



UW Undergraduate Research Symposium

May 21, 2021, 11AM to 6PM

A celebration of undergraduate scholarship and creative work.

www.washington.edu/undergradresearch/symposium

UW Bothell students presented their research at the 2021 UW Undergraduate Research Symposium as oral presentations, visual arts & design displays, or as research posters. Below is a list of students who presented. We encourage everyone to come and support our UW Bothell students annually during the spring!

2021 Undergraduate Research Symposium

First Year Preparedness Today for a More Resilient Campus Tomorrow

Presenter:

Ariah M. Perez, Senior, Science, Technology, and Society

Mentor:

Rob Turner, Interdisciplinary Arts & Sciences

Description:

The University of Washington Bothell (UWB) has a campus emergency response team (CERT) that is not widely known or sustainable. Part of its mission is to train students to participate in emergency response and engage them in other CERT activities. However, UWB CERT struggled in its efforts to recruit students for CERT training and raise awareness of CERT and hazard threats among students. This research project analyzed the successes and best practices of CERT programs in other universities across the United States and assessed which practices would be most feasible for implementation at UWB. Research methods included reading case studies about best disaster preparedness practices and conducting interviews of staff at different universities to see what works on each campus. A report centering on recommended best practices will be provided to UWB administrators. This should help UWB develop a plan for the creation of a sustainable CERT program which will greatly increase the number of students trained in emergency preparedness and response skills that they can apply on and off campus, as well as keep the university accountable to student safety.

Importance of Mental Model Shift in Team Dynamics

Presenter:

Marjanthi (Mari) Cekrezi, Senior, Community Psychology, Global Studies,
Spencer Onstot, Junior, Community Psychology,
NASA Space Grant Scholar, Undergraduate Research Conference Travel Awardee

Mentor:

Deanna Kennedy, Business Administration (Bothell Campus), University of Washington Bothell

Description:

Teamwork, now widely recognized as a vital corporate, academic and social dynamic, requires each team member to share a similar individual understanding of the task at hand. In this research, we analyzed shifts in team members' individual mental models to gain a deeper understanding of this process. We listened to and coded audio files granted by NASA's Human Research Program, extracted from a few of NASA's Human Exploration Research Analog (HERA) mission campaign teams as they were preparing for, executing, and debriefing various simulated missions. We developed a coding scheme to assess the statement's process, purpose, and contribution to mental model shifts. A statement's process refers to its topic in terms of planning, acting or evaluating (this idea is backed by literature). A statement's purpose declares whether what was said was an agreement, disagreement, suggestion, or direction. In accordance with the purpose and process of the statement, we concluded whether each specific statement helped in moving the team towards a shared understanding (positive shift) or away from a shared understanding (negative shift). At the end of each task, based on the gathered data, we deduced whether the team had a shared mental model of the task. This coding scheme, as well as its application, will be instrumental in guiding future research that implements team communication in the understanding of mental model states. In addition, this coding system may reveal patterns that can predict future instances where teams experience a series of negative mental model shifts and instruct future interventions.

Out of Time? Our Perception of Time In Relation to Ordering of Tasks

Presenter:

Spencer Onstot, Junior, Community Psychology
NASA Space Grant Scholar, Undergraduate Research Conference Travel Awardee

Mentor:

Deanna Kennedy, Business Administration (Bothell Campus), University of Washington Bothell

Description:

In the fields of physics and economics, the conceptualization of time is that it is constant, never changing. However, using a cognitive psychological approach, time is anything but constant. Some days seem incredibly long, while others fly by quickly. Some days we have all the time in the world, while other days we don't have enough time. This is a result of our perception of time. There is much research in cognitive psychology about manipulation of our Temporal Perception, but there is no research on the application of this phenomenon to how we organize and prioritize our daily tasks. Additionally, there is no current information on whether the perceived Temporal Distance of a task's due date changes when a person completes a task alone vs in a team. My project seeks to fill both these voids in literature. This project is based on perception, so there is commonly a difference between what participants say and what they do. To address this difference, I intend on conducting a survey about individual participants' experiences with prioritizing tasks and experiences with teamwork, as well as conducting a task-

prioritization activity. The survey will be disseminated over Amazon mTurk's survey service, while the teamwork task prioritization activity will be conducted throughout courses here at the University of Washington. I am still in the construction phase of this study so I have no preliminary results yet, but one hypothesis is that there will be a positive correlation between team process gain (whether a group of people works better in a team than alone) and perceived temporal distance, with a negative correlation between stress level and these variables. A summary matrix of temporal distance perception and prioritization will be presented that can inform team leaders, as well as individual members about the management of time.

Collective Bargaining Agreements and Teacher Wages

Presenter:

Jordan Theodorikus (Jordan) Woltjer, Senior, Law, Economics & Public Policy
Mary Gates Scholar

Mentor:

Xiahua (Anny) Wei, Economics

Description:

This study evaluates the relationship between collective bargaining agreements (CBAs) and average teachers' wages with econometric analysis. The literature suggests that teachers' pay impacts the quality of educational provision, teacher retention, and quality of educational staff. Hence, understanding the determinants of teachers' salaries is of critical policy importance. Using Washington and Idaho state as the geographic frame for my research, I collected and compiled data from 143 school districts from the National Center for Education Statistics (NCES), the Washington State Report Card, the American Community Survey (ACS), the Washington State Department of Education, and the Idaho State Department of Education. I proposed several regression models and used a CBA dummy variable to explain the variation in teachers' wages, controlling for other relevant factors including student teacher ratio, expenditure per pupil, etc. The estimation results show that the presence of a CBA predicts a 6.1 to 6.7% increase in average WA/ID teachers' salaries. This result is consistent with the findings in the literature that a CBA predicts a minor increase in average teachers' salaries. This study extends the literature by verifying the importance of CBAs in the Washington/Idaho geographic area. The findings could be useful to educational stakeholders in salary negotiations, budget forecasting, and educational administration.

Caught on Camera: Discourses of Globalization and Global Citizenship in Latino Film

Presenter:

Sarah Ramirez, Senior, Law, Economics & Public Policy, American and Ethnic Studies *McNair Scholar*

Mentor:

Yolanda Padilla, Interdisciplinary Arts & Sciences

Description:

The historically racist relationship between Global South countries and the U.S. has led to misconstrued media representations of the Global South. This breeds ignorance about those countries when privileged U.S. travelers go to them, and a lack of critical consideration leading to limited perspectives of global citizenship and globalization. By intentionally exposing ourselves to proper representation of the Global South, U.S. travelers can begin to decolonize previous understandings of other countries and people. In

my research, I analyze portrayals of globalization and global citizenship in the films *Sleep Dealer* (2008) by Alex Rivera and *Ya No Estoy Aqui* (2019) by Fernando Frias. I chose these films because they were created approximately a decade apart, which might indicate changes to portrayals of globalization and global citizenship. More importantly, they were created by Latino filmmakers who share the identities of the characters they portray. I explore how these films, when created by filmmakers from the Global South, can aid in efforts to decolonize globalization and global citizenship, and the discourses surrounding them. Such filmmakers push against boundaries set by Western media that offer simplistic, often voyeuristic representations of the Global South, by presenting complex, realistic portrayals that offer more nuance to Western audiences. The films also grapple with issues of immigration; by centering their narratives on undocumented people and their experiences with citizenship, these films challenge the legitimacy of dominant definitions of global citizenship. I found that films like the two I researched here can challenge commonly accepted definitions of globalization and global citizenship and may be successful in changing attitudes of travelers from the U.S. Moreover, these challenges to dominant discourses can breed inclusion for travelers of color who would typically be left out of travel or global citizenship.

Investigating Predator Response of the American Crow (*Corvus Brachyrhynchos*) along an Urbanization Gradient

Presenter:

Lauren Watson, Senior, Biology

Tram Lam, Senior, Biology

Mentor:

Douglas Wacker, Biological Sciences, University of Washington Bothell

Description:

Over the last 50+ years, American Crow populations have increased in urban areas in the United States, taking advantage of abundant food sources and protection received under the Migratory Bird Treaty Act. However, heightened urbanization is correlated with increased anthropogenic noise, which can negatively impact bird communication. Some avian species compensate for this by increasing their call frequency to improve sound transmission. Previous work has also shown that avian social behavior can vary with urbanization, with individuals displaying increased boldness in more urban environments. In this study, we assessed the vocalizations, number of approaches per crow, latency to respond, and closest approach of groups of American Crows in response to a predatory owl decoy and playback of a distressed crow call, across an urban gradient in Western Washington. To quantify urbanization, we scored aerial photographs of each site, assessed levels of pavement, vegetation, building cover, and water, and used principal component analysis to create an urbanization score. Analysis of the first 12 sample sites revealed no statistically significant relationship between behavior or the frequency of vocalizations against urbanization. Surprisingly, ambient noise did not vary across our urbanization gradient, so our lack of significant findings may be the result of decreased anthropogenic noise due to the Covid-19 shutdown. However, we did detect a significant negative relationship between average pause duration, the spans of silence between separate calls, and urbanization, so crows may have adapted to produce more predator-related calls in the once noisier urban areas. We have increased our sample size to 31 sites and are currently continuing our analysis. Understanding how human impacts on the environment influence how wildlife responds to threats is important given the continuous expansion of urban areas. Our results may aid with ecologically-focused urban planning and urban wildlife efforts.

Recognizing Adaptations in Microbial Mutualism Through Allele Mutation Frequency Differences in Mutualistic Communities and Solitary Populations

Presenter:

Catherine Gohar, Senior, Biology

Mentors:

Kristina Hillesland, Biological Sciences

Reshmi Upreti, Biological Sciences

Description:

Some environments hinder microbes from gaining the nutrients they need for a chemical reaction. Species in this circumstance collaborate to produce energy by clearing toxic substrates or providing nutrients. This is mutualism, where two species benefit from each other's fitness. Previously, *Desulfovibrio vulgaris* and *Methanococcus maripaludis* were forced to rely on mutualism for survival over time. *D. vulgaris* catabolizes lactate, producing hydrogen as a byproduct. Hydrogen is inhibiting at high concentrations. *M. maripaludis* consumes this hydrogen and uses it for energy, producing methane as a byproduct. To learn how these microbes adapted to mutualism over time, 22 communities were propagated for 5000 generations. Each species was also propagated alone in environments that were as similar as possible to the mutualistic evolution environment. The whole genomes of the entire population of *D. vulgaris* or *M. maripaludis* were sequenced for the first 1000 generations using Illumina sequencing. This was done from 8 mutualism-evolved and 8 solitary-evolved cultures. Our research goal is to identify alleles that were substituted because they had a beneficial effect on mutualism fitness instead of other generic features of the environment. We can rule out generic adaptations in the population data by comparing mutations in community versus solitary-evolved clones. Clones were collected from each population that had been stored at -80°C by streaking them on plates. Plates were also used to test if the clones could grow on sulfate. The DNA of these clones will be sequenced to confirm the presence and determine linkage of alleles that are beneficial to mutualism. It is anticipated that the mutation frequency of catabolic proteins will increase within *D. vulgaris* solitary clones in comparison with community *D. vulgaris* clones. This experiment has greater implications for mutualistic interactions between microbes, specifically in terms of the methane greenhouse gas that microbes produce.

GPU Acceleration of Homomorphic Encryption for Federated Learning on Mobile Devices

Presenter:

Joshua Stuart Sterner, Senior, Computer Science & Software Engineering *Mary Gates Scholar*

Mentor:

Afra Mashhadi, Computing & Software Systems

Description:

Homomorphic encryption is a type of encryption which allows computations to be performed on encrypted data, without the need for the data to be decrypted first. Recent works have shown that homomorphic encryption can be used to train encrypted machine learning models on untrusted hardware. Federated learning enables distributed training of machine learning models on remote devices with their own private datasets. Existing federated learning techniques focus on protecting the privacy of the remote data, but not on protecting the content of the model being trained. Homomorphic encryption can be used with federated learning to protect the model. Homomorphic encryption is very computationally

expensive, however, it has been shown that GPU (Graphics Processing Unit) acceleration can be used to decrease its required computation time. Modern GPUs, including those in mobile devices, can be used for general purpose computing. GPUs are well suited to data-parallel tasks in which one operation is applied to many items. Many of the computations involved in homomorphic encryption are well suited to a data-parallel approach. This research investigates the use and implementation of GPU accelerated homomorphic encryption on mobile devices and examines the potential for its use in federated learning tasks. There are many types of homomorphic encryption, some of which are better than others for certain types of computation. For instance, HEAAN (Homomorphic Encryption for Arithmetic of Approximate Numbers), also known as CKKS (the initials of the authors of HEAAN), is well suited to computations involving vectorized fixed-point values. We implement and benchmark HEAAN for mobile GPUs. We anticipate that the practically achievable model depth will be very limited even with GPU acceleration, but that it will be significantly better than CPU implementations. We also anticipate that memory requirements will be a significant limiting factor for practical model depth.

Deep Embedded Clustering of Audio Data using LSTM AutoEncoders

Presenter:

Ali (Arshia) Jahangirnezhad, Senior, Computer Science & Software Engineering *Mary Gates Scholar*

Mentor:

Afra Mashhadi, Computing & Software Systems

Description:

Deep embedded clustering (DEC) utilizes deep neural networks (DNN) in order to learn feature representations using an autoencoder which is optimized for clustering. This is done by integrating a clustering loss using Kullback-Leiber divergence (KL divergence). Autoencoder models have been successfully applied to many types of data in order to enable unsupervised representation learning. Recurrent neural networks and long-short term memory (LSTM) networks have been utilized in learning representations of audio data. In many cases, convolutional autoencoder algorithms (CAE) have been used in processing audio data, in order to extract their feature representations. However, for the purpose of clustering similar learned embedded features from audio data, there has not yet been an integration of DEC in the LSTM autoencoders. This research project focuses on implementing DEC for audio signals. For this purpose, we have integrated a clustering loss using KL divergence into a LSTM autoencoder. Mel Spectrograms of the audio data are then extracted. This time-series data is fed into the network. We have evaluated our model performance using enormous data sets of audio signals collected from deep and shallow water hydrophones. With the decrease of hardware costs, stationary hydrophones are increasingly deployed in the marine environment to record animal vocalizations amidst ocean noise over an extended period of time. Bioacoustic data collected in this way is an important and practical source to study vocally active marine species and can make an important contribution to ecosystem monitoring. However, a main challenge of this data is the lack of annotation which many supervised neural network models rely on to learn to distinguish between noise and marine animal vocalizations. In contrast to the previous works done in this field, our approach is designed for unsupervised representation learning, allowing us to use a large volume of unlabeled data.

Mycoremediation of Wetland Water Contaminated by Antibiotic Resistant and Pathogenic Bacteria

Presenters:

Max Morioka Llewellyn, Senior, Biology

Carla Talbaux, Senior, Biology

Mentor:

Keya Sen, Biology

Description:

Mycoremediation is a widely researched method using mycelia to clean bacterially contaminated water bodies, such as the Bothell Wetlands, which has been contaminated by crow roosts. This research aims to analyze and quantify the remediative properties of the fungus *Stropharia rugosoannulata* on the bacteria *Escherichia coli*, *Salmonella enteritidis*, *Campylobacter jejuni* and *Klebsiella pneumoniae*. Additionally, the remediation of the antibiotic resistance genes (ARG), *Tet[A]*, *Tet[B]*, *Tet[M]*, *StrA*, *StrB*, *bla_{CMY}* and *bla_{CTX}* genes, was examined. One pound rye-seed bags were inoculated with liquid *Stropharia*. After three weeks, 35g of seeds were used to inoculate 60g of sterile wood chips in four 250mL bottles, for an incubation period of 3 weeks. Including a control bottle containing 60g of wood chips, we added 150mL of wetland water, spiked with 3500 CFU/100mL of the aforementioned bacteria, to each of the 5 bottles that were shaken via rocker. The following water retention times were chosen based on past experiments: 5min, 1hr, 5hrs, and 24hrs. When performing membrane filtration we used duplicate volume of 50ml for both genotypic analysis (qPCR), and for colony counting on selective plates. We analyzed the remediation using colony forming units and quantified using gene copy numbers (qPCR). The remediation of the following ARG was the highest after 1 hour of retention time: *StrB* (88.6%), *Tet[M]* (83.5%), and *Sul-1* (23.2%), while *bla_{CMY}* (100 %) and *StrA* (73.8%) had the greatest remediation after 24 hours. Results showed no remediation for *Tet[A]* and *Tet[B]* for any retention time. The remediation of *Campylobacter* (83.6%), *Salmonella* (97.6%) and *Klebsiella* (93.23%) was the highest after 1hr of retention time, while *E.coli* (27.61%) showed a greater remediation after 24hrs. The exponential increase in anthropogenic activities promoting bacterial contamination of the ecosystem and the spread of antibiotic resistant bacteria, highlights the urgency to find ways to mitigate them.

Pacific Northwest and Southeast China Climatology: A Comparative Analysis of CMIP5 Global and Regional Climate Model Time of Emergence

Presenter:

Kedar Yadav, Senior, Physics

Mentor:

Eric Salathe, Physical Sciences, UW Bothell STEM

Description:

The power of climate models are in part derived from their predictive ability. One such prediction is the Time of Emergence (ToE). The ToE is the year in which the year-to-year variability of a given holistic climate variable over a given period, such as 90th percentile maximum temperature, is overtaken by the effects of climate change. The Time of Emergence can help society plan for our climate future by dictating deadlines for levy construction completion or other such necessary climate change ready

infrastructure. In the Coupled Model Intercomparison Project Phase 5 (CMIP5) models and data sets, there are both Global Circulation Models (GCM) and Weather Research and Forecasting (WRF) models. In these two classes of climate models, there are different resolution scales and different parameters. GCM models are less local, do not consider smaller scale geographical features, and lack the regional resolution of WRF models. This analysis compares these two model classes through the ToE, determining how each model sees the emergence of climate change in the Pacific Northwest and Southeast China at local and global levels. The differences therein elucidate the predictive accuracy of each model class at small scales and further highlights the phenotypical aspects of each model class.

Does the American Crow (*Corvus brachyrhynchos*) Show Geographical Variation in its Calls?

Presenter:

Audrey Lynn Martin, Senior, Community Psychology

Mentor:

Douglas Wacker, Biological Sciences

Description:

Songbirds can learn different song dialects depending on their geographical location. Taxonomically, the American Crow (*Corvus brachyrhynchos*) is a songbird, but lacks a traditional 'song'. Despite this, research suggests that crows do possess brain regions necessary for song learning and production. Unlike their songbird relatives, it is not understood whether American Crow populations learn regional call dialects. Using recorded crow calls from the online database, Xeno-Canto, I analyzed the acoustic properties of over 150 audio files across nine ecoregions of North America. Using the bioacoustics program Raven Pro 1.6, I am currently quantifying the lowest frequency, syllable number, syllable duration, and call duration for each call. Geographical differences in call structure, if detected, may indicate that crows learn regional dialects, or the differences may be the result of different selection pressures in each region.

Variance in Steller's Jay (*Cyanocitta stelleri*) Vocalizations Within and Between Geographic Regions

Presenter:

Kira Noelle Lemke, Senior, Biology *Mary Gates Scholar*

Mentor:

Douglas Wacker, Biological Sciences

Description:

Steller's Jays (*Cyanocitta stelleri*) emit multiple call types. Variation within and between call types could indicate a sophisticated method of vocal communication. Variation could also indicate different selective geographic pressures or learned regional dialects. It is currently unknown whether Steller's Jays have

geographic variation in their calls. In this study, I investigated whether the 'wah call' of Steller's Jays varies between and within geographic regions. I analyzed recordings of 'wah calls' from two geographic regions spanning from Canada to Mexico. I quantified the number of syllables, the syllable duration, the call duration, and the average silence between syllables. 'Wah calls' are highly variable, with durations from 0.41 to 10.00 seconds, one to eleven syllables with durations from 0.26 to 0.71 seconds, and gap (silence between syllable) durations from <.01 seconds to 0.67 seconds. Preliminary analysis shows no significant differences in these acoustic variables between Steller's Jays in the Marine West Coast Forest and Mediterranean California regions. I am currently increasing my sample size, beginning analysis of additional Steller's Jay call types, and expanding data analysis to five geographic regions. The presence of regional variation could indicate that Steller's Jays learn their different vocalizations. Learning vocalizations could be a sign of complex communication within Steller's Jays.

Cross-Species Comparison of Coral Microbiome Structure and Disease Susceptibility

Presenter:

Ayomikun Olutimilehin Akinrinade, Junior, Health Studies

Mentor:

Jesse Zaneveld, Biological Sciences

Description:

Disease is a major threat to tropical coral reefs which can be made worse by local stressors like overfishing and nutrient pollution and global stressors such as climate change. However, not all coral species suffer disease at equal rates. It has been hypothesized that these differences may be due to differences in coral innate immune strategies, biogeography, or the symbiotic associations between corals and protective microorganisms (the 'coral probiotic hypothesis'). This project seeks to test if there are properties of coral microbiomes that correlate with differences in disease susceptibility. We've tested this using 1272 coral 16S rRNA gene amplicon libraries and three long-term coral disease datasets. Establishing a general picture of coral disease susceptibility requires integrating data from multiple regional disease monitoring projects. This is challenging because these projects use different methodologies, monitor different species and occasionally use different terminology for the same diseases. I've merged three long-term coral disease datasets: the Florida Reef Resilience Project, the Hawai'i Coral Disease database, and an extensive unpublished dataset from Dr. Joleah Lamb. This combined dataset consists of 141 different coral taxa and 31 unique categories of diseases and stressors. This combined disease resource allows for both investigation of the evolutionary history of coral disease susceptibility and comparison against our microbiome data. Our results so far identify coral groups especially susceptible to certain diseases (e.g., Acropora and Skeletal Eroding Band). So far, phylomorphospace analysis indicates an intriguing potential association between microbiome complexity and disease susceptibility. Preliminary results also indicate a strong correlation between microbiome richness and skeletal eroding band disease over more than 450 million years of coral evolution. This new evidence, if confirmed would support the coral probiotic hypothesis.

Food Waste to Energy: Identifying and Characterizing Microbial Partners in the Cooperative Breakdown of Butyrate

Presenter:

Chardai J Thomas, Junior, Extended Pre-Major, *Mary Gates Scholar*

Mentors:

Heidi Gough, Environmental & Forest Sciences
Thomas Lie, Civil and Environmental Engineering

Description:

Understanding the microbial process in the conversion of food waste into methane is necessary to realize the societal need to convert waste into a sustainable energy source. A critical step in the process is the synergistic breakdown of butyrate to methane. My project Food Waste to Energy allows us to mimic the degradation of food waste to isolate the microbial partners responsible for the production of methane. This process is carried out by a syntroph and a methanogen. Although we do not know the specifications of either organism, identification can allow us to improve the way we utilize bio-reactors dependent on food waste to produce clean energy. Each organism has been grown using media designed to allow for their specific development, doubling methane production within four months on average. We are in the process of conducting a dilution to extinction to reduce the contaminating microbes while selecting for the target majority by close observation of the purity of each sample microscopically. We will sequence the genome of each organism to characterize their respective genetic capabilities and identity which we suspect is novel. Activity and growth characteristics will then be studied to understand the growth kinetics when the organisms grow separately and together. Once the organisms are isolated, we look forward to accelerating methane production by selecting mutants that can catalyze the conversion of butyrate into methane. By identifying the organisms responsible for the conversion of butyrate to methane, we can begin to introduce highly productive bioreactors in urban, rural, and manufacturing settings to combat the use of non renewable energy and create energy from the 40 million tons of food waste produced annually in America.

Ribonucleotide Reductase is Essential in Adult Cardiomyocytes

Presenter:

Djelli Berisha, Senior, Biology

Mentor:

Farid Moussavi-Harami, Medicine

Description:

Heart failure (HF) is a constellation of symptoms caused by the heart's inability to pump blood to the rest of your body efficiently and keep up with its workload. As an increasing problem worldwide, there is a need to better understand the underlying mechanisms in HF to develop new therapeutics. HF activates many pathways that could potentially contribute to worsening conditions, such as deoxynucleotide biosynthesis which utilizes Ribonucleotide Reductase (RNR; rate-limiting step). RNR is a vital catalyst in converting nucleotide diphosphates (NDPs) to deoxynucleotide diphosphates (dNDPs) for further phosphorylation to deoxynucleotide triphosphates (dNTPs; utilized as building blocks of nuclear and mitochondrial DNA). RNR is made up of two subunits; Rrm1 which serves as a binding and catalysis domain, and Rrm2/2b which coordinates RNR activity. This project aims to understand how hearts respond with reduced RNR activity, which we investigate through a new mouse model that selectively removed Rrm2 from cardiac cells. We inject tamoxifen daily (25 mg/kg) for five consecutive days into two mouse lines we breed with LoxP sites in the Rrm2, one with and one without α MHC-MerCreMer (R2KO and control, respectively). Tamoxifen injections will conditionally knockout Rrm2 in adult mice with the α MHC-MerCreMer (R2KO). We used echocardiography to assess cardiac function which

showed increased cardiac chamber dilation and reduced cardiac function in R2KO mice compared to control mice. We harvest the tissue for histological, DNA, and RNA analysis. Histological analysis suggests that loss of RNR activity does not have any significant effect on cell size or fibrosis in comparison to the control. We will isolate DNA from mice cardiac tissue and use quantitative PCR to assess mitochondrial DNA content, as well as, isolate RNA to perform quantitative Polymerase Chain Reaction (qPCR) to confirm Rrm2 deletion and assess expression of other genes involved in the pathway.

The Socioeconomic Factors and Delivery of Care that Influence Patient Healthcare Treatment

Presenter:

Micheline P. Nguyen, Senior, Health Studies (Bothell), Biology (Bothell Campus)

Mentor:

Hoa B. Appel, Nursing (Bothell Campus)

Description:

A patient's experience and their health outcome can depend on numerous factors: (1) financial security of the healthcare institution, (2) patient's insurance type, and (3) the performance of care delivered by healthcare providers. The aim of this study focuses on socioeconomic factors such as a healthcare facility's financial status and the patient's insurance which influence their health outcomes. The study is a meta-analysis using health outcomes and providers' institutions. Findings show that having strong financial security of the healthcare institution allows providers to meet each patient's numerous needs. This can range from having the necessary resources to provide treatment or the ability to develop programs and systems that ensure providers are meeting or exceeding the standard quality of care. Results also reveal patients without insurance coverage will result in a lower probability of receiving treatment options, thus experiencing worse health outcomes than patients who are privately insured. The amount and quality of care that goes into each patient is different since it's based on the provider's capacity, the educational background their practice came from, or, in some cases, the patient's cooperation towards the treatment. These aspects, although unique from each other, all contribute towards achieving optimal patient health outcomes. Future research should examine the provider-patient interaction to learn more about how the experience can positively or negatively affect the patient's health outcome.

Understanding and Addressing Barriers to COVID-19 Testing in the Somali community in King County, WA: A Community-Driven Strategy

Presenters:

Najma Abdi, Junior, Public Health-Global Health *Louis Stokes Alliance for Minority Participation*

Asiya Abdurahman Ahmed, Senior, Anthropology: Medical Anth & Global Health

Andrea Jade (Andrea) Scallon, Senior, International Studies *UWHonors Program*

Ayan Hussein (Ayan) Mohamed, Senior, Anthropology: Medical Anthropology & Global Health, Public Health-Global Health *McNair Scholar*

Nasra Mohamed, Senior, Environmental Studies

Sabrina Ebengho, Senior, Public Health-Global Health (Global Health)

Mentors:

Kathleen West, Global Health

Keshet Ronen, Global Health

Description:

Immigrant and refugee communities are disproportionately impacted by COVID-19 due to pre-existing social and health disparities. In King County, COVID-19 incidence among Black individuals is 2.8-times higher than White individuals. In addition, communities with limited English proficiency have elevated rates of hospitalization particularly in Washington state. King County testing data has not been disaggregated by racial groups, limiting our knowledge on community testing needs. To better understand these issues, our team has collaborated with the Somali Health Board (SHB) to explore the barriers to COVID-19 testing within the King County Somali Community, where approximately 30,000 Somali immigrants reside. We administered anonymous surveys to Somali and non-Somali participants aged ≥ 18 (n=540) at testing fairs in South King County and recruited through community outreach. Survey data were used to quantitatively determine prevalence and correlates of timely COVID-19 testing within the King County Somali Community (defined as testing within 2 days of symptom onset). We conducted in-depth interviews with healthcare workers (n=5) and policymakers (n=5) to qualitatively explore the barriers and facilitators of testing in the community. We hosted two virtual focus group discussions -- one female-identifying group (n=10) and one male identifying group (n=10) -- with members from the King County Somali community to gather personal experiences of COVID-19 testing barriers and concerns. Our preliminary results suggest that there is a trend towards longer time from symptom onset to test for Somali respondents and that Somali respondents face various barriers to testing such as distrust, misinformation, stigma, language barriers, and transportation. This work is critical to help identify Somali community barriers to COVID-19 testing and how they can be adequately mitigated to improve access and promote equity in King County's pandemic response.

Using Urinary N-telopeptide and Serum C-Telopeptide as Biomarkers of Disease Activity in Children with Chronic Nonbacterial Osteomyelitis Who Are Treated with Bisphosphonates

Presenter:

Greta Emilie Kanestrom, Senior, Biology

Mentor:

Yongdong Zhao, Pediatrics

Description:

Chronic nonbacterial osteomyelitis (CNO) is an autoinflammatory bone disease associated with persistent bone pain, destruction and pathological fractures. While physical findings and laboratory tests are used in monitoring CNO disease activity, these methods are not yet reliable. Laboratory tests for N-terminal telopeptide (NTx) in the urine and C-terminal telopeptide (CTx) in the serum can be used to measure bone resorption that results from the breakdown of affected bones in CNO. These tests can serve as a useful monitoring marker in CNO patients taking bisphosphonates because these medications work by inhibiting osteoclasts that cause the degradation of bone. We aimed to assess the dynamic change of urinary NTx and serum CTx in children with CNO during and after treatment with bisphosphonates to determine if there is a correlation with disease activity. After IRB approval, we obtained consent from participating patients and families. Blood and urine samples, MRI scans, and clinical data including Physician Global Assessment (PGA) were collected during clinical visits at Seattle Children's Hospital. We analyzed collected data using descriptive statistics and performed a correlative analysis. Based on our small cohort, we confirmed an initial decrease of NTx and CTx during bisphosphonate treatment in

patients with improved PGA scores. After treatment, disease flare among these patients was not clearly correlated with the subsequent increase of these two markers; however, a well-controlled large-scale study is warranted for further confirmation. Results of this study have the potential to improve the efficiency of disease monitoring methods for pediatric CNO.

Racial Disparities in Health Funding: A Mixed-Methods Analysis of Medical Crowdfunding Campaigns

Presenter:

Aaron Davis, Senior, Health Studies *Mary Gates Scholar*

Mentors:

Nora Kenworthy, Nursing

Shauna Elbers Carlisle, Interdisciplinary Arts & Sciences

Description:

The utilization of crowdfunding websites has grown in popularity, particularly in the arena of medical crowdfunding to cover costs due to inadequate health insurance coverage and lack of social safety-net systems in place. Research on medical crowdfunding in global health contexts is not robust, and knowledge about its impacts on health outcomes is limited. What is known is that unmet health disparities are driving the need for medical crowdfunding, and crowd funders face numerous disparities that impact campaign outcomes, such as racial or gendered biases among campaign donors. Using descriptive statistics and content analysis of viral medical campaign data from the GoFundMe site, this research helps create an archetype for the most successful campaigns and examine social ideas of deservingness related to race, gender, and severity of the disease. The results show stark disparities in medical crowdfunding outcomes based on race and gender and a lack of diverse representation among highly successful crowdfunding campaigns, particularly in the case of Black women. This mixed methods research analysis looks to create further discussion on how technology may aid in creating health inequities for already marginalized and traditionally disenfranchised populations.

ECG Authentication for Wearable Medical Devices using Deep Learning

Presenters:

Larissa Gao, Senior, Computer Engineering

Aika Usui, Senior, Computer Science & Software Engineering

Mentor:

Geetha Thamilarasu, Computing & Software Systems

Description:

Wearable medical devices are now increasingly connected to the Internet, enabling improved patient outcomes and quality of care. However, this increased connectivity has also increased the attack surfaces, making the device and their data vulnerable to cyberattacks. Because wearable medical devices transmit private and sensitive medical information, it is critical to secure access to these devices. As evidenced by recent ransomware attacks on hospitals, the ability to remotely access and manipulate a medical device

poses a direct threat to patient health whether in a hospital or at home. In this research, our goal is to enhance the security of wearable medical devices by using patients' electrocardiogram (ECG) signals to authenticate devices. Specifically, we propose a deep learning approach for classifying a patient's electrocardiogram (ECG) as a biometric for authentication. The deep learning approach allows a device to learn its user's ECG in order to authenticate them against untrusted entities. Our research also extends the use of electrocardiogram signals for authentication by accounting for patient's stress levels and varying emotional states, as the accuracy of ECG authentication may be affected by these variables. Our experimentation involves testing different parts of electrocardiogram signals using deep learning models and determining the most accurate method of classifying the end user's device. The proposed research is useful for studying and evaluating the benefits of deep learning algorithms used in conjunction with authentication techniques in healthcare domains.

Humor Effects on Team Success: A NASA Case Study

Presenter:

Agne Januskeviciute, Fifth Year, Business Administration

Mentor:

Deanna Kennedy, Business Administration

Description:

Long duration space missions pose a challenge on crew members' mental well-being and, subsequently, their work together. Since the trip to Mars is expected to last 3 years, researchers need to help prepare teams to be successful throughout this time period. The crew spends not only working time together, but also a majority of their downtime. As such, we can consider how this fluid suite of interactions can be used to maintain morale and team relationships for the long haul. In this study, I explore the use of humor in downtime engagements by crews in the HERA station - an analogue space station situated at Johnson Space Center in Houston. I listen to the audio data from crews completing a 45 day mission to explore how humor influences their task success. I use a qualitative case based approach to assess humor and its effect on teamwork and validate these assessments with NASA subject matter experts in behavioral health performance. Preliminary research shows that activities, such as watching sitcoms and joking while watching the news help crew members form and maintain strong relationships that later influence task success. My findings can instruct the set up of humor opportunities for long duration space mission crews. In addition, real-world team leaders can utilize these findings to improve their team cohesion and performance.

Automation of Data Processes to Ensure Consistency in the Exploration of Trends in the Atmospheric Composition of Extrasolar Planets

Presenter:

Aria Xin Yi Li, Senior, Computer Science & Software Engineering

Mentor:

Paola Rodriguez Hidalgo, Physical Sciences

Description:

Extrasolar planets (planets orbiting another star) were discovered in the early 1990's and since then over 4,350 exoplanets were confirmed to exist as of February 2021, according to the NASA Exoplanet Archive. Our research focuses on looking for trends between the physical/orbital properties and the atmospheric properties of exoplanets. To search for these trends, we use Python and the Habitable Zone Gallery, which is a website that is dedicated to tracking the orbits of exoplanets in relation to their habitable zones, to select exoplanets that are within our desired scope. We have written software that extracts particular physical and orbital data on planets from the Habitable Zone Gallery, but currently, both the download and the transfer to our Google Drive are done manually. These manual tasks are inefficient, among other things, due to the fact that they do not account easily for updates. I will present the software we have developed and our latest developments to resolve these issues, such as modifications to automatically download and upload all of the necessary data. This increases efficiency and in turn, ensures everyone on our team is using the same set of data. Additionally, we are designing a PostgreSQL database that would hold all of our collected data. To increase accessibility of the database, we would utilize interfaces that allow individuals from various academic backgrounds to perform searches on our data. This helps guarantee that all of our data is in one place, accessible, and up to date. In the future, we intend for our software and results to be published for the scientific community. This allows for all of our research to be accessible to individuals who wish to learn more about the relation between the physical/orbital and atmospheric properties of exoplanets.

Age of First Parental Concern of Language/Behavior and Later Language Development in Youth with ASD: The GENDAAR Study

Presenter:

Milana Premkumar, Senior, Health Studies

Mentors:

Sara Webb, Psychiatry & Behavioral Sciences, Seattle Children's Research Institute, Seattle Children's Research Institute

Megha Santhosh, Seattle Children's Research Institute, Seattle Children's Research Institute

Description:

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in communication, cognitive, and social impairments (Morgan et al., 2019). Earlier diagnosis has been shown to have a positive language trajectory for children with ASD. Delays in language development is one of the earliest signs of autism, and the more severe the child's early language delays are, the more likely they will have impaired language functioning (Mody & Belliveau, 2013). This project aims to evaluate if early language behavioral concerns raised by parents (age at first concerns of language) predict later language ability in youth with and without ASD. Participants included 68 children with ASD (males=34) between the ages of 8 and 17 years from the four site NIH funded study looking at sex differences in autism. All participants included met ASD criteria via standardized measures and had a verbal IQ >70. Parents of participants completed the Autism Diagnostic Interview (ADI-R), including questions related to when they observed the first signs of language and behavioral concerns and if concerns started at certain milestone ages (before 12 months, 18 months). Child participants completed a clinician-administered language task (CELF-IV), including answering questions related to recalling and formulating sentences. We predict that ASD children, whose parents identified concerns at an earlier age, have better language skills later in childhood. Previous research has indicated that females with ASD have a better language trajectory and have more vital verbal skills (Banks, 2020). Considering this research, we

will explore sex differences, age of concerns, and later language development. This research can shed light on the importance of providing training to parents to recognize language delays early in children.

The Geographical Location and Marginalized Population of Medical Crowdfunding's Blind Spot

Presenter:

Seohyun Bae, Senior, Health Studies

Mentor:

Jin-Kyu Jung, Interdisciplinary Arts & Sciences

Description:

People use online crowdfunding sites to raise money to afford their medical bills. We might commonly think this happens because of lack of government support but in fact, online crowdfunding sites lead to health inequality. One important concept of this research is that online discrimination is connected to offline. For instance, there are some places there is more segregation compared to other places, and online space has inequalities as well. Marginalized group of people tends to show poor funding performance so this study takes place to figure out who those marginalized people are and where they settle to observe if people unfairly treated is actually living in a place where there is more segregation.