An Evaluation of Existing Self-Report Outcome Measures for People with Amputations Who Have Limited Community Ambulation

Kavya A. (Kavya) Magham, Senior, Psychology
CoMotion Mary Gates Innovation Scholar, Mary Gates Scholar
Mentor: Murray Maitland, Rehabilitation Medicine
Mentor: Katheryn Allyn, Bioengineering
Mentor: Donald Fogelberg, Rehabilitation Medicine

Lower extremity amputations (LEA) affect more than 1 million people in the US. A large proportion of these individuals, about 300,000, have poor levels of community ambulation, meaning they have limited mobility. They can usually walk less than 300 ft before stopping for rest. Despite this, current patient-centered outcome measures were largely developed and tested with people who exhibit unrestricted community ambulation, and not people who have significant mobility challenges. The purpose of the current study is to evaluate if current, standardized questionnaires for people with LEA are relevant and comprehensive for people with lower levels of mobility. I conducted a literature review and a consultation with experts which resulted in items from twenty questionnaires. Items were compiled from the four most appropriate questionnaires into themes including: transfers, ambulation, static postures and activities of daily life. To assess comprehensiveness, my team and I compared the number of items in each general category across the questionnaires and found that “mobility on uneven ground” is needed for this population. Additionally, I designed an interview strategy so that people with LEA and lower levels of mobility could expand on their opinions of the questionnaires. The combination of the feedback on survey items and interview questions led me to the create the final questionnaire with a Likert scale so that subjects could respond with the relevance of each question. Results from my research will ultimately be used to improve measurement tools that are responsive to meaningful differences in quality of life and functional mobility for this population.

New Chemistries and Materials

Alkane Functionalization with (Phebox)Ir^I/II and Molecular Oxygen
Zoha Syed, Senior, Chemistry, Biochemistry
Mary Gates Scholar, NASA Space Grant Scholar, UW Honors Program, Undergraduate Research Conference Travel Awardee, Washington Research Foundation Fellow
Mentor: Karen Goldberg, Chemistry

Alkanes are the major constituents of natural gas and petroleum. The development of catalysts for the efficient and cost-effective catalytic conversion of alkanes to functionalized organics is highly desirable. Previously, Nishiyama and coworkers found that the Ir^II complex (4mPhebox)Ir(OAc)2(OH)2 (Phebox = 3,5-dimethylphenyl-2,6-bis(oxazolinyl)) could activate the C-H bonds of n-octane at high temperatures under nitrogen. Goldberg and coworkers found upon increasing the temperature, β-H elimination could be promoted, giving isomers of n-octene. Reactions of similar Ir complexes with alcohols, ketones and other organic substrates will be presented.

Using Modern Genetic Approaches to Investigate Development and Disease

Session Moderator: Celeste Berg, Genome Sciences

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A Novel Growth Factor Gene Family Mediates Tube Formation in *Drosophila*

Liesl Grace (Liesl) Strand, Senior, Biology (Molecular, Cellular & Developmental)
Levinson Emerging Scholar, Mary Gates Scholar, Undergraduate Research Conference Travel Awardee
Mentor: Celeste Berg, Genome Sciences

From blood vessels to the small intestine to the spinal cord, tubes are an essential part of nearly all multi-cellular organisms. Errors in tube formation, called tubulogenesis, cause many of the birth defects that afflict infants, including congenital heart defects and spina bifida, a failure to close the neural tube. Our lab uses the fruit fly *Drosophila melanogaster* to study tube formation because of the highly conserved nature of this morphological process between our species. My project focuses specifically on a family of genes called Imaginal Disc Growth Factors (IDGFs), which are linked to tubulogenesis in *Drosophila* and are closely related to a human protein family (CLPs) that have been found to be dysregulated in numerous diseases, including arthritis, and in metastasizing tumor cells. While this homology indicates that IDGFs have a role in cell behaviour, the mechanisms by which these genes act remain unclear. Last year, I used the gene-editing technology CRISPR/Cas9 to investigate the function of one IDGF, the gene Idgf6, by deleting it entirely. Analysis of these knock-out mutants suggests that Idgf6 plays an important role in making and shaping tubes and that removal of Idgf6 results in branched structures instead of discrete tubes. This branching phenotype likely limits the flow of oxygen to the developing embryo, resulting in decreased survival of offspring. My current research explores this genetic pathway further by testing tube morphogenesis under hypoxia and other stress conditions such as crowding, with the aim of further defining the mechanism of tube dysfunction in these mutants.

**SESSION 2R**

**ECOLOGY FROM MICROBES TO BIRDS**

*Session Moderator: Frieda B. Taub, Aquatic & Fishery Science*

JHN 111
3:30 PM to 5:15 PM

*Note: Titles in order of presentation.

**Skin Lipids of the Striped Plateau Lizard (Sceloporus virgatus): Oleic and Stearic Acids as Potential Indicators of Mate Quality**

Tiare Elaine (Tiare) Gill, Junior, Biology, University of Puget Sound
Mentor: Stacey Weiss, Biology, University of Puget Sound
Mentor: Jay Goldberg, Biology, Indiana University - Bloomington

Chemical signaling, in the form of pheromones, is an important mechanism of sexual selection in reptiles, as it provides a means of communicating mate receptivity and quality during the mating season. Previous research on the chemical profile of Striped Plateau Lizard (*Sceloporus virgatus*) skin lipids found that lower levels of oleic and stearic acid in female skin lipids correlate with larger egg clutch sizes, suggesting that low levels of the fatty acids might be an attractive mating cue for males. The purpose of this research was therefore focused around two aims: 1) Determine if male lizards respond to manipulation of oleic and stearic acid ratios, as well as between presence and absence of the fatty acids when presented as an isolated cue; 2) Investigate how altering the levels of the two fatty acids in the skin lipids of female lizards affects male courting behavior. To address these aims we recorded male chemosensory behaviors (nose taps, tongue flicks, and air tasting), as well as escape behaviors (scurrying and jumping) during 40 minute behavioral trials. Although there was no significant difference in male chemosensory behavior between low and high lipid ratio treatments when the cues were isolated, results from the manipulated female trials show that male lizards demonstrated significantly more escape behaviors when presented with cues from a fatty acid spiked female than from an un-manipulated female. This suggests that male lizards were less interested in fatty acid spiked females—possibly due to the unattractive nature of a high lipid ratio cue.

**POSTER SESSION 3**

Balcony, Easel 118
2:30 PM to 4:00 PM

**Improving Communication about Serious Illness (ICSI)**

Tori T (Tori) Ly, Senior, Neurobiology
Mary Gates Scholar, UW Honors Program
Mentor: Ruth Engelberg, Medicine
Mentor: J. Randall Curtis
Mentor: Patsy Treece, Medicine, Harborview Medical Center

Discussing end-of-life care, especially for patients with serious illness, is an important way to ensure that clinicians understand their patients’ wishes and that patients therefore receive the types of care and treatments they want. Conversations about end-of-life care are often not a part of outpatient clinic visits even though the outpatient setting is the best
place to have these conversations before a crisis occurs. In this randomized trial, we are investigating whether the use of a short feedback form, the “Jumpstart” form, can help facilitate improved communication about end-of-life care and treatment preferences. The “Jumpstart” form is based on survey questions that the patient completes at the time of enrollment into the study, and the form is shared with the patient, his/her family and clinician. The form provided to the clinician includes prompts to assist the clinician in discussing the patient’s end-of-life care and communication preferences. The effectiveness of this communication feedback intervention will be measured by comparing patients who received the “Jumpstart” form with patients who received usual care. If the “Jumpstart” intervention is effective, patients in the intervention group, as compared with those in the control group, should report improved frequency and quality of communication with their clinician and better agreement between the care they desire and the care they receive. These outcomes were measured by data in the electronic health record (EHR) and abstracted from clinic visit notes and from a series of surveys collected at three time points after the target visit, during which the intervention was implemented (2 weeks, 3 months and 6 months). If this intervention is successful, healthcare systems could implement the “Jumpstart” forms as a tool to improve patient care.

**Poster Session 3**

**MGH 241, Easel 144**

2:30 PM to 4:00 PM

**Ceftazidime E-test Antimicrobial Susceptibility Validation and Rescue of Susceptibility with Ceftazidime-Avibactam**

_Sihan (Bronte) Li, Senior, Medical Laboratory Science_

_Mentor: Andrew Bryan_

_Mentor: Heather Berger_

Ceftazidime as a cephalosporin antibiotic has become much less effective against Gram-negative bacterial infections because of the appearance of multi-drug resistant, β-lactamase-producing strains. One of the newly FDA-approved drug inhibitor combinations, ceftazidime-avibactam, is a promising solution to rapidly decreasing susceptibilities to ceftazidime-resistant bacteria. E-test is a well-known manual antimicrobial susceptibility testing method widely used in clinical laboratories as an alternative for the gold standard. This study aims to validate ceftazidime E-tests with a selected panel of non-fastidious Gram negatives consisting of Escherichia coli, Stenotrophomonas maltophilia, Acinetobacter baumannii calcoaceticus complex, Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella typhi, Citrobacter spp., Enterobacter cloacae, Klebsiella oxytoca and Proteus mirabilis, against gold standards including TREK Sensitre® micro-broth dilution and agar dilution while performing ceftazidime-avibactam E-tests to generate more data for future investigations on the novel antibacterial drug and its resistance profiles at University of Washington Medical Center. Ceftazidime and ceftazidime-avibactam E-tests were done on all selected patient isolates, and agar dilution was performed only on Stenotrophomonas maltophilia as the reference method instead of TREK Sensitre®. Both the accuracy and precision study results support ceftazidime E-test as a valid susceptibility test, and ceftazidime-avibactam was found to restore sensitivity in most of the resistant strains that were tested. We conclude that ceftazidime E-test is verified and the comparison of ceftazidime and ceftazidime-avibactam yields consistent outcomes as previous research.

**Poster Session 3**

**MGH 241, Easel 135**

2:30 PM to 4:00 PM

**The Role of Imaginal Disc Growth Factors in Wound Healing in Drosophila**

_Bernice Lin, Junior, Biology (Molecular, Cellular & Developmental)_

_Mentor: Celeste Berg, Genome Sciences_

_Mentor: Sandra Zimmerman, Genome Sciences_

Wound healing is a biological process that tissues use to repair themselves after damage. If wound healing is impaired, the tissue may scar or the wound may be fatal. Our lab uses the fruit fly Drosophila melanogaster as a model organism to study the cellular and molecular mechanisms involved in tissue growth, morphogenesis, and homeostasis. Recently while characterizing a novel family of growth factors, Imaginal Disc Growth Factors (IDGFs), our data suggested that one family member, IDGF3, may be upregulated following damage to imaginal discs, the future adult tissue. To explore the potential involvement of the IDGFs in wound healing, I have quantified their expression by in situ hybridization and localized the mRNA sequences at wound sites in the Drosophila wing imaginal disc. Next, I plan to determine whether specific molecular pathways such as the canonical Wnt pathway or the beta-Akt pathway, which are known to play a role in innate immunity, interact with IDGFs during wound healing. Subsequently, I will use a yeast transcription factor, Gal4, to express RNAi that interferes with mRNA in the same wing disc to determine the relationship between the different pathways. These studies will contribute to our understanding of the mechanisms that regulate tissue healing during development.
Due to their luminescent properties, semiconductor nanocrystals are promising tools for optical imaging of biological samples. This experiment explores how the surface chemistry of CdSe/CdS core-shell semiconductor nanocrystals impacts cell targeting and cytotoxicity. Growing a CdS shell on top of a CdSe core and then altering the surface chemistry allows functional control of how these nanocrystals interact with the surrounding environment. Cytotoxicity was analyzed as a function of surface chemistry, in order to identify biocompatible surface chemistries. Surface chemistries were also altered to allow targeting of different cell types. CdSe core nanocrystals were produced using a hot injection method, and UV-vis spectroscopy was used to relate peak absorbance wavelength to nanocrystal core size. To increase the quantum yield, a uniform CdS shell was grown using a slow-growth process with cadmium and sulfur precursors. A ligand exchange was performed to transfer the nanocrystals from an organic solvent to an aqueous solvent. A fluorimeter was used to determine the nanocrystal quantum yields after synthesis of cores, shell growth, and surface functionalization with transfer to aqueous solvent. Quantum yields increased after the shell growth, but decreased in general after surface functionalization and transfer to aqueous solvent. Decreased cytotoxicity was observed for surface chemistries with longer ligands, such as functionalized polyethylene glycol (PEG) chains. Further research will aim to tune the properties of CdSe/CdS core-shell nanocrystals and target a variety of cell types.

**Poster Session 3**

MGH 206, Easel 168

2:30 PM to 4:00 PM

**Assessing the Taxonomic Utility of Grass Silica Short Cells Using 3-D Morphometrics**

Ashly Marie Senske, Senior, Biology (Ecology, Evolution & Conservation)

Brian Connor Desmond, Freshman, Pre-Sciences

Claire Rose Marvet, Senior, Biology (Ecology, Evolution & Conservation)

Sultan Z Akbar, Senior, Biology (Physiology)

Mentor: Caroline Stromberg, Biology

Mentor: Timothy Gallagher

Our research involves microscopic deposits of silica within the leaves of grasses, called phytoliths. Grasses produce distinctive phytoliths which can be diagnostic at various taxonomic levels. Phytoliths are particularly important in paleobotanical work because they can help us reconstruct earth’s past vegetation and climate history. Currently, there is a severe lack of quantitative data on phytolith morphotypes and relative abundances within Poaceae, the grass family. We used confocal microscopy to create 3D images of phytoliths in the Bambusoideae, the Bamboo subfamily, and applied geometric morphometrics in order to quantify shape variation. The 3D objects will contribute to a family wide digital reference collection for use by paleobotanists and grass taxonomists worldwide.

**Poster Session 4**

Balcony, Easel 108

4:00 PM to 6:00 PM

**Tamoxifen-Inducible Cre System in Immunotherapy Against Lung Cancer**

Oanh Tran, Senior, Biochemistry

Mentor: Philip Greenberg, Medicine and Immunology

Mentor: Leah Schmidt, Medicine

Immunotherapy has yielded exciting results in the clinic, primarily against blood cancers. Moving toward applying immunotherapy to solid cancers, the field has seen success in treating certain cancers, such as lung cancer, with immunotherapy. However, only a fraction of patients respond to treatment, highlighting a need for continued research in this area. The ‘KP’ model is a genetically engineered mouse model of lung cancer, relying on Cre-recombinase inducible activation of oncogenic Kras and inactivation of the tumor suppressor p53, the two most frequently mutated genes in human lung adenocarcinoma. Tumors are initiated by delivery of Cre into lung alveolar cells by the administration of Cre-expressing viruses. Using this virally-induced model, we can control the timing of tumor induction and tumor burden, and introduce additional genetic modifications into tumors. However, the use of viruses can cause inflammation, potentially impacting the immune responses that we are studying. Improving this model will make the study of lung cancer more physiologically relevant. Therefore, we are developing a system for separating viral infection from tumor initiation, dependent on a tamoxifen-inducible Cre-ER allele. By developing viruses that express Cre-ER, mice can be infected and the induction of tumors can be delayed until a timepoint when virus-related inflammation has subsided. Then, Cre activity can be induced by administration of tamoxifen. Additionally, this system allows us to control the number tumors that form, by titrating the doses of tamoxifen, to better recapitulate human disease. To date, we have cloned DNA fragments and performed Gibson Assembly, and are currently validating clones. We have produced lentiviruses and titered the viruses using GreenGO cells, a cell line carrying a Green Fluorescent Protein reporter of Cre activity. To test Cre-ER functionality
and sensitivity, we will use GreenGO cells to assay differences in Cre–ER activity, using different concentrations of tamoxifen \textit{in vitro}.