Undergraduate Research Symposium May 18, 2018 Mary Gates Hall

Online Proceedings

Poster Session 1

MGH 241, Easel 142

11:00 AM to 1:00 PM

Shining the Spotlight on Spinal Cord Injury: Generating Neuronal Activity using LEDs to Enhance Synapse Formation

Kirsten Puanani Gilchrist, Senior, Neurobiology
Mary Gates Scholar, UW Honors Program
Mentor: Steve Perlmutter, Physiology and Biophysics

Spinal cord injuries cause damage to the corticospinal tract which can lead to deficits in coordination and movement. This greatly alters and may decrease an individual's quality of life. This project utilizes optogenetics to trigger action potentials in neurons, and tests the hypothesis that activity can promote regeneration of corticospinal connections. Co-cultured mouse spinal and cortical neurons serve as an in vitro model system. The spinal and cortical neurons are in separate chambers that are connected by a canal. Cortical cells are transfected with light- activated channels and stimulated with LED lights to trigger action potential firing. The canal connecting the chambers allows for the cortical neurons to form new synapses with the spinal neurons. In order to quantify the results, synapsin, a protein found in presynaptic vesicles, is labelled using immunocytochemistry, allowing us to quantify the number and size of synapses by measuring synapsin-positive puncta. It is expected that cells stimulated with light will show a greater number of synapses compared to those that were not. Different patterns of neuronal stimulation are tested to determine the best parameters for promoting synapse regeneration and strengthening. Once these have been determined, they will be validated in an in vivo rodent model, prior to testing in primates.

Poster Session 2

Commons West, Easel 21

1:00 PM to 2:30 PM

Using Linguistic Knowledge to Resolve Ambiguity in Speech Perception When Hearing is Degraded

Siuho Gong, Senior, Speech and Hearing Sci (Com Disorders)
Mentor: Matthew Winn, Speech & Hearing Sciences
Mentor: Steven Gianakas

Sometimes speech sounds (phonemes) can be ambiguous, and people have a tendency to interpret the ambiguous phoneme differently in different contexts so that they perceive a real word, as opposed to a non-word. This effect is called "lexical bias." For example, when there is ambiguity between whether /m/ or /n/ is heard, /m/ is more likely to be perceived if it is followed by "uch," because "much" is a word, but "nuch" is not (and vice versa if the context is "udge"). We hypothesized that for people who have hearing loss or use a cochlear implant, there will be additional ambiguity in hearing speech, and that the lexical bias effect would be stronger. We simulated degraded hearing using vocoded speech played to listeners with normal hearing. Participants heard speech continua that gradually morphed from /m/ to /n/ in the "uch" and "udge" contexts, and either had a clear spectral quality or a degraded spectral quality. Results suggest that the lexical bias is stronger when the speech signal quality is less clear, which is consistent with the hypothesis because of the increased phonemic ambiguity in these conditions. By understanding how signal degradation impacts the perception of phonemes, audiological tests for speech reception can be improved to separately acknowledge the effects of hearing from the adjustments that the listener makes to maintain lexical biases in speech perception.

Session 2I

Pursuing Justice

Session Moderator: Steve Herbert, Geography

MGH 254

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Framing Drug Use: King County's Debate over Supervised Consumption Sites

Medha Raman, Senior, Communication, Law, Societies, & Justice
Jon Michael Schaeffer, Senior, Law, Societies, & Justice, Political Science
UW Honors Program
Mentor: Steve Herbert, Geography

In early 2017, King County Executive Dow Constantine and Seattle Mayor Ed Murray approved a proposal to create the nation's first supervised consumption sites, areas where drug

users can safely consume illicit drugs while medically supervised and without fear of legal repercussions. The proposal planned for two supervised consumption sites, one located within the city of Seattle and the other in another region of King County. In response to these recommendations, opposition began to arise from members of the community, eventually growing into organized movements to ban supervised consumption sites, most notably King County Initiative 27. This study examines the various arguments that groups on either side of the debate are making in order to sway the public on the morally charged issue of supervised consumption sites. Primary data for this study was collected via interviews with key individuals on both sides of the issue. Additionally, this study analyzes community engagement efforts by both campaigns, various sources of media, and international research on supervised consumption sites. Currently, twelve interviews have been completed, along with reviews of media and campaign publications. Arguments from these sources have then been compiled into various "frames," in an attempt to categorize the key assumptions and principles at the heart of this debate. The research draws parallels between claims in attempt to compare and contrast arguments along moral, political, and legal lines. This study outlines the current discussion on this topic in King County and has the potential to serve as a guide for future groups that aim to advocate or develop proposals on this issue.

POSTER SESSION 4

MGH 241, Easel 143

4:00 PM to 6:00 PM

Dose-Dependent Photoreactivation in an Excision-Repair Mutant of *Chlamydomonas reinhardtii*

Nataliia Piestrup, Sophomore, Nursing, Pre-medical, Wenatchee Valley Coll
Jared Harris, Sophomore, Engineering, Chemistry, Biology, Wenatchee Valley Coll
Mentor: Sue Kane, Wenatchee Valley College
Mentor: Steve Stefanides, Biology and Chemistry, Wenatchee Valley College

The purpose of this study was to explore the interrelationship between two major DNA repair systems–photoreactivation, with blue light as an energy source, and excision repair, which uses ATP as an energy source–of *Chlamydomonas reinhardtii*, a single-celled algae, by studying the in vivo efficiency of photoreactivation when the excision repair system was suppressed. Working with a mutant which was completely lacking in excision repair, we found that this strain was also deficient in photoreactivation, as compared to wildtype, at low levels of post-UV visible light treatment, measured by killing on plates. We hypothesized that the level of light intensity might have an impact on the efficiency of the photoreactivating enzyme. Using alkaline agarose gel electrophoresis analysis, we quantitatively evaluated the extent of repair of DNA damage over 24 hours under two different light intensities. We found less damage removal in the mutant under low light intensity, suggesting that a positive correlation does indeed exist between the flux of visible light used in our experiments and the amount of photoreactivation for the mutant. This correlation was not observed in the wildtype. Our work is interesting in the context of human-caused changes to Earth's atmosphere; both photoreactivation and excision repair of DNA damage are present in virtually all organisms studied, including bacteria, fungi, plants and most animals (although not in placental mammals). With the weakening of the stratospheric ozone layer, there is the possibility of increasing solar UV flux to the surface of Earth, with possible negative downstream effects on biological systems. Understanding the functional relationship between these two DNA repair systems could provide information of fundamental importance to ecological and agricultural problems arising from increased solar UV flux to Earth.

POSTER SESSION 4

Commons West, Easel 43

4:00 PM to 6:00 PM

Method Development: Collecting and Measuring Cortisol in Afro-Textured Hair

Tayla Simone Bolden, Senior, Psychology
Mentor: Steven Goodreau, Anthropology
Mentor: Julius Doyle, Anthropology
Mentor: Eleanor Brindle, CSDE

Cortisol, a biomarker of stress, is deposited into blood, skin, saliva, as well as into growing strands of hair. A previously established method for extracting and analyzing cortisol from hair showed that it can serve as a longitudinal measure of psychophysiological stress activity as the hormone is incorporated into the hair strand. While working under a Doctoral Candidate's research on measuring hair cortisol in Black men in the Seattle area, we determined that the prevailing methodology for collecting hair is inefficient in its applications to this group. The current collection method is likely to repel potential Black research participants for many reasons including stylistic concerns as well as their inability to provide adequate volume, resulting in their non-participance. We have developed and standardized an Afro-textured friendly method for hair sample collection, and applied Meyer and Novak's cortisol extraction technique. Where the inefficient method suggests sampling from only the back of the head, our newly developed method collects hair from the entire head and relies upon a homogeneous mixture of the hair to represent an average cortisol output from a single individual. Using traditional statistical computation, we test the validity of this new method by comparing a calculated average of hair from independently measured sections of the head from each par-

ticipant against homogeneous mixtures from the same participants. We hypothesize that there will be no significant difference between our calculated average of independents and the homogeneous mixture. Detecting no significant difference between these groups will serve to validate this collection method.

POSTER SESSION 4

Commons East, Easel 74

4:00 PM to 6:00 PM

Ground Truthing The Drumlin Pressure Gradient Theory on Whidbey Island

Patrick Glenn Milstead, Senior, Earth and Space Sciences: Geology

UW Honors Program

Mentor: Steven Walters, Earth and Space Sciences

Mentor: Terry Swanson, Earth And Space Sciences

Drumlin formation in the Puget Lowland occurs at varying scales ranging from tens of meters to a few kilometers both in length and width. There is no unifying theory to explain drumlin formation, but Boulton (1987) contends that drumlin features comprised of stratified sediment overlain by till, such as those observed in the Puget Lowland, are formed by differential erosion and deposition of a heterogenous, deformable bed. According to Boulton's model, deformable sediment under high ice-pressure, coupled with high pore water pressure, flows around cores of less-deformable sediment. As pressure around the obstruction (i.e. less deformable sediment) increases from the converging ice, the ice starts to erode and deform. Deposition occurs where pore water can drain from the bed, such as into permeable outwash. Till would then accrete incrementally, increasing the drumlins height and length over its development history. Drumlinoid features bisected by wave erosion and channel incision on Whidbey Island provide an excellent opportunity to empirically quantify the thickness of till deposition in relation to position on the drumlin, as well as the underlying sedimentological properties of the substrate units underlying the till. Numerous well logs recorded on drumlinoid features complement the field measurements. A detailed assessment of the drumlin's substrate geology, specifically the thickness of the overlying till will provide important quantitative data relevant to assessing the validity of Boulton's model to explain the formation of larger-scale drumlinoid features in the Puget Lowland.