UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 20, 2016 Mary Gates Hall

Online Proceedings

Session 1P

Past, Present, and Future: Measurements to Understand Evolution and Climate Change

Session Moderator: Bonnie Becker, Environmental Science (Tacoma)

JHN 111

12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Using Real-Time Polymerase Chain Reaction to Determine Spatial Distribution of Multiple Species of Shellfish

Brenda Smithhisler (Brenda) Tran, ,
Mentor: Bonnie Becker

The success of both wild and cultured shellfish populations is dependent upon recruitment of planktonic larvae. Due to issues of cost, time, expertise and inaccuracy associated with bivalve identification using microscopy, quantitative polymerase chain reaction (qPCR) is being employed to identify and quantify larvae using DNA technology. We are quantifying species-specific abundance and distribution of four commercially important species using novel approaches. Environmental samples were collected via two rounds of in-situ pumping at four locations in intertidal waters in Washington State. Pumping was performed at two depths: near the water surface and above the sea floor and at two times: before sunrise and sunset, in order to determine the spatial and temporal distribution of bivalve larvae. Genetic assays for the Pacific geoduck clam (*Panopea generosa*), Olympia oyster (*Ostrea lurida*), Pacific oyster (*Crassostrea gigas*) and Manila clam (*Venerupis philippinarum*) have been designed. The collected field samples are currently undergoing qPCR quantification using these assays. Results will be analyzed to determine cross-species patterns or species-specific behavior in larval distribution throughout Washington State. This information will provide a comprehensive snapshot of the larvae of multiple shellfish species in Washington. Additionally, this information may further be utilized by hatcheries by providing the best times and locations to plant cultured seeds and substrate and by researchers studying the effects of localized ocean acidification.

Poster Session 2

Balcony, Easel 92

1:00 PM to 2:30 PM

L-selectin, CXCR-4 and VLA-4 Expression and Function Influence Chemotherapy Sensitivity in AML

Yifan Lu, ,
Mentor: Pamela Becker, Medicine

Acute myeloid leukemia (AML) is characterized by uncontrolled proliferation of abnormal immature bone marrow progenitor cells (“blasts”). AML blasts reside in the bone marrow microenvironment via adhesion molecules such as CXCR-4 and VLA-4, which confer protection from chemotherapy in AML. L-selectin is a surface receptor utilized by leukocytes (white blood cells) for rolling on the endothelial lining of blood vessels and adhesion to sites of inflammation. CXCR-4 is a chemokine receptor for stromal derived factor (SDF-1, CXCL12) produced by bone marrow stromal cells. VLA4 is an $\alpha 4 \beta 1$ integrin that mediates adhesion to alternatively spliced fibronectin and cellular vascular cell adhesion molecule 1 (VCAM1). Previous studies in our laboratory and others suggested that expression of CXCR-4 and VLA-4 is associated with prognosis in AML, and L-selectin expression increases with older age in AML patients. The hypothesis of my project is that L-selectin expression level is associated with chemotherapy resistance in AML. We performed experiments on blasts with high vs. low L-selectin surface expression as measured by flow cytometry assessment of mean fluorescence intensity (MFI). We allowed the AML blasts to be attached to plates coated with PSGL-1, an L-selectin ligand, or bovine serum albumin (BSA), a control protein. Then blasts were treated with cytarabine (Ara-C), one of the most active chemotherapy drugs in AML, for 72 hours. Data were collected by manual counting of viable cells, Cell-Titer Glo luminescent viability assay, and flow cytometry for Annexin V, as a measure of apoptosis. Our data showed that PSGL-1 binding protected AML blasts from chemotherapy in 4/15 (27%) of the samples, which had higher L-selectin ($p = 0.05$), lower VLA-4 expression ($p = 0.10$) and higher CXCR-4 ($p=0.11$) surface expression. Therefore, these results suggest that differences in expression and function of L-selectin, CXCR-4 and VLA-4 are associated with chemotherapy sensitivity in AML blasts.

POSTER SESSION 3

Commons West, Easel 36

2:30 PM to 4:00 PM

Olympia Oysters, Connectivity, and LASERS

Jennifer D. (Jenn) Gonzaga, ,
Mentor: Bonnie Becker
Mentor: Megan Hintz

Olympia oysters (*Ostrea lurida*) were historically overharvested to near extinction. Populations have failed to recover naturally leading to a need for active restoration. *O. lurida* provide ecosystem services including filtering water, providing habitat, food, and increasing the overall diversity of the ecosystem. The intent of this research is to determine spatial patterns and connectivity of *O. lurida* planktonic larvae in Puget Sound, WA. We sampled larvae at two depths in the water column and at both ebb and flow tides. Larvae in the water can be sourced back to the natal populations using trace elemental fingerprinting. Trace metals embedded into shell during early life history is representative of the water body where the individual formed its shell. Analysis by Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) will yield results that indicate trace elemental ratios with respect to calcium. This information will be used to analyze the distribution patterns of different source populations of *O. lurida* planktonic larvae in the bay. The big picture of this study is to provide useful information that will aid in restoration efforts.

POSTER SESSION 3

Commons West, Easel 37

2:30 PM to 4:00 PM

Olympia Oyster (*Ostrea lurida*) Larval Abundance from Two Bays in Puget Sound

Axton Kj (Axton) Bullock, ,
Mentor: Bonnie Becker
Mentor: Megan Hintz

The Olympia oyster (*Ostrea lurida*) is a native oyster along the west coast of the U.S. that has been commercially extinct in Puget Sound since the 1940s. Recently they have been the subject of restoration efforts in Washington State. They are a beneficial part of the ecosystem by providing filtration and oyster beds that offer habitat, food, and increased speciation in estuaries. It has been documented that bivalves can travel vast distances of coastline as larvae in their planktonic life stage. This is a valuable stage in the *O. luridia* lifecycle as it is the only time that the oyster is mobile and can contribute to other populations. It is therefore important to track the oyster in its larval planktonic stage to help aid in restoration of the species. Plankton samples were collected from two bays in western Washington. Fidalgo Bay to the north, and Dyes Inlet in Central Puget Sound. Plankton samples were collected at the ebb tide and the flood tide from both locations, as well as from two different heights in the water column, 1m from the surface and 0.5 meter from the bottom of the bay. Samples were collected weekly for 5 weeks. The plankton samples were then hand counted visually using microscopy, and quantified with quantitative, real time PCR for comparison. The results will indicate what the larval oysters are doing at different tides. If higher densities of oysters are found in an ebb tide versus the flood tide, it is predicted that larval oysters are being exported. If the flood tide contains significantly higher densities then at ebb tide, then it is possible that larval oysters are being imported from other estuaries, or are being retained in their natal bay.

POSTER SESSION 4

Commons West, Easel 10

4:00 PM to 6:00 PM

Modeling Fluid and Thermal Properties of Melting Sea Ice

Samuel Mages (Sam) Farley, ,
Mary Gates Scholar
Mentor: Bonnie Light, Polar Science Center
Mentor: Carie Frantz, APL Polar Science Center

As the Arctic warms, understanding the physical processes controlling ice melt will allow us to better understand and make predictions in our changing world. One aspect of the summer melt that is not well understood is the fluid permeability of sea ice. Current permeability tests determine that the ice is permeable, but do not show how permeable. Advanced summer melt ice has a physical structure that is similar to Swiss cheese. With this structure, sea water can penetrate to the interior of the ice sheet. In this project I use Darcy's Law of fluid flow in a porous medium to evaluate the permeability of 3D printed ice core samples, created from CT scans of field samples. Darcy's equation is mainly used to evaluate the flow of water in aquifers, but I believe it can be applied to porous summer sea ice as well. To test if this is a valid application of Darcy's law I will create an apparatus to apply a constant hydraulic head to a 3D printed core. The reasoning behind using printed core samples is that a collar can be printed around edge of the core to prevent side seepage of water, as well as it is a material that will not decay over the course of the test. This test will give me parameters that will be used in a simple computer model for the fluid permeability of sea ice, that would quantify the sea water entering the ice sheet. I expect the results of this experiment to show a new method to evaluating the permeability of sea ice, and the effectiveness of 3D printed cores as a method to evaluate the structure of sea ice. A follow up study of the permeability of summer sea ice would expand on the thermal properties of

the ice.