Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

Online Proceedings

POSTER SESSION 2

MGH 241, Easel 170

12:45 PM to 2:15 PM

Prolactin Levels in Captive Marine Mammals

Lorelei Clark, Sophomore, Biology, Mathematics, Seattle Central College
Mentor: Shawn Larson
Mentor: Angela Smith, Laboratory

In aquariums and zoos across the world marine mammals are among the most popular exhibits. Caretakers strive to provide the least stressful and natural environments for the animals. Analysis of (steroid) hormones in excrement has proven to be an effective, non-invasive method. It allows animal keepers to monitor physiological health associated with reproduction and the stress response in captive animals. Prolactin (PRL) is a non-steroidal, non-tropic peptide hormone most commonly associated with milk production in nursing females. However, it has a multitude of normal physiological functions such as: regulation of the immune system, osmotic balance, angiogenesis, an indicator of parental care (in both males and females), sexual maturity in males, and near-term pregnancy in females. Chronically high or low levels of PRL have been associated with a number of ailments. For instance, impotence reduces the secretion of estrogens and testosterone. To date, no studies have been documented on prolactin PRL levels in captive northern fur seals, (Callorhinus ursinus), harbor seals (Phoca vitulina), or sea otters (Enhydra lutris). Using an enzyme-immunoassay (EIA) kit, previously tested only in human and elephant serum analysis, we investigated PRL levels of several samples collected from captive marine mammals (Northern fur seal blood serum, harbor seal saliva, and sea otter urine/fecal samples). Due to the helical structure of PRL, fecal samples were not expected to survive intact after transit through the digestive tract; therefore, were not expected to produce positive results. Here we report preliminary results of the EIA PRL assay on several different types of samples, as well as several longitudinal samples from the same individual, to show significant changes in this hormone over time. If detectable in urine, fecal matter, and/or saliva, this assay could prove to be a useful non-invasive method for determining health in captive marine mammals.

POSTER SESSION 2

Balcony, Easel 116

12:45 PM to 2:15 PM

Dye-Sensitized Solar Cells Utilizing Porphyrin Dyes

Daniel (Dan) Polking Jr, Senior, Chemistry, The Evergreen State College
Tristan Workman, Senior, Biology, The Evergreen State College
Mentor: Peter Pessiki, Chemistry, The Evergreen State College

Alternative energy sources have been becoming a greater necessity as fossil fuels become higher in demand and pollution endangers the world. Dye-sensitized solar cells have been of increasing interest in the last twenty years as a possible low-cost and efficient alternative to conventional fuel sources. Porphyrins are synthetic analogs of chlorophyll, the molecule responsible for molecular oxygen. Our group has synthesized a number of porphyrins and constructed solar cells using these compounds as the light harvesting pigments necessary to produce energy. Our goal is to determine the change in energy gathering potential and binding capability of the porphyrins to the cells based on the substituent groups bound to the parent molecule. These results will be presented as well as our progress toward optimizing a working dye-sensitized solar cell.

POSTER SESSION 2

Balcony, Easel 115

12:45 PM to 2:15 PM

Investigation into Growth and Lipid Production of Two *Botryococcus Braunii* Strains as Potential Biofuel Feedstock

Alexander (Alex) West, Sophomore, Biology, Computer Science, North Seattle College
Debra Del Castillo, Fifth Year, Biochemistry, North Seattle College
Joanna Qiao Zuo Liew, Senior,
Zeno DeRooy, Sophomore, Chemistry, North Seattle College
Richard W. (Richard) Lee, Junior, Extended Pre-Major
Jennifer Elliott

Mentor: James Patterson, Chemistry, North Seattle Community College
Mentor: Brian Saunders, Biology, North Seattle Community College

Two strains of *Botryococcus braunii* algae were grown in three different sets of conditions to compare growth characteristics and lipid production. One species, UTEX LB 572, was a Race A *Botryococcus braunii* from the culture collection of the University of Texas in Austin. The second species, AC 762, was a Race B *Botryococcus braunii* from the culture collection of the University of Caen, France. UTEX 572 was found to produce two hydrocarbon chain lengths of C:16 and C:18 in a 2:3 ratio respectively. The AC 762 was found to produce hydrocarbons called botryococcenes of chain lengths between C:30 and C:36. The lipid chain lengths of both strains were evaluated by mass spectrometry. The UTEX 572 lipid content was quantified by analytical spectrometry after direct transesterification of the lipid content to biodiesel. The AC 762 lipid content was quantified by a photospectrometry technique developed by UC Berkeley researchers Eroglu and Melis (1985). Cells of both species were harvested during exponential growth phase from 400 mL of growth media and then freeze dried and analyzed gravimetrically. Nine flasks of each species were grown with 3000 lux average light intensity on a 12h:12h light:dark cycle at room temperature averaging 22 C. Three flasks of each species were grown with 1.5% CO2 in BG-11 media, three flasks of each species were grown in BG-11 media with air only and three control flasks were grown in respective carrier medias as those used in the algae collection of origin. Knowledge of the rates at which AC 762 and UTEX 572 produce hydrocarbons as well as the specific lengths and proportions of those hydrocarbons contributes to data needed for comparison of economic considerations in industrial applications.

POSTER SESSION 3

Balcony, Easel 114

2:30 PM to 4:00 PM

Oil Spread Assay

Adrienne M Scott, Sophomore, Oceanography, Biology, Geology, Seattle Central College
Mentor: Shelly Carpenter, Oceanography

Wildlife suffer from many ecological and biological consequences after an oil spill. The use of chemical surfactants to convert oil spills to small droplets has been the source of ongoing debate since little is known about the impacts they have on plants and animals in the ocean. Surfactants are a natural byproduct of many bacteria that are uniquely adapted to the marine environment. Our research assessed surfactant activity of cell free supernatants (CFS) from several cold-adapted bacteria using crude oil. We cultured various bacterial isolates under optimal growth conditions to ensure surfactant production was not missed. Exudates, the chemically benign "leftovers" containing the extracellular surfactants from the bacteria, were extracted from the cultures by gentle centrifugation before filtration of the supernatant through a membrane filter. The oil-spread assay was then used to determine surfactant activity from the exudates of several organisms. CFS was pipetted to the center of a small oil slick and surfactant strength was indicated by the amount of oil displaced. Some organisms with high surfactant ability were identified for further examination as candidates for environmentally viable alternatives to chemical dispersants.

POSTER SESSION 3

MGH 241, Easel 160

2:30 PM to 4:00 PM

Influencing Colorectal Cancer Screening through Health Education

Avigail Galvan, Senior, Biology, Heritage College
McNair Scholar
Mentor: Katherine Briant, Fred Hutchinson Cancer Research Center
Mentor: Beti Thompson, Cancer Prevention Program, Fred Hutchinson Cancer Research Center
Mentor: Genoveva Ibarra, Fred Hutchinson Cancer Research Center

Colorectal cancer is the third most common cancer in the United States; and is also the third for highest mortality rate. About 90% of all Colorectal Cancer (CRC) cases are in people 50 years of age or older. For that reason, colorectal cancer screening tests such as the FOBT and colonoscopy are recommended for everyone over 50. Colorectal Cancer death rates in Washington State go up by age but differ by ethnicity. They are highest in African Americans (27.5 per 100,000), Native Americans (14.8 per 100,000), Whites (14.8 per 100,000), and Hispanics (13.4 per 100,000). CRC has a high chance of being treated successfully if caught at an early stage, with up to 90% of early cancers being successfully treated and/or prevented. In this study, we will ascertain if Hispanics and

Native Americans are more likely to complete a colorectal cancer screening test after getting a tour of the large inflatable colon (CASPER). The colossal colon is a walk-through inflatable replica of the human colon. It illustrates examples of healthy colon tissue, as well as polyps and colon cancer. The study uses a pre/post-test design. Each participant will be asked to complete a brief test. Pre-test questions ask basic questions to assess knowledge about colorectal cancer and attitudes about colorectal cancer screening. A pre-test is completed before walking through CASPER. Post-test questions will ask the same basic colorectal cancer knowledge and attitude questions to see if there is a change after walking through the inflatable colon. Data analysis was done using paired t-tests to assess changes, if any, using Excel. The results show significant changes in participant likelihood to have a CRC screening, CRC knowledge, perceived knowledge, and likelihood to talk to acquaintances about CRC screening. They also show that CASPER is an effective way to educate participant about CRC.

POSTER SESSION 4

MGH 241, Easel 146

4:15 PM to 5:45 PM

Phosphoproteomics of the Epidermal Growth Factor Receptor Pathway in Glioblastoma Multiforme

Darius Fullmer, Sophomore, Biology, Seattle Central College
Mentor: Vineet Sangar

Dysregulation of the Epidermal Growth Factor Receptor (EGFR) pathway has been implicated in 50-60% of glioblastoma multiforme (GBM) tumors. The EGFR signaling network regulates cell proliferation, differentiation, growth, and apoptosis. The binding of an extracellular ligand activates the EGFR molecule, initiating a cascade in which proteins are serially activated and deactivated through phosphorylation and dephosphorylation. This process is time-sensitive: proper function depends upon each protein remaining active for the proper interval. Wild-type astrocyte proteins respond to phosphorylation by tyrosine kinase, dephosphorylating within five to ten minutes. A dysfunction of EGFR resulting in sustained low-intensity activity or over-activity of the EGFR pathway causes distal abnormalities, including the aplastic over-proliferation and aggressive invasion of astrocytes endemic to GBM. A detailed temporal map of signal transduction through various components of EGFR pathway is needed to find the proteins contributing to the deviant cell behavior. To that end, we will create a 7-time point model of the EGFR pathway in GBM. The GBM cell line will be exposed to EGF for various lengths of time starting from 5 minutes through 24 hours. At each time point the phosphorylation status of pathway proteins will be profiled and quantified. This assay is anticipated to yield approximately 500 phosphorylated proteins. We will use high throughput phosphoproteomics strategy, in which quantitative mass spectrometry will be utilized to measure phosphorylation levels of each component of the pathway. Information generated through phosphoproteomics will be overlaid on the computational EGFR network for each time point resulting in seven different EGFR pathway models. We will compare the network at each time point with the other to track the signal transduction through different proteins in the pathway. At the end of this project, we will have seven detailed EGFR networks, which can elucidate the dynamics of signal transduction from ligand exposure to the cell's response through gene activation.

POSTER SESSION 4

Balcony, Easel 109

4:15 PM to 5:45 PM

Heavy Metal Distribution in the Snohomish River Estuary

Mayan Shaw, Freshman, Biology, Everett Community College
Danica Buse

Hannah McCollum, Freshman, Oceanography, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Life Sciences, Everett Community College

Possession Sound is an estuarine system in Puget Sound's northeast arm that is influenced by freshwater input from the Snohomish River. The Snohomish River carries sediments from upriver and deposits them in Possession Sound. Over the past three years, Ocean Research College Academy (ORCA) students have collected sediment samples at specific locations within Possession Sound that are analyzed by Everett Environmental Laboratory for concentrations of various heavy metals: mercury, zinc, copper, cadmium, lead, and arsenic. This area's history of industrial development, including the Asarco Smelter in Everett 1900s, focused our attention on the lead and arsenic concentrations in Possession Sound. The purpose of this research is to discern any changes in concentrations of lead and arsenic observed at three stations within Possession Sound in the last three years. It was hypothesized that the station Buoy would experience greater fluctuations than the other two stations due to its proximity to the Snohomish River. The heavy metal concentrations are expected to be greater in the spring than during the other seasons because of increased river discharge from melting ice in the mountains, which results in increased stirring of benthic sediments. Dolphin 1 is a shallower location near Hat Island that is expected to have similar fluctuations that correlate with ice melt in the spring. Mukilteo is located farther south in Pos-

session Sound, which would lead to a subtler influence from the Snohomish River, if any at all. Other factors that may impact the concentrations of lead and arsenic at Mukilteo include its proximity to the Mukilteo Ferry, a potential source of runoff containing toxins from human sources.

POSTER SESSION 4

Balcony, Easel 110

4:15 PM to 5:45 PM

Marine Bird Distribution during Tidal Stages in Possession Sound

Hannah Toutonghi, Sophomore, Biology, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Life Sciences, Everett Community College
Mentor: Josh Searle, ORCA, Everett Community College

The wintering migration of marine birds in Possession Sound due to tidal influence is a complex and challenging study. Possession Sound provides habitat for the Pacific Flyway migration of marine birds, and the dynamic estuarine environment influences distribution of these birds due to tidal variation. The working hypothesis of this study was that birds were more active feeding during high tides in the morning hours. The data collected for this study was done by land surveys and small vessel trips along transects on North Jetty Island near the Port of Everett. The species of interest included Bald Eagles, Buffleheads, Common Loons, Double Crested Cormorants, Northern Pintails, and Pigeon Guillemots. The status of recovery from the Washington Department of Fish and Wildlife was compared to data collected. Preliminary data suggests that high tides influence the sandy substrate in Possession Sound, which provides optimum feeding grounds for Buffleheads, Northern Pintails, and Pigeon Guillemots as they have been observed more frequently.