

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

Balcony, Easel 122

11:00 AM to 1:00 PM

Identifying Species Divergence in the Endemic *Caecidotea* Cave Populations

Justin Harris, Senior, Molecular Biology, East Central Coll
McNair Scholar

Mentor: Alisha Howard, Department of Biology, East Central University

Mentor: Kevin Blackwood, Earth Science, East Central University

The Arbuckle karst system consists of caves, microfractures, and hydrogeologic barriers. Isopods in the genus *Caecidotea* inhabit the pools of water within the groundwater system. Young *Caecidoteas* travel through microfractures, and small populations move from one cave system to the next. Over the time these fractures close, causing the populations of *Caecidotea* to be isolated and potentially drift genetically. The sampled distinct populations have become morphologically distinct, but it is yet to be determined if they also have become genetically distinct species. Genetic classification may also provide a more timely identification of fracture closing. DNA Barcoding using the Cytochrome Oxidase subunit 1 (COX1) gene will provide the percent of divergence in the samples obtained from different populations/locations; however, the chitin-heavy exoskeleton of isopoda could make it difficult to have DNA extractions that are “clean” (without protein) and decent yield. An extraction method was used proteinaseK (protK) and high salt to release the DNA followed by ethanol precipitation to concentrate the extract. For DNA Barcoding, the COX1 gene sequences need a PCR protocol with the robust primers is crucial. We plan to explore various primer sets for the optimal amplification.

POSTER SESSION 1

MGH 258, Easel 191

11:00 AM to 1:00 PM

Characterization of Brain Measurements to Reflect Neonatal Hypoxic-Ischemic Injury in the Ferret

Olivia R. White, Junior, Pre-Sciences

Mentor: Thomas Wood, Pediatrics

Hypoxic-Ischemic Encephalopathy (HIE) is a brain injury that commonly causes mortality in neonates. Current treatment consists of therapeutic hypothermia, but close to 50% of affected infants still have a poor outcome (death or severe disability). In order to discover new effective therapies, it is important to compare how different treatments affect the brain in animal studies. The research laboratory has developed a ferret model of HIE because the ferret brain has more complex gyrification compared to rodents. Animals underwent unilateral carotid ligation at postnatal age 17 days (P17), in which one side of the carotid artery was restricted temporarily and the other was restricted permanently. The animals then received periods of hypoxia and hyperoxia. To better quantify the extent of injury, a system involving measurements of the gyri, sulci, and cerebellar exposure was developed. Ex vivo brain measurements were collected from a population of 63 ferret kits at age P42, and adjusted by the weight and sex of the animal. These measurements included the lengths of: the longitudinal fissure (anterior and posterior), lateral sulci, suprasylvian sulci, coronal sulci, pseudosylvian sulci, ansinate sulci, cruciate sulci, presylvian sulci, lateral gyri, suprasylvian gyri, sigmoid gyri (anterior and posterior), coronal gyri, ectosylvian gyri (anterior and posterior), orbital gyri, and the exposure of the cerebellum. In injured animals, significant changes in the longitudinal fissure, ansinate sulci, left coronal sulci, cruciate sulci, presylvian sulci, posterior sigmoid sulci, and exposure of the cerebellum were seen compared to littermate controls. The implications of this measurement system include the ability to accurately characterize the degree of injury in animals with an hypoxic-ischemic brain injury, which will help to show whether potential treatments are neuroprotective.

POSTER SESSION 1

Commons East, Easel 55

11:00 AM to 1:00 PM

Snail Intermediate Host Behavior in Schistosomiasis Transmission

Hiruni Thisanka Jayasekera, Senior, Environmental Science & Resource Management

UW Honors Program

Mentor: Chelsea Wood, Aquatic and Fishery Sciences

Schistosomiasis is classified as a neglected tropical disease, ranking second only to malaria as the most common para-

sitic disease in the world. The two species of interest for this project are *Schistosoma haematobium* and *Schistosoma mansoni*, both of which can infect humans who come into contact with infested waters. The disease can manifest in urogenital (*S. haematobium*) or intestinal (*S. mansoni*) forms, leading to a variety of symptoms, including chronic pain, bladder and liver cancer, and – in extreme cases – death. Despite the extremely infective nature of schistosomiasis’ environmental stages and its complex transmission ecology, relatively little has been done to understand the effect of schistosome parasitism on the behaviors on its intermediate snail host. Expanding our understanding of snail behavior is necessary to explain the transmission dynamics of the disease and to reduce rates of human infection. In this research project, I examine snail choice behavior in infected and uninfected snails in a simulated lake habitat, and determine if schistosome infected and uninfected freshwater snails exhibit a difference in aggregation behavior, and where within a simulated pond environment infected and uninfected snails reside. I hypothesize that in a large population, both infected and uninfected snails will aggregate towards infected snails. I also hypothesize that infected snails will tend to linger closer to the surface of the water than uninfected snails and be less likely to quit the water, thus increasing the probability of transmission to a mammalian host. Understanding snail intermediate host behavior in the transmission of schistosomiasis gives us a way to control infection rates from an ecological perspective in addition to the traditional medical perspective.

POSTER SESSION 1

Commons East, Easel 56

11:00 AM to 1:00 PM

Parasitism in Nearshore and Offshore Herring in the Puget Sound

Emily C Oven, Senior, Aquatic & Fishery Sciences

Mentor: Chelsea Wood, Aquatic and Fishery Sciences

Mentor: Emily Oven

Forage fish such as Pacific herring, *Clupea pallasii*, are a valuable economic and ecological resource in marine food webs. Forage fish are integral species as they can drive both top-down and bottom-up effects in pelagic marine communities. Understanding population dynamics of herring and other forage fish species is essential to management. Although poorly studied, parasites of forage fish are of particular interest due to their potential effects on population dynamics and ability to predict the presence of anthropogenic contaminants in the environment. The goal of this study is to determine if parasite communities differ in composition and diversity between year-zero herring collected in offshore and nearshore (marina) environments in the Puget Sound. I am performing necropsies on 180 herring collected from 6 Puget Sound sites. I expect to find a greater abundance of parasites that use direct

transmission in nearshore herring due to decreased stock mixing, as well as a greater prevalence of certain parasites due to closer proximity to anthropogenic contaminants. Parasites remain understudied in important forage fish like herring; and, this research can be used to understand population dynamics of herring in local marine environments as well as aid in fisheries management.

POSTER SESSION 1

Commons East, Easel 72

11:00 AM to 1:00 PM

Linking *Clavinema mariae* Abundance to the Diet of English Sole *Parophrys vetulus*

Abigail Ilene Moosmiller, Senior, Aquatic & Fishery Sciences

Mentor: Chelsea Wood, Aquatic and Fishery Sciences

Mentor: Evan Fiorenza

English sole *Parophrys vetulus* is a species of benthic flatfish that is commercially and tribally exploited off the coast of Washington State. The commercial value of English sole can decrease if the fish is infected with parasites, which degrade their appearance and health; in fact, widespread parasitic infection contributed to the closure of the commercial fishery in south Puget Sound in 1948. *Clavinema mariae* is a trophically transmitted nematode parasite that has increased in abundance by eight-fold since 1930 in Puget Sound. Since *C. mariae* is a nematode that infects hosts via ingestion, I used a diet analysis of English sole to: 1) assess the types of prey that sole consume, and 2) correlate the prey type abundance to *C. mariae* abundance. I evaluated the gut contents of contemporary sole collected in 2017 and historical sole collected over the past 80 years and held in the UW Fish Collection. I categorized gut contents to the lowest taxonomic family. Sole are hypothesized to primarily consume invertebrates, and *C. mariae* is transmitted by copepods, thus we expect copepods to represent a larger portion of the diet in more recently collected, more heavily infected sole. Knowing the type and number of organisms that English sole consume will improve our understanding of how sole interact with the Puget Sound food web; specifically, how they are initially infected with *C. mariae*, which would offer insight to their observed increase in abundance in sole over the past 80 years.

POSTER SESSION 2

MGH 258, Easel 184

1:00 PM to 2:30 PM

The Effects of Isoflurane Exposure, Length of Surgery, and Rest before Hypoxia on Ferret Mortality and Gross Brain Injury

Vivienne Etain Riggs Acuna, Senior, Biology (General), Sociology

Mentor: Thomas Wood, Pediatrics

Mentor: Kylie Corry, Pediatrics

Mentor: Daniel Moralejo, Pediatrics

The most recent National Vital Statistics Report reports that approximately 9.85% of babies in the United States are born preterm, with 72% of those born late-preterm (at 34-36 weeks of gestation). Using neonatal ferrets at age 17 days old, the Juul lab in the Division of Neonatology at the University of Washington Medical Center has developed a preliminary model of brain injury to mimic late-preterm neonatal injuries. In this species-specific adaptation of the Vannucci Model, the left carotid artery is permanently ligated, along with a temporary (4h) occlusion of the right carotid artery. Ferrets are then exposed to periods of hypoxia and hyperoxia. By looking at data and outcomes from our surgeries, I aim to examine the effects of certain surgical parameters on ferret mortality. These parameters include: time the animal is exposed to isoflurane, the length of surgery, and the amount of time the animal is given to recover between surgery and hypoxia. Aside from mortality, I will also analyze the effects of these parameters on respiratory rate after surgery as well as gross brain injury and data from behavioral testing in an attempt to discern the level of injury in living animals and the most common predictors of death in those that died prior to their determined endpoint.

POSTER SESSION 2

Commons West, Easel 8

1:00 PM to 2:30 PM

Analysis of Oral Swabs for Universal Bacterial 16s rDNA to Optimize Diagnostic Application

Divya Naidoo, Senior, Public Health-Global Health

Mentor: Gerard Cangelosi, Environmental and Occupational Health Sciences

Mentor: Rachel Wood, Department of Environmental & Occupational Health Sciences

Mentor: Alaina Olson, Environmental and Occupational Health

Oral swab analysis (OSA) is a possible alternative sample type for tuberculosis diagnostics. It has been observed that tongue swabs contain greater amounts of *Mycobacterium tuberculosis* DNA than cheek swabs ($p < 0.0001$) from tuberculosis patients. After determining that oral microbiota follows this same pattern, several factors including time-of-day swabbed and health status were analyzed to understand factors affecting the amount of bacteria on the tongue. This project aims to optimize the oral swab sampling methods in

order to facilitate more sensitive diagnostic tests, using universal bacterial 16s rDNA as a proxy for *Mtb* DNA. Previously tested samples from South Africa were further analyzed to investigate amount of oral microbiota by day collected, HIV status, health status, and other demographic factors. To evaluate whether collecting multiple swabs per sample yielded more universal bacterial DNA, tongue swabs were taken from healthy volunteers in Seattle. Each subject provided a 1-swab sample and a 3-swab sample, which was then extracted and analyzed by a previously optimized universal bacterial PCR. Additionally, tongue scrapers are being assessed as an alternative to oral swabs. Swabs collected early in the morning had more bacterial DNA than swabs collected later ($p < 0.03$). 3-swab samples yielded an average of 2-fold greater amounts of bacterial DNA than 1-swab samples. Bacterial biomass correlated with *M. tuberculosis* signal in most comparisons. Bacterial biomass may serve as a useful proxy when developing better oral swab sampling strategies for TB diagnosis.

SESSION 2Q

PUBLIC POLICY, INEQUALITY & POLITICAL EXCLUSION: CAUSES, CONSEQUENCES & REMEDIES

Session Moderator: Rebecca Thorpe, Political Science

JHN 026

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Pursuing Social Justice: How Would a Universal Basic Income or Federal Jobs Guarantee Undermine Women's Oppression?

Kathryn Mason Karcher, Senior, Political Science

Mentor: Scott Lemieux, Political Science

Mentor: Chelsea Moore, Political Science

Welfare policies in the United States perpetuate women's oppression. This is largely because these policies reinforce sexism, racism, and classism that plague American society. When discussing policy options, scholars and political players should not just consider their economic consequences. They should emphasize the social consequences of these policies, such as how effectively they may combat women's oppression. In this study I aim to demonstrate what an emphasis on vulnerable groups' needs may look like and to further the political debate surrounding a federal jobs guarantee (FJG) and a universal basic income (UBI). I use the framework established in Justice and the Politics of Difference by Iris Marion Young and her explanation of the five faces of oppression to evaluate how FJG and UBI may help or harm women. I also analyze recent public opinion polling to deter-

mine the likelihood of the U.S. implementing these policies. This paper answers the following questions: Which policy, FJG or UBI, would more effectively undermine women's oppression? Which is more likely to be implemented? Should those concerned with women's oppression favor UBI, FJG, or a combination of the two? My theoretical analysis shows that UBI would more effectively combat women's oppression. However, public opinion polling suggests that FJG is more likely to be implemented. This presents a dilemma for progressive advocates who wish to prioritize vulnerable groups' needs while focusing on realistic goals. The social justice framework that I adopt in this paper resolves this dilemma — due to its inability to further the cause of gender equity, FJG should not be implemented unless it accompanies a form of UBI. These conclusions both contribute to ongoing debates over these policies and demonstrate how researchers and advocates going forward can analyze policies within a social justice framework that prioritizes the needs of our most vulnerable populations.

POSTER SESSION 3

Commons West, Easel 16

2:30 PM to 4:00 PM

The Buffering Effect of Social Support on Internalizing Symptoms in Transgender Youth

Sophia Robinson, Senior, Psychology

Mentor: Kristina Olson, Psychology

Mentor: Lily Durwood, Developmental Psychology

The mental health of transgender children, children who have socially transitioned to live as the gender “opposite” their assigned sex at birth, have not been researched extensively, although the occurrence of childhood social transitions have increased in recent history. Instances of bullying and discrimination are reported in the LGBTQ community in high rates, which has been known to lead to higher rates of internalized symptoms. Previous studies have looked at the stress buffering hypothesis, which postulates that social support protects against the negative effects of victimization experiences, but the results from those studies are mixed. In the present study, we examine whether social support moderates the association between bullying and discrimination with internalizing symptoms in transgender youth. To test our hypothesis, we had the parents of 265 socially transitioned children, from ages 3-15 (mean age 9.41), answer questions regarding a child's support structure (family, peer, school) and whether their child has been bullied and/or discriminated against specifically because of their gender. Our results show that the relationship between victimization experiences and internalizing symptoms was moderated by peer support, but not by family support or school support. We found that when participants had less peer support, being victimized more was associated with more internalizing symptoms, while higher levels of peer support do

not yield significant results between the two variables, indicating that peer support may act as a buffer between victimization experiences and internalizing symptoms in transgender youth.

POSTER SESSION 3

MGH 206, Easel 172

2:30 PM to 4:00 PM

C-di-AMP Regulation and Toxicity in *Listeria monocytogenes*

Kimberly (Kim) Gutierrez, Non-Matriculated, Microbiology, University of Washington

Louis Stokes Alliance for Minority Participation, UW Post-Baccalaureate Research Education Program

Mentor: Joshua Woodward, Microbiology

Secondary nucleotide messengers are used by all domains of life to sense and respond to the changes in their environment. In bacteria these secondary nucleotide messengers play a role in regulating several signaling pathways such as cell wall homeostasis, motility, and the expression of virulence genes. The nucleotide cyclic di- 3, 5' adenosine monophosphate (c-di-AMP) was recently added to the list of secondary nucleotides. C-di-AMP is found in many bacteria such as *S. aureus*, *S. pneumoniae*, *B. subtilis*, and *L. monocytogenes* (Lm). C-di-AMP has been best characterized in Lm, a well-studied intracellular pathogen. Lm has adapted to survive and replicate in the host cell cytosol by evading host cell defenses through use of key virulence factors. In Lm, synthesis of c-di-AMP is catalyzed by the diadenylate cyclase *dacA* and degradation is coordinated by the phosphodiesterases, *pdeA* and *pgpH*. Studies using Lm mutants that lack both *pdeA* and *pgpH* contain abnormal c-di-AMP levels that cause growth and virulence defects of about four logs compared to wild type Lm. This highlights the importance of c-di-AMP regulation for bacterial virulence and growth, but we still know very little about c-di-AMP regulation and toxicity. Our goal is to further understand the toxicity of high levels of c-di-AMP during bacterial infection. We aim to create a transposon library in the double phosphodiesterase KO ($\Delta\Delta$ Pde) background to identify suppressor mutations. Previous approaches to analyzing suppressor mutations in the $\Delta\Delta$ Pde strain has not been thorough or cannot be utilized *in vivo*. Therefore, we have created an amenable phosphodiesterase mutant that knocks out the phosphodiesterases in Lm (*pdeA* and *pgpH*) to grow *in vivo* successfully to investigate c-di-AMP regulation. Understanding the regulation of c-di-AMP could result in targets for novel treatments against Lm and allow for ways to investigate regulation methods of c-di-AMP in other organisms.

POSTER SESSION 3

MGH 241, Easel 144

2:30 PM to 4:00 PM

Dual HIV Prevention and Contraceptive Intrauterine Device

Hienschi V. Nguyen, Junior, Bioengineering

Mentor: Kim A. Woodrow, Bioengineering

Mentor: Jamie Hernandez, Bioengineering

For women to have protection from unintended pregnancy and human immunodeficiency (HIV), current lead prevention options use oral antiretroviral drugs (ARV) for pre-exposure prophylaxis (oral PrEP) along with a form of contraception. Failure to adhere to these drug therapies will increase the risk of contracting HIV or pregnancy. We have proposed to integrate drug-eluting materials onto a copper-intrauterine device (IUD) that could provide both HIV prevention and contraception. We will evaluate two methods to formulate a matrix release drug delivery system. Injection molding is a method to inject material into a mold that can be used for constructing drug-eluting medical devices with low drug degradation. For our purpose, we injected a polymer and drug combination into a mold to construct a solid slab. Whereas, electrospinning is a method that uses electric force to formulate stable and high surface-to-volume ratio nanofibers with high drug encapsulation and porosity compared to the molded slab. Both delivery systems will be used to administer ARV drugs to the female genital tract for a year. We optimized the molded slab and electrospun nanofibers technique for maximum polymer-loading, and used 3-D printing and nanofiber wrapping technique as a process for slab integration and fiber integration onto the IUD respectively. The polymer and drug combinations for both electrospun nanofibers and molded slabs were chosen to have the maximum drug-loading and stable mechanical properties. Drug release was measured in vitro to predict daily release rates out to three years. The ideal matrix release drug delivery system method for the dual HIV prevention and conception IUD is determined based on the mechanical properties and drug release rate of the polymer and system combination. We also investigated the drug delivery systems for cytotoxicity to verify dosage safety.

POSTER SESSION 4

Commons West, Easel 20

4:00 PM to 6:00 PM

A Qualitative Study on the Implementation Practices and Policies for the Delivery of Mental Health Treatment in Low- and Middle- Income Countries

Gabrielle Tejada Jamora, Junior, Psychology

Mentor: Shannon Dorsey, Psychology

Mentor: Grace Woodard, Department of Psychology, RISE Mental Health

In a majority of low- and middle-income countries (LMICs), resources for mental health care are extremely limited. For children and adolescents especially, there is little to no mental health care available. In a recent large randomized controlled trial, an evidence-based treatment (EBT) was delivered in two LMICs, Kenya and Tanzania, using trained lay counselors in a task-shifting/sharing model. Over a 12-week span consisting of weekly group meetings, this EBT, trauma-focused cognitive behavioral therapy (TF-CBT), was delivered to orphaned children who had posttraumatic stress (PTS) and/or grief symptoms, along with their guardians. The effects sizes were large for child PTS/grief, but little is known about how to scale up and implement TF-CBT to benefit more children. The current study uses data from a large TF-CBT trial implemented in 10 schools and 10 communities in Kenya by existing staff who served as lay counselors (teachers in schools and community health volunteers [CHVs] in communities). After the delivery of the treatment, qualitative interviews were conducted with the lay counselors from 6 of 10 sites in each to better identify efficient implementation practices and policies (IPPs) that supported TF-CBT delivery. The goal of studying the IPPs is to identify those that support the effective adoption and fidelity of TF-CBT. This study pinpoints which IPPs are most critical for the different settings, sectors, and populations that this study encompasses. We analyzed the IPP resource provision to be able to compare the difference in resource allocation in urban versus rural settings in regards to transportation, materials, etc. This study allows us to gain a better understanding of the necessary implementation strategies to better tailor to the needs of communities to support evidence-based mental health care in specific sectors and settings in LMICs.

POSTER SESSION 4

Commons West, Easel 4

4:00 PM to 6:00 PM

Optimizing Oral Swab Analysis for Tuberculosis Diagnosis

Rita Noor Olson, Senior, Microbiology

Mentor: Rachel Wood, Department of Environmental & Occupational Health Sciences

Mentor: Gerard Cangelosi, Environmental and Occupational Health Sciences

Tuberculosis (TB) remains a major international health concern and one of the top 10 causes of death worldwide, ac-

ording to the World Health Organization. Previous clinical work in our lab demonstrated that oral swab analysis (OSA) can successfully diagnose tuberculosis by detecting *Mycobacterium tuberculosis* DNA in the mouths of infected patients. In order to strengthen OSA against traditional but more invasive methods, such as sputum sampling, improvements to DNA extraction and swab type must be investigated. I am comparing different degrees of automation with Mol-Bio's Trueprep, the AudioLyse, and ThermoFisher's King-Fisher against our previously validated manual Qiagen extraction protocol—with the comparison lying in sensitivity and efficiency. In order to increase the versatility and sensitivity of OSA, I am also investigating boil preparations and dissolvable swabs. Boil preparation of swabs is a relatively simple extraction procedure, and early results have demonstrated its comparability against the Qiagen extraction. Meanwhile, dissolvable swabs have a hypothetical 100% yield of sample material. I have successfully dissolved calcium alginate swabs from Puritan in acidic sodium citrate solutions, and Luna swabs were dissolved in chaotropic agents. DNA yields are compared to non-dissolvable, previously validated swabs.