**
Ryan Apathy, Recent Graduate, Biochemistry, University of Puget Sound
Mentor: Bryan Thines, Biology, University of Puget Sound

It is critically important that eukaryotic cells possess the capacity to undergo intracellular change in response to both internal and external cues. *Arabidopsis thaliana* F-box (FBX) and 14-3-3 proteins are two distinct protein families that regulate intracellular change and have important roles in regulating responses to environmental stress. FBX proteins are variable substrate adaptors within the Ubiquitin 26S Proteasome System (UPS), a system the selects proteins to be degraded by the 26S proteasome using selective ubiquitylation. 14-3-3 proteins recognize and bind unique phosphorylated residues in client proteins to regulate subcellular localization, inhibit protein interactions, and act as a scaffold to facilitate protein interactions. Thus, these two protein families independently have the ability to drastically alter cell physiology. 14-3-3 proteins have been shown to interact with components of the Ubiquitin 26S Proteasome System in only a few instances, including their interaction with the F-box protein F-BOX STRESS INDUCED 1 (FBS1). However, the biological consequences of this FBS1:14-3-3 interaction are completely unknown. FBS1 belongs to a four-member FBX protein family, along with FBS2-4, and we hypothesize that 14-3-3 proteins more broadly interact to at least regulate this family of four proteins. A Yeast 2-Hybrid assay has been employed to test for interactions between FBS1-4 and five of thirteen different 14-3-3 proteins. Full length and truncated constructs are currently being tested to probe the extent of interactions between these two important protein families. Interaction between multiple members of these two important protein families could point to a more broadly used scheme in regulating intracellular events in plant cells.

SESSION 2H

CENTERING OUR VOICES

Session Moderator: Ralina Joseph, Communication
MGH 251
3:30 PM to 5:15 PM
* Note: Titles in order of presentation.

Analyzing the Correlation between Active Learning Practices and Positive Student Outcomes in Introductory Biology
Catherine Pham, Senior, Biology (Bothell Campus), Health Studies (Bothell)
Mentor: Bryan White

There is an ongoing movement to improve undergraduate biology courses by elevating student learning beyond rote memorization toward thinking about science as experts do. Previous research indicates that most students leave introductory biology with novice-like perceptions of science. We hypothesize that these scientific ways of thinking can be cultivated in an active learning environment where students take ownership of their learning, and instructors question and facilitate understanding rather than dispense knowledge. In addition, there are no delineations of paradigms of active learning that optimize student learning. In our project, we asked whether student attitudes and expert-like thinking improved throughout an introductory biology course at UW Bothell. In addition, we analyzed the active learning practices in this course to see if these practices correlate with improving student attitudes. During the first and last weeks of class, students voluntarily completed the CLASS (Colorado Learning Attitudes about Science Survey), a 32-piece questionnaire developed by educators at the University of Colorado Boulder inquiring about enjoyment, real-world connections, problem solving and conceptual understanding in biology. We coded results using a published tool, with pre and post data separated for comparison. Classroom lectures were recorded using Panopto, and sessions will be evaluated using PORTAAL (Practical Observation Rubric to Assess Active Learning), a tool that allows for the assessment of the extent of active learning in the curriculum. With this data, we will be able to gauge the effectiveness of active learning methods in an introductory biology class and see if they correlate with a transition towards expert-like perceptions of biology. It is our hope that with this data, these pedagogical techniques can be refined and adopted more widely in academia to help all students succeed in biology.

POSTER SESSION 4

Balcony, Easel 104
4:00 PM to 6:00 PM

Using Concept Mapping to Identify Influencers of College Student Vaccination Behavior
Joshua Bryce (Josh) Scheck, Senior, Biology (Molecular, Cellular & Developmental), Political Science
Mary Gates Scholar
Mentor: Mersine Bryan, Pediatrics

Vaccine hesitancy, or negative beliefs and attitudes about vaccines, is a key driver to under-immunization in the United States, which can lead to an increase in vaccine preventable diseases (VPDs). Although adolescents are among the populations at risk for VPDs, little research focuses on vaccine beliefs and vaccine hesitancy in this age group, especially college students. College students have both greater independence and increased autonomy in healthcare decisions including the decision to receive HPV, Tdap, Flu, and meningococcal vaccinations. However, only a small percentage of college students receive all the recommended vaccines. The purpose of this study is to explore and identify factors that influence college student's perceptions about vaccine safety and reliability using cluster mapping. We enrolled 65 current undergraduate college students from the University of Washington, who are between 18 and 23 years old. Participants generated statements about factors that influence college student's perceptions about vaccine safety and reliability. These statements were linked and ranked using Concept System's software (Concept Systems, Inc., Ithaca, NY), and the resulting data was used to generate a cluster map, which was interpreted in focus groups. 25 students participated in generating statements and were 56% female, 44% Caucasian, and have an average age of 19.8 years. After eliminating redundancy, the open ended question yielded 102 unique responses. Examples include: "affordability of vaccinations" and "social media". For the next stage, 25 participants who were 48% female, 52% Caucasian, and have an average age of 19.75 years grouped these statements into clusters. Participants on averaged created 7.5 clusters, which included cluster titles such as: "personal beliefs", "vaccine accessibility", and "media about vaccines". The generated cluster map will provide researchers with invaluable insights that may aid in the development of interventions and may help achieve our long-term goal of increasing vaccine uptake among college students.