

## Undergraduate Research Symposium May 20, 2016 Mary Gates Hall

### Online Proceedings

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#### POSTER SESSION 2

Balcony, Easel 115

1:00 PM to 2:30 PM

##### **Production of Valuable Compounds from Methane using Methanotrophic Bacteria as a Biocatalyst**

*Madeline Anne (Madeline) Dale, Senior, Microbiology*

*Mentor: Mitchell Pesesky*

*Methylomicrobium buryatense* 5GB1c is a strain of methanotrophic bacteria that serves as an attractive model for production of valuable compounds from methane that can be used in industrial applications. Using this bacteria to transform cheap methane into a commercial commodity is not only a profitable venture, but an effective use of this potent greenhouse gas. This project attempted to genetically manipulate 5GB1 to increase its concentration of cellular lipids, which can be used as precursors to diesel, and introduce new metabolic pathways to produce three stereoisomers of 2,3-butanediol, a compound that can be used in the synthesis of materials such as rubber, plastics, and several others. 5GB1 has a complex membrane structure to support methane oxidation, from which the desired lipids can be utilized in fuel production. By overexpressing five genes previously determined to be involved in high-lipid generating conditions, we expected a greater yield of the product. To accomplish this, direct chromosomal insertion of a genetic construct with a highly active promoter increased transcription of the target genes. After this successful transformation of the cells through homologous recombination, sample cultures were analyzed to determine if the level of lipid production increased. A knockout of the cell-shape determining gene was also made in an attempt to increase lipid concentration; however it was lethal. For 2,3-butanediol biosynthesis, cells were transformed with plasmid constructs containing genes encoding enzymes that are downstream of existing pathways within 5GB1. Three different sets of plasmids were made for the three stereoisomers of the compound, resulting in the production of mostly pure diols. After transformation, 5GB1 was expected to be able to convert methane to the desired products. This process can be scaled up at the industrial level for manufacture and profit.

#### 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, Senior, Biochemistry*

*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  $\alpha4\beta1$  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 4

Commons West, Easel 23

4:00 PM to 6:00 PM

### **Impact of a Perioperative Enhanced Recovery after Major Spine Surgery (PERMSS) Pathway on Patient-Reported Pain Outcomes using the International Pain Outcome (IPO) Registry**

*Cindy Dong, Senior, Nursing*

*Mary Gates Scholar, UW Honors Program*

*Mentor: Pamela Mitchell, Biobehavioral Nursing & Health Systems*

*Mentor: Debra Gordon, Anesthesiology & Pain Medicine*

Approximately 500,000 Americans undergo surgery for lower back problems each year. Despite dramatic improvements over the last decade in perioperative care, the outcome of spine surgery is associated with prolonged hospitalization and poor pain management. In April 2014, Harborview Medical Center introduced an enhanced recovery protocol, called the Perioperative Enhanced Recovery from Major Spine Surgery (PERMSS), which aims to reduce significant physiological stress and shorten hospitalization by implementing pre-operative nutrition supplement, standardized analgesic administration, and early mobilization. The purpose of this study is to investigate the efficacy of PERMSS on post-operative pain relief. This project takes a quantitative approach and follows the descriptive correlational design. From June 2015 to Feb 2016, fifty PERMSS and fifty non-PERMSS patients were recruited and interviewed in their hospital rooms on their first postoperative day. The validated International Pain Outcome survey was used to capture comprehensive data including patient demographics, comorbidity, surgical procedure, analgesic regimen, and patient-reported outcomes. In April 2016, data analysis will be conducted through Stata MP V13.1. to compare the difference between PERMSS and non-PERMSS patient outcomes. We expect a significant improvement in pain management, reflected by less time spent in severe pain, decreased interference in recovery activities, and improved patient satisfaction. The result of this study leads to two potential benefits: first, to introduce enhanced recovery protocol to other similar complex surgeries; and secondly, to reduce reliance on opioids especially in spinal patients who have a 15-30% likelihood to develop failed back surgery syndrome (FBSS) and become frequent victims of opioid use disorders. In contrast to traditional practice that relies heavily on opioids, PERMSS may help address this problem with its emphasis on multi-modal analgesic, which is a combination of opioid and non-opioid prescription.

## POSTER SESSION 4

Commons East, Easel 67

4:00 PM to 6:00 PM

### **Are Washington State School Nurses Prepared to Provide Sensitive, Knowledgeable Care to Transgender Youth?**

*Javier Nova Rosa, Senior, Nursing*

*UW Honors Program*

*Mentor: Pamela Kohler, Global Health and Nursing*

*Mentor: Samara Hoag, Health Services, Seattle Public Schools*

Among middle school age youth, recent research estimates that approximately 1.3% of students identify as transgender (a gender identity that differs from the sex assigned at birth). Transgender youth are at considerable risk for depression, anxiety, and suicide associated with bullying at school or difficulties at home. School nurses are well positioned to identify these youth, intervene, and provide support. Public health study of cultural competence in caring for sexual minorities has begun to emerge, yet little of this research addresses the disparities of care experienced by transgender patients. Previous research has shown that school-based health professionals lack adequate skills and knowledge to care for transgender youth. This study focuses on the state of care within the school setting for transgender youth in Washington State. A survey of knowledge of transgender issues and experiences with transgender youth was conducted among Washington State school nurses serving youth grades 6-12. The UW Catalyst hosted questionnaire was distributed to members of the SNOW (School Nurses Organization of Washington) email list-serv. A snowball sampling approach enabled recipients to forward the survey link to additional respondents. Questions included demographic information (educational attainment, type of work settings, institution size, etc), confidence in ability to provide care to transgender youth, presence and enforcement of the school anti-bullying policy, willingness/interest in receiving additional education, knowledge of community resources, and awareness of/contact with transgender students in the school population. Data from this study provides a picture of the educational needs of Washington's school nurses in order to care for this sensitive population successfully.

## POSTER SESSION 4

Commons East, Easel 66

4:00 PM to 6:00 PM

**Communicating with Patients with Communication Disorders: A Survey of the Nursing School Curriculum**

*Devon Christopher (Devon) Sidhu, Senior, Nursing  
UW Honors Program*

*Mentor: Michael Burns, Speech and Hearing Sciences*

*Mentor: Pamela Mitchell, Biobehavioral Nursing & Health Systems*

Good communication is crucial to a patient's healthcare experience and an integral part of a nurse's role in providing care. Patients with communication disorders are susceptible to poorer health outcomes and decreased satisfaction with services due to breakdowns in communication with nurses. Literature suggests that nurses should receive training on how to effectively communicate with these patients, but it is unclear whether this training is currently included in nursing school curriculum. What are nursing students at universities across Washington State being taught about how communication disorders impact medical interactions, or how to better communicate with patients who struggle? Are these students lacking the necessary education and training to provide quality care for patients with communication disorders? In an attempt to answer these questions, survey data will be collected from junior and senior nursing students at the University of Washington, as well as from faculty responsible for developing nursing student curriculum at UW and other in-state universities regarding the current communication skills curriculum being taught in this area. Based on preliminary findings we hypothesize that a gap exists in nursing student curriculum related to how to communicate effectively with this patient population, and that the survey data collected will show that nursing students in Washington State are not currently being taught about communicating with patients with communication disorders. The key implication of this study will either suggest a need for nursing school curriculum to implement communication skills training targeted toward patients with communication disorders or show that students are in fact receiving this training. The addition of education and training in this area can help nurses improve the quality of care for this patient population.

**POSTER SESSION 4**

**Commons West, Easel 38**

*4:00 PM to 6:00 PM*

**Arsenic in Shallow Polymictic and Seasonally Stratified Urban Lakes: Mobility, Bioaccumulation and Ecological Toxicity**

*Erin Agnes (Erin) Hull, Senior, Environmental Science, UW Tacoma*

*Mentor: Jim Gawel, Environmental Science, University of Washington Tacoma*

*Mentor: Rebecca Neumann, Civil and Environmental Engineering*

*Mentor: Pamela Barrett, Civil and Environmental Engineering*

*Mentor: Corey King*

Elevated levels of arsenic have been reported in surface waters of many urban lakes around the Puget Sound as a result of the widespread heavy metal contamination from the late ASARCO smelter in Ruston, Washington. Arsenic is a neurotoxin and carcinogen and a priority Superfund contaminant. However, the mobility and toxicity of arsenic is not fully understood. Physical and biogeochemical processes that lead to elevated arsenic concentrations in the water column and aquatic organisms have been studied well in thermally stratified lakes, but not in periodically mixed (polymictic) oxygenated lakes. This project examines the mobility, bioaccumulation and toxicity of arsenic in four urban lakes in south King County that range from seasonally stratified and oxygen depleted (anoxic) to polymictic and oxygenated (oxic). Specifically, we aim to discover why one of the lakes has elevated levels of arsenic (up to 40 ppb) in surface waters, yet regularly mixes and thus remains oxygenated. Typically, arsenic is only mobilized from sediments when a lake becomes anoxic during stratification. Monthly water quality parameters (temperature, pH, dissolved oxygen, and specific conductivity) were measured and water samples (alkalinity, chlorophyll, sulfide, iron, arsenic, and nutrients) were collected at multiple depths throughout the water column. Plankton samples were also collected using vertical net tows. Water and plankton samples were analyzed for dissolved and total arsenic (after digestion) by ICP-MS. Phytoplankton and zooplankton in polymictic oxic lakes accumulated more arsenic than plankton in thermally stratified lakes, even though aqueous arsenic concentrations were similar between the lakes. This data suggests that arsenic in polymictic urban lakes is not only bioavailable, but has the potential to travel up the food chain. This project aims to create a model for predicting arsenic bioavailability based on physical lake characteristics to better predict possible toxicity and, therefore, has important implications for lake management.