



*Undergraduate*  
SYMPOSIUM

FRIDAY, APRIL 3

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**ABSTRACT 2020**

Showcasing research, creativity, and service learning

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Welcome to our 22nd Annual Undergraduate Symposium at the University of Wisconsin-Madison. The Symposium takes a new turn this year in response to the COVID-19 pandemic whereby we celebrate the research accomplishments of our undergraduates in a virtual format. We look forward to getting back to our labs, field sites, studios and similar locations where the creativity and curiosity of our undergraduates can flourish without constraint as they build their Wisconsin Experience.

*Steven M. Cramer, Vice Provost for Teaching and Learning  
University of Wisconsin–Madison*

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2020 Undergraduate Symposium Organizing Committee: Hannah Bailey, Liza Chang, Steven M. Cramer, Doug DeRosa, Sarah Hagedon (coordinator), Marina Kelly, Mandy Morrow, Samantha Samreth, Amber Smith, Julie Stubbs, Beth Tryon

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*Cover photo by the Office of University Communications.*

## **HIDDEN HISTORIES AND RHETORICAL DISSONANCE IN THE PLANTATION HERITAGE SITE**

Heidi Weston, Michael Bernard-Donals (Mentor)

My aim with this paper was to document the range of rhetorical tensions that are embodied in Plantation Heritage Sites and their preserved architecture, objects and collections, tour talks and historical interpretation. These tensions are engendered by the rhetorical needs and desires of tourism and through the uncertain admixture of Old South myths and more historically accurate narratives. I argue that these rhetorical conflicts which are represented in the plantation heritage site are indicative of the friction that exists between dominant publics and subaltern counterpublics, who both view the plantation heritage site as central to their sense of self and collective identity.

## **COLLEGE STUDENTS BEFORE CROSS CULTURAL STUDY ABROAD**

Kendi Aaron, Julie Larson-Guenette (Mentor)

University students seeking to gain global experiences take part in study abroad programs. This research focuses on a 3-phase study investigating cultural literacy and linguistic gains among a cohort of UW-Madison students in an 11-month study abroad program in Freiburg, Germany. Data for this project consists of surveys, interviews, and writing samples taken before, during (at 4.5 months) and after the program. Dr. Julie Larson-Guenette and her colleague previously noted increased linguistic proficiency in students' writing samples. However, the current project focuses on a subset of interview data (n=6) collected prior to the 11-month program. Data analyses explore themes present in the initial interviews that offer insight into students' motivations for study abroad and their desire to cultivate cross-cultural awareness and linguistic development.

## **OS AND ND ISOTOPE STRATIGRAPHY OF THE ~2.05 GA ZAONEGA FORMATION TO UNDERSTAND CHEMICAL AND PHYSICAL WEATHERING DURING THE GREAT OXIDATION EVENT**

Sheila Rozalia Binti Abdul Rashid, Annie Bauer (Mentor)

About 2.4 billion years ago (Ga), the concentration of oxygen in Earth's atmosphere rose dramatically, changing the nature and intensity of chemical and physical weathering until oxygen levels crashed 2.0Ga. Paleoproterozoic organic-rich shales of the Zaonega Formation in the Onega Basin, Russia, contain weathered detrital material that could provide critical information about the nature of these fluctuations in atmospheric oxygen. We performed Os and Nd isotope over 100s of meters of stratigraphy to evaluate the authigenic and detrital components in these shales. Our Os isotope results track the variation in chemical weathering input across millions of years in the Onega Basin, providing a record of the crash in oxygen levels. We use the  $^{143}\text{Sm}$ - $^{147}\text{Nd}$  isotope system to track variations in the detrital provenance throughout this interval.

## **POSITRON EMISSION TOMOGRAPHY PROTOTYPE ASSEMBLY**

Paul Adu, Duncan Carlsmith (Mentor)

Positron Emission Tomography (PET) is a nuclear medicine functional imaging technique for observing cell metabolism and diagnosing diseases. In the Garage Physics lab, we're trying to assemble a pint-sized prototype of the PET scan. The system works on the principle that a radioactive tracer undergoes decay to emit a positron. The positron travels until it interacts with a nearby electron to annihilate, producing a pair of gamma photons. The gamma photons produce a scintillation, which is detected by a silicon photomultiplier. We use MATLAB to collect raw data. The Pint-sized PET prototype will be able to solve the problem of high operational cost associated with the existing PET scan. Moreover, it can be used to diagnose diseases from wide range of bodies: humans, pets, and lab animals.

## **THE USE OF UNNECESSARY IMAGING FOR DIAGNOSIS OF INGUINAL HERNIAS**

David Aguilar, Dr. Anne Lidor (Mentor)

In the US, over 700,000 inguinal hernia repairs are performed each year. Inguinal hernias are usually diagnosed by a physical exam. In the event where physical exams are inconclusive, imaging techniques can be used. However, some physicians order radiology studies even when a hernia is felt during the physical exam. Studies such as CT scans, ultrasounds, and MRIs are used. Unnecessary radiographic imaging can lead to adverse side-effects for the patient, increase the cost for the patient, and put an economic strain on our healthcare system. The purpose of this project is to determine how much unnecessary imagery is used. Electronic health records from the UW-Health system will be analyzed to determine the rate of usage of radiology studies in the inguinal hernia surgery population.

## **MAPPING THE TEMPORAL: CATALOGING ECONOMIC SECTORS IN LATINO VENDOR MARKET**

Naga Sahiti Akondi, Edna Ledesma (Mentor)

Flea markets in America generate around \$300 billion in sales annually. These markets tend to be run and visited mostly by Latino in areas with a high concentration of this population. Despite this, not much attention was given to them as important places of attachment. This research studies the economic profile of these markets with a place based approach. It draws comparisons between four sample flea markets in California and Texas chosen because they are home to a high number of Latinos. The research methodology includes site observations, surveys, and key informant interviews. Some findings from this research show how Latinos feel a sense of attachment to these markets. This research aims to suggest policy measures to support Latino owned businesses.

## **ELECTROPORATION OF GFP-MRNA INTO NK92**

Adeela Ali, Christian Capitini (Mentor)

Natural killer (NK) cells are a subset of lymphocytes that can kill cells in an antigen-independent manner. The human NK cell line, NK-92, when transduced with a CD19 CAR has been shown to be highly cytotoxic to cancer cells. However, conventional lentiviral approaches for CAR transfection into NK cells have the potential to cause insertional mutagenesis. Here, we attempt to transduce GFP into NK-92 cells using mRNA electroporation. This method has been shown to have higher transduction efficiency as compared to DNA-based methods. We will be testing the efficacy of electroporation as well as NK-92 cell viability post-transduction. The results from this study will help establish safer, more efficacious methods of CAR transduction into NK cells for clinical purposes.

## **GENERATION OF ENHANCED RIBOSOMES FOR OPTIMAL PROTEIN OVEREXPRESSION VIA CRISPR-CAS9-ASSISTED RECOMBINEERING**

Anna Allen, Silvia Cavagnero (Mentor)

The accumulation of insoluble protein aggregates in overexpression conditions is a common obstacle for researchers aiming to study proteins and turn them into useful products. Existing methods used to prevent or counteract this problem in bacteria are largely inadequate. A promising alternative is modification of the ribosome to unlock its intrinsic ability to chaperone protein folding. This approach is made possible with the gene-editing potential of CRISPR-Cas9-assisted recombineering. Through systematic edits to the structure of the E. coli ribosome, we hope to design an idealized machine capable of both synthesizing proteins and promoting their complete, proper folding prior to release. Timely folding in this way is crucial to bypassing the aggregation pathway.

## **GEODESIGN FOR RIPARIAN VEGETATION BUFFERS TO MAINTAIN TEMPERATURES TROUT STREAMS IN A CHANGING CLIMATE**

Rykia Amos, David Allen Hart (Mentor)

Recognized as a trout fishing haven, Wisconsin attracts tourism to its more than 10,000 miles of cold-water streams. Anthropogenic climate change threatens the long-term health of these water bodies. This project focuses on trout streams within western Dane County. The first phase involves review of observed and predicted climate trends for temperature in Wisconsin developed by the UW Center for Climatic Research, and use of the FishVis Mapper developed by the U.S Geological Survey to identify streams with cold-water species vulnerable to increasing temperatures. The second phase reviews literature about the capacity of riparian vegetation buffer practices to decrease stream temperatures. The final phase applies a geodesign process using GeoPlanner software to place riparian vegetation buffer practices needed to mitigate expected increases in stream temperatures.

## **REFUGEE RESETTLEMENT IN THE UNITED STATES- COMPARING THE EXPERIENCES OF WOMEN IN TWO CITIES**

Olivia Anderson, Gay Seidman (Mentor)

This research aims to illustrate the complex and diverse state systems of refugee resettlement in the United States from the perspective of both service providers and women refugees. While women refugees are the majority of resettled refugees in the United States, there is a gap in the current scholarly literature regarding the particular experiences and struggles of women refugees. In an effort to address this gap, this project looks at two distinct cities- Minneapolis, Minnesota and Portland, Maine- with sizable Somali communities to capture how women refugees resettle in certain ways based on local service capacities and the close knit refugee communities. This research surveys the available sociological research to make new arguments regarding the refugee resettlement system in the United States.

## **DURABILITY AND DIFFUSION KINETICS STUDY OF CFRP COMPOSITE IMMERSSED IN SEAWATER**

Justin Apresa, Pavana Prabhakar (Mentor)

Carbon Fiber Reinforced Polymer (CFRP) composites are replacing other structural materials due to their high strength and its excellent stiffness to weight ratio. This research project is designed to observe the effects of seawater on CFRP composites while manipulating the geometrical orientation and volume fraction. The diffusional kinetics will be determined from the moisture absorption test. Mechanical and thermomechanical tests will also be performed to understand the effects of seawater diffusion in the CFRP composite. The experimental diffusion data will then be incorporated into a finite element model to predict the overall diffusion in the CFRP composite. Knowing the effects of seawater on CFRP will give engineers the tools to incorporate CFRP in the industry to build better buildings, boats, and other structures.

## **NOVEL BIODEGRADABLE NANOCAGE-DELIVERED CAS9-RNP FOR ROBUST GENE EDITING IN MICE BRAIN.**

Alex Araki, Krishanu Saha (Mentor)

Despite recent advancements in CRISPR-Cas9 research, in vivo plasmid delivery methods in the brain remains to be a challenge due to its dense structure and blood-brain-barrier. One promising alternative utilizes a combination of safe and easy-to-manufacture non-viral delivery vehicles with a pre-assembled Cas9-RNP, which produces less off-target effects due to its shorter half-life compared to plasmids. This research aims to develop and evaluate the efficiency of a novel covalently-crosslinked, yet intracellularly biodegradable non-viral nanocapsule (NC) for safe and robust Cas9-RNP delivery in neurons. Experiments in cultured neuronal cells and mouse models have indicated that decorated NCs can effectively deliver Cas9-RNPs, resulting in efficient editing in neurons and glia.

## **THE ROLE OF ENVIRONMENTAL RISK FACTORS IN PRESCHOOLERS' SELF-REGULATION AND VERBAL ABILITIES**

Joana Arengo, Janean Dilworth-Bart (Mentor)

The purpose of this study is to explore the relationships between environmental stressors, self-regulation, and verbal abilities of preschoolers. Previous research shows that environmental stressors, such as fine particulate matter (PM<sub>2.5</sub>) and high-level noise exposure, can decrease children's school readiness and increase their susceptibility to health problems in the future. In this study, I will review the literature on fine particulate matter (PM<sub>2.5</sub>), high-level noise exposure, and their impacts on self-regulation and verbal abilities. Next, I will present preliminary analyses of the associations between air quality, noise, child verbal ability, and self-regulation. I will conclude this study with a discussion of future actions and policies that are aimed towards reducing child exposure. This study will deepen the understanding of environmental risk factors and child development.

## **SYNTHESIS OF BIMETALLIC CATALYSTS FOR THE SELECTIVE HYDROGENATION OF ACETYLENE**

Samantha F. Ausman, Elise Gilcher (Mentor)

In heterogeneous catalysis, bimetallic catalysts offer advantages in activity, stability, and selectivity over monometallic catalysts for many reactions. For example, the selective hydrogenation of acetylene is typically carried out over AgPd catalysts. This reaction is used to remove acetylene impurities present in industrial ethylene streams without producing ethane through over-hydrogenation. Our work focuses on CuPd and AgPd catalysts synthesized by controlled surface reactions with well-defined active sites to develop structure-selectivity relationships for this reaction. To understand the interactions between the Pd precursor and the SiO<sub>2</sub> support, a series of controls were carried out to analyze the concentration dependence of precursor uptake onto the support through UV-vis spectroscopy. Selectivity was also tested between Pd/SiO<sub>2</sub>, AgPd/SiO<sub>2</sub>, and CuPd/SiO<sub>2</sub> catalysts.

## **TESTING THE ROLE OF CLIMATE IN DRIVING WING PATTERN VARIATION IN THE BUTTERFLY PARNASSIUS SMINTHEUS**

William Awve, Sean Schoville (Mentor)

The purpose of this research is to determine whether wing color pattern for *Parnassius smintheus* evolves in response to environmental factors, specifically climate. It is important to understand the relationship between current climate conditions and unique phenotypic characteristics to evaluate the implications of a warming climate on geographically sensitive species. This research will identify a relationship between wing color pattern and environmental factors for this rare alpine butterfly species. Data collected during research consist of wing pattern data across geographically separated sites and climate data from each site. The data will be used to assess whether phenotypes vary as a function of climatic variation, while controlling for genetic divergence. Results from this research suggest a strong correlation between wing color and variation with climatic variables.

## **EFFECTS OF EARLY REARING HISTORY ON HANDEDNESS IN RHESUS MACAQUES**

Kavya Ayalasomayajula, Peter Pierre (Mentor)

Studies have shown significant differences between left- and right-handed people, such as evidence that left-handed people are more susceptible to certain autoimmune disorders. Once thought to be a uniquely human trait, handedness has also been observed in nonhuman primates, and it could shed light on the evolution of brain lateralization. However, there are inconsistencies in findings between nonhuman primate lateralization studies, and more research needs to be done to isolate variables contributing to handedness. Past studies have indicated that early rearing environment has an effect on handedness in rhesus macaques, and we aim to expand on this research. We assessed handedness in two groups of monkeys with different rearing histories by using a well-validated coordinated bimanual test known as the TUBE task.

## **PROTOTYPE FOR A DREAM SEQUENCE**

Kristian Marril Bacarro, Anna Campbell (Mentor)

Prototype for a Dream Sequence is an image and material-based inquiry that seeks to critique contemporary hierarchies and patterns of violence, and the semiotic traces and cultural antecedents that define how we recognize valor and value. A series of sculptures and art forms assemble scaffolding fragments, “oriental” rugs, archival images, and critically, the fragmented form of the classical Greek sculpture, the Farnese Hercules (4th century BCE). A centerpiece of this work is Lamp, a CNC carved and manually assembled sculpture of Herakles made from layered plywood, wires, led lights and an industrial footswitch, whose purpose is to engage the viewer in questioning constructions of masculinity both through Herakles’s dual expressions of masculinity and femininity and through the compositional interventions of this classical form.

## **THE CHINESE REFORM: A PERSPECTIVE FROM THE WORKERS OF THE GUANGZHOU 524TH TELECOMMUNICATIONS EQUIPMENT FACTORY (1978 - 1989)**

Mingcong Bai, Judd Kinzley (Mentor)

This project will focus on the first decade of Chinese Reform and Opening Up (1978 - 1989) from the perspective of the workers of the Guangzhou (National 524th) Telecommunications Equipment Factory. Specifically, this project aims to create a humanised and nuanced picture of labour relations and individual political representation in this period. Through a case study of the Guangzhou Telecommunication Equipment Factory in the first decade of the Reform and Opening Up, I will trace the shift from the revolutionary premise of class struggle to one for economic growth and private interests, and thereby explain how it contributes to the decline in the willingness to participate in politics and facilitates the development of a hierarchical and authoritarian governmental system in post-Reform China.

## **IDENTIFYING ACTIVE EXTRAVASATION ON ARTERIOGRAMS USING MACHINE LEARNING**

Achutha Balaji, Anjaney Mishra, Ethan Chauhan, Anthony Lam, Dane Morgan (Mentor)

This project aims to use artificial intelligence to identify regions of arterial bleeding on angiograms. To artificially block arteries that are causing internal bleeding, radiologists must perform angiograms to identify bleeding sites. Given that perceptual errors account for 60-80% of all radiology errors, machine learning algorithms can be trained to be more accurate in identifying bleeding on angiograms. In the initial work, two deep neural networks, ResNet-152 and Faster R-CNN, were used to classify whether a bleed was present and to identify the bleeding site, respectively. Preliminary results show 90% accuracy for ResNet-152 and 50% for Faster R-CNN. More machine learning techniques are being explored, and discoveries from this project can improve the accuracy of radiologists performing urgent, life-saving procedures.

## **DEVICES OF THE COMEDY GENRE ACROSS ERAS**

Maia Bandera, Ben Singer (Mentor)

We are researching elements of comedy most characteristic of the genre. Using the American Film Institute (AFI) Catalogue, we examine the prevalence of certain elements in certain periods of comedy films; elements such as deception, imposture, mistaken identity, for example. We hope to gain insight into distinctive devices of the genre and ultimately explore why comedies gravitate towards these particular conventions. Our sample incorporates films from three main periods: the silent era, the classical era, and the period following the introduction of the rating system in 1968 in order to highlight possible shifts in representation across periods. This research is important because comedy is a universal popular amusement relevant in many ways to the analysis of culture and human nature.

## **EVOLUTIONARY GENETICS OF ALPINE INSECTS**

Corinne Banks, Sean Schoville (Mentor)

Many species are experiencing the rapid pace of climate change, but it is especially concerning that diverse groups in vulnerable habitats, such as insects in alpine habitats, remain poorly studied. The purpose of this research is to study the evolutionary genetics of Alpine insects, specifically the beetles found within Mt. Rainier National Park, in Washington. We will reconstruct the relationships among populations sampled as well as estimate the timing of diversification events. Through this research, we will be able to learn how climate change affects this species, which is important.

## **CHANGE IN THE PERCENT OF CD41-POSITIVE LEUKOCYTES IN PATIENTS TREATED FOR EOSINOPHILIC ESOPHAGITIS**

Kelly Bartig, Dr. Mats Johansson (Mentor)

To assess the disease activity of Eosinophilic Esophagitis (EoE), esophageal biopsies must be examined. AlphaIIb- integrin (CD41, reporting platelet association) on blood eosinophils correlates with tissue eosinophil count in EoE patients after treatment. Platelets also associate with other leukocytes. I found that CD41-positivity of monocytes, neutrophils, or natural killer lymphocytes correlated with CD41-positivity of eosinophils after treatment. I am doing the same analyses before treatment to see if the leukocytes change similarly during EoE treatment. I will use receiver operating characteristic (ROC) curve analyses to compare the predictive value of CD41-positivity of the other leukocytes compared to eosinophils, identify optimal cutoff for CD41-positivity of each cell type, and determine whether a combination of cutoffs better predicts disease than only one cutoff.

## **CROSS-LINKING OF FERONIA TO REVEAL ITS STRUCTURE AND BASIS OF SIGNALLING**

Jordan Bartosiak, Matthew Blackburn (Mentor)

Many factors like climate change and new pathogens now threaten the development and growth of plants, which are essential for our survival. Previously, it has been possible to explore the structure and signalling pathways within some plants, but how signalling is driven by complex formation is unknown. Our research works to uncover the understudied structure and biochemical basis of Feronia in *Arabidopsis thaliana*. This receptor-like kinase controls the signalling of growth, reproduction, immunity, and stress. Utilizing cross-linking and mass spectrometry, we can study and map the interfaces of interacting molecules. With our uniquely designed insert, we will genetically modify *Arabidopsis* and observe cross-linking of Feronia to learn more about its structure, advancing knowledge of signalling and physiological responses.

## **NEGOTIATING ANTI-BLACK RACISM IN “LIBERAL” CONTEXTS: THE EXPERIENCE OF YOUTH WORKERS IN COMMUNITY-BASED EDUCATIONAL SPACES**

Jaylah Batemon, Shilpa Maddikunta, Bianca Baldrige (Mentor)

There are stark racial disparities between Madison’s White and Black residents. This project examines how these disparities are discussed in order to challenge claims of liberalism. The Race to Equity report found extreme disparities in Madison (WCCF, 2013). Focus groups, interviews with Black youth and youth workers, and community event notes will be analyzed to learn how community-based youth workers understand how anti-black racism and racial disparities inform the lives of Black youth. These first-hand accounts will inform youth workers’ engagement with youth and support their programming efforts with Black and other youth of color in Madison/Dane County. Structural racism shapes schooling and the social experiences of Black youth; however, as this project demonstrates, these issues are often brushed aside within progressive, predominantly-white, cities.

## **SELF-REFLECTION OF EMOTIONS IN BOYS WITH AUTISM SPECTRUM DISORDER AND FRAGILE X SYNDROME**

Lily Beckers, Laura Friedman, Audra Sterling (Mentor)

Fragile X syndrome (FXS) is a genetic disorder that presents similar social and language deficits as autism spectrum disorder (ASD); up to 75% of boys with FXS meet criteria for ASD (FXS+ASD). Emotional understanding is impaired in individuals with ASD and FXS and is crucial for relationship formation. With the goal of understanding emotion perception in adolescent boys with ASD and FXS+ASD, responses to questions about emotions were coded for coherency and content for 29 boys. We asked: 1) Do boys with idiopathic ASD and FXS+ASD differ in the coherence and content of their responses to questions about their emotions?; 2) Are ASD severity or nonverbal IQ related to emotion perception in boys with idiopathic ASD and boys with FXS+ASD?

## **DECARBONYLATIVE, NICKEL-CATALYZED CROSS-ELECTROPHILE COUPLING OF ARYL ACYL FLUORIDES WITH ARYL TRIFLATES**

Peyton Beyer, Dr. Jiang Wang (Mentor)

Biaryl compounds are found in a plethora of chemicals with pharmaceutical and agricultural relevance. Cross coupling reactions are often the best route for synthesis of aryl-aryl bonds. However, starting materials are often a limiting factor in the utility of these transformations, due to the requirement of both pre-generating reactive organometallic species and relying on commercially limited aryl halide coupling partners. A more attractive approach would be the coupling of two commercially abundant aryl electrophiles in the presence of stoichiometric reductant to yield biaryl compounds. We report the use of commercially accessible aryl carboxylic acid derivatives as starting material which, in the presence of a transition metal catalyst, successfully decarbonylate and couple to commercially abundant aryl triflates to yield biaryl compounds.

## **RECONSIDERING REVOCATION**

Anna Bierley, Cecelia Klingele (Mentor)

Community supervision (CS) is widely used in the U.S. criminal justice system as an alternative to incarceration. ; even though many people on CS will fail to meet their conditions and become incarcerated. This calls the effectiveness of CS into question, - particularly for those whose mental illness or addiction prevents them from succeeding. Most research on CS has been done in urban settings, with little attention given to rural communities which often have fewer employment options, public transportation, and resources for those who struggle with mental illness and addiction (high-needs individuals). Thus, the purpose of this project is to collaborate with local partner agencies to create a program that will meet those needs, - including mental health, addiction, and transportation services, - which often contribute to the failure of supervision.

## **LATE MESOLITHIC FOODWAYS IN ARCTIC AND SUBARCTIC COASTAL ZONES: AN ETHNOARCHAEOLOGICAL APPROACH**

Megan Binkley, Dr. Sarah Clayton (Mentor)

In this research, I investigate hunter-gatherer resource exploitation in fjord-skerry landscapes during the Scandinavian Late Mesolithic via an ethnoarchaeological analogy. Specifically, I ask: is there a correlation between topography type and the targeted exploitation of specific marine resources? Additionally, my research explores how ethnoarchaeological analogies in Scandinavian fjord-skerry landscapes expand our understanding of foodways in synonymous landscapes worldwide. Using data collected from families practicing traditional exploitation methods, I argue that there is a strong correlation between fjord-skerry topographies, climate, and specific resource exploitation. Furthermore, my work analyzes the participation of juvenile hunter-gatherers as young as four. To best illustrate the relationship between resource type, topography, and forager demographic, I divide fjord-skerry landscapes into six 'accessibility zones', each with distinct resources and exploitation advantages and disadvantages.

## **A SEARCH FOR SUBMILLIMETER GALAXY COUNTERPARTS**

Ariana Blair, Amy Barger (Mentor)

We look to find counterparts to our 450 $\mu$ m sources found in our SCUBA-2 imaging of the Chandra Deep Field North (CDF-N) and Chandra Deep Field South (CDF-S). We chose sources greater than  $4\sigma$  and found 91 and 21 sources respectively. We then matched the sources to published 850 $\mu$ m catalogs and found 57 matches in the CDF-N and 12 matches in the CDF-S. Using their fluxes, we created flux ratio-redshift figures plotted against Arp220 SEDs at varying temperatures. Also in the CDF-N, we used VLA 20cm observations to find radio counterparts to our matched sources, with all having a 20cm counterpart. We used this data to construct a ratio-ratio plot for redshift estimates. With this data, we aim to construct a better picture of the 450 $\mu$ m population.

## **THE APPLICATION OF CLARITY TISSUE CLEARING TO VOCAL FOLD MICROSTRUCTURE**

Larissa Blazek, Jack Jiang (Mentor)

Phonatory dysfunction can be caused by a number of factors, many of which are related to the microstructure of the vocal folds. Medical professionals need a clear picture of the vocal folds to investigate pathologies. Previous research into the structure of the vocal folds was done through tomography or histology, where researchers cut the vocal folds into fragments in order to analyze it. Through the use of CLARITY, researchers can image vocal fold microstructures in a clear, three-dimensional tissue, allowing professionals to more easily visualize its proteins and fibers. CLARITY is done in three steps; hydrogel fixation, electrophoresis, and immunostaining. After this process, the vocal folds will be clear, providing researchers with the ability to map specific parts of the vocal fold microstructure in three-dimensions.

## **DEVELOPMENT OF A COMMUNITY-BASED, BRAIN HEALTH-PROMOTION PROGRAM**

Laura Block, Andrea Gilmore-Bykovskiy (Mentor)

Dementia is widely considered one of our nation's most significant health crises. Though individuals with or at risk for dementia benefit from brain health-promoting activities, many people cannot access such programs in their communities. Locally, we developed a community-based, brain health-promotion program for older adults. The resultant program addresses stigma and information regarding brain health and incorporates group-based activities to promote healthy brain aging including physical/cognitive exercises and socialization. In our preliminary evaluation, participants reported satisfaction with the cognitive exercises and education but suggested improvements for the physical exercises. Program facilitators identified multiple implementation strategies: a dementia-friendly environment, individualizing activities based on abilities, understanding sensory and mobility impairments, and cultural humility. This initial implementation provides insight into necessary improvements to increase program feasibility and acceptability.

## **MUSEUM FEELINGS: A LITERARY STUDY OF THE AMERICAN MUSEUM**

Sarina Boley, Sarah Carter (Mentor)

This project seeks to examine the cultural perception of museums in literature and art. Through literary analysis and the creation of annotated bibliographies about important works on museum studies, this examination creates a base for a deeper study of the museum as an affective space. Findings challenge the museum as a perceived space of learning, and instead suggest it to be a space of pain. Museums have the potential to be beneficial to all communities, and that is ultimately the hope, but their history can be dark. Both *The Underground Railroad* by Colson Whitehead and *The Chinese Lady* by Lloyd Suh represent how different minority communities are exploited in the American museum, past and present.

## **ROLE OF PME-1 IN BLOCKING SUBSTRATE-RECOGNITION OF PP2A-B' HOLOENZYMES AND IMPLICATIONS FOR INTELLECTUAL DISABILITY DISEASE MUTATIONS IN B'**

Anastasia Bravos, Yitong Li (Mentor)

Protein phosphatase 2A (PP2A) is a major tumor suppressor and plays a critical role in many essential aspects of cellular processes. PP2A-specific methyltransferase 1 (PME-1) catalyzes demethylation of PP2A core enzyme and down-regulates holoenzyme formation. We recently discovered that PME-1 can directly catalyze demethylation of PP2A holoenzymes and block their substrate recognitions. PP2A-B' holoenzyme is exceptionally stable in mammalian cells, but becomes less stable in a group of severe intellectual disability (ID) mutations in PPP2R5D gene that encodes the B' $\delta$  regulatory subunit. Here I will test our hypothesis that the unique C-terminal domain of B' hinders PME-1 interaction with PP2A-B' holoenzyme and the ID mutations in B' would alter the holoenzyme conformation, and render PME-1 interaction and inhibition of substrate recognition.

## **CLOT DYNAMICS IN TRANSPLANT POPULATIONS**

Charles Broghammer, Dr. Stephanie Savage MD (Mentor)

In the United States, 8,000 liver transplants are performed each year, with the physicians' goal to simplify and minimize the treatment process. The last few years of research have been used to investigate coagulopathy related to trauma patients. "Clot Dynamics and Mortality: The MA-R Ratio" sets the basis for current research where the relationship between clot strength and clot formation time is the main factor. This project uses many of the same techniques to relate thromboelastography to liver transplant patients. The utilization of medical records is essential to the progress of this retrospective study. It is expected that the MA-R ratio, which is used for trauma patients, may also be an early warning signal of the clotting process decay for liver transplant patients as well.

## **UNDERSTANDING THE ROLE OF PREMEMBRANE PROTEIN (PRM) IN ZIKA VIRUS PATHOGENESIS**

Elizabeth Brown, Chelsea Crooks (Mentor)

First discovered in 1947, Zika virus (ZIKV) was largely unstudied until its explosive emergence in the Americas. Previous studies suggested that a serine-to-asparagine substitution in the prM protein (S139N), which emerged as Asian-lineage viruses crossed the Pacific and entered the Americas, is responsible for an increase in ZIKV's neurovirulence, and perhaps the sudden emergence of the collection of birth defects known as congenital Zika syndrome (CZS). We deep sequenced samples from both mice and macaques infected with an African-lineage ZIKV and found that serine was present at amino acid residue 139. Similar pathology was observed in animals infected with both African- and Asian-lineage viruses, suggesting that prM S139N is not significant in ZIKV pathogenesis in both mouse and macaque models.

## **NONHUMAN PRIMATES IN RESEARCH IN THE US: ANALYSIS OF 2016-2018 USDA ANNUAL ANIMAL NUMBER REPORTS FOR REGISTERED RESEARCH FACILITIES**

Alanna Brownell, Yufan Ye, Allyson Bennett (Mentor)

US facilities that perform research or testing with nonhuman primates (NHP) are subject to federal regulations and requirements that include submitting an annual census report that is posted on the U.S. Department of Agriculture (USDA) website. In 2018 there were 70,797 NHP in research. The reports include categorization of presence and levels of pain/distress and show 62% were in research without pain or distress; 37% with pain/distress relieved by analgesia/anesthesia; and 1% with unrelieved pain/distress. Our analysis showed that 83% of the total was accounted for by twenty-seven facilities. Of those, roughly 32% were academic centers, 46% private companies, and 5% federal facilities. Together the analysis provides a descriptive overview of the number of NHP in research or testing in the US.

## **GERMINATION MUTANT SCREEN IN FUNGAL PATHOGEN CRYPTOCOCCUS NEOFORMANS CAN OFFERS INSIGHT INTO ESSENTIAL GENES FOR GERMINATION**

Christine Brutus, Hunter Gage, Imane Cherif El Farissy, Christine Hull (Mentor)

The goal of this project is to develop a cohort of *Cryptococcus neoformans* mutants that are incapable of germinating into yeast. The genetic sequence of these mutants will be analyzed to identify genes crucial for *C. neoformans* germination - a process necessary for spore-mediated disease. A library of agrobacterium-mediated transformants will be generated in a haploid strain of *Cryptococcus* (JEC20). Crosses will be conducted between JEC20 mutant strains and a haploid  $\alpha$  strain (JEC21) that lacks a uracil gene for uracil biosynthesis. Recombinants that cannot form colonies on media containing neomycin and the uracil-activated inhibitor 5-fluoroorotic acid (5-FOA) will indicate germination mutants. A secondary screen will be carried out on primary mutants to confirm the phenotype of the mutant and confirm that the defect is germination-specific.

## **PLATFORM DEVELOPMENT OF KURI ROBOT FOR SOCIAL CAPABILITIES**

Mikayla Buford, David Porfino (Mentor)

The commercial social robot, Kuri, was developed by Mayfield Robotics to capture moments in a user's home. Unfortunately, the company's closing resulted in sparse documentation detailing how to extend the functionality of Kuri programmatically using its application programming interface (API). Despite efforts to expand the existing documentation, not enough material exists for a new user. In the Human-Computer Interaction Lab at the University of Wisconsin-Madison, we are documenting the platform development of the Kuri robot under the Robot Operating System. Our focus is on how to programmatically access Kuri's system and develop social robot programs using its API. The final report of the project will describe the challenges and potentials of using Kuris for educational and research purposes and serve as documentation for future users.

## **BACTERIAL GENE ESSENTIALITY IN A HIGH-ASPECT ROTATING VESSEL IS LARGELY INDEPENDENT OF GRAVITY**

Emanuel Burgos-Robles, Mark J. Mandel (Mentor)

Animals and microbes have co-evolved symbiotic partnerships that are essential for tissue and immune development, nutrient acquisition, and defense from pathogens. These associations are also critical to maintaining astronaut health during long-duration spaceflight which creates a need to understand the development and stability of microbial symbioses under microgravity conditions. In the laboratory, a high-aspect rotating vessel (HARV) bioreactor can be used to simulate microgravity and assess its impact on model organisms such as the specific symbiosis formed by *Vibrio fischeri* bacteria colonizing the Hawaiian bobtail squid (*Euprymna scolopes*) light organ. We applied transposon insertion sequencing (INSeq) to query the fitness of each bacterial gene of *V. fischeri* during growth in simulated microgravity using this reactor. We obtained results that suggest minimal gene essentiality under microgravity.

## **DOES THE SEQUENCE OF REPRESENTATION MODE OR STUDENT ACTIONS AFFECT LEARNING WITH VISUAL REPRESENTATIONS?**

Isa Butz, Isabel Saber, Dr. Martina Rau (Mentor)

Many subjects, including chemistry, incorporate physical and virtual visual representations to teach students; however, little is known about the integration of these representation types. This study investigates the difference between virtual and physical representations. Additionally, we compare theories of learning based on student interaction with visual representations. The interactions that we are interested in are consistent with embodied action or conceptual salience theories. Students learn about the increase or equality of energy within orbitals through interacting with the energy diagram via metaphor-inducing actions (embodied action theory). Alternatively, students actively pay attention to electron placement, increasing salience of the same concept. We expect to find embodied actions followed by conceptual salience to be the most beneficial. These findings will aid in improving instruction via blended methods.

## **CORTICAL NETWORK STATE TRANSITIONS ACROSS LEVELS OF CONSCIOUSNESS**

Declan Campbell, Matthew Banks (Mentor)

What changes occur in the brain upon loss and recovery of consciousness is an open problem in neuroscience. Both the conscious and unconscious brain transitions dynamically between a variety of network states defined by functional connectivity between cortical regions. Emerging evidence from studies of loss and recovery of consciousness (LOC, ROC) under anesthesia suggests that different levels of consciousness may be associated with differences in the identity, dwell-time, and transition probabilities between network states. However, whether similar state transitions occur during LOC in natural sleep and how these states relate to those observed during LOC under anesthesia is currently unknown. These differences were investigated using time-varying functional connectivity maps estimated from human intracranial electrophysiological data recorded during natural sleep and under anesthesia in the same subjects.

## **LATINO ENTREPRENEURSHIP**

Kelsey Campbell, Edna Ledesma (Mentor)

The Latino population in the U.S. is quickly growing. As a result, Latino entrepreneurship is also growing. I have researched the ways in which to best help support Latino businesses in the U.S. through policy, specifically in Texas and California. The approach taken is a literary analysis and a comparison of books, documents, and dissertations. The primary findings consist of entrepreneurship and local economic development, and how they are connected to the Latino population in the U.S. Latino entrepreneurship is important because it contributes over \$500 billion to the U.S. economy. Local economic development and how it addresses problems that impact Latino communities in the U.S. is some of the content that is known.

## **IONIC CONDUCTIVITY PREDICTION OF COMPOSITE SOLID ELECTROLYTE BASED ON CONVOLUTIONAL NEURAL NETWORK**

Socorro Canelo, Wenguang Liao, Guanzhao Li, Jirameth Tarnsangpradit, Kejia Fan, Evan O'keefe, Jiamian Hu (Mentor)

Existing batteries are based on a liquid electrolyte, which is flammable and toxic. Solid-state batteries are inflammable, non-toxic, and denser, allowing them to store more energy. Solid-state batteries are more efficient and safer than existing ones. A key challenge in creating solid-state batteries is in the speed at which the cations are being transferred. Over the past 50 years, much progress had been made, but the key problem still being faced is to ensure a fast cation transfer. This interdisciplinary team project brings together students from both materials science and computer science with the purpose to identify the ideal morphology of an electrolyte that can provide faster transport of cations with the use of high-throughput phase-field models and convolutional neural network machine learning.

## **EFFECT ON CNS REGENERATION BY INHIBITION OF ATPASE AND THE SODIUM POTASSIUM PUMP**

Emily Cannon, Bermans Iskandar (Mentor)

Researchers have been searching for a way to regenerate and grow nerve cells, an essential part of healing central nervous system injuries such as spinal cord damage or traumatic brain injuries, for decades. CNS cells don't regenerate due to inhibitory mechanisms, so in an effort to understand what exactly causes this inhibitory environment, we are investigating the relationship between the sodium-potassium pump and ATPase and neuron regeneration. To do this, we are using Digoxin to inhibit subgroups 2 and 3 of APTase (therefore inhibiting the action of the sodium-potassium pump) and measuring axon length in relation to dosage. By performing this experiment, we aim to establish a definitive relationship between APTase/the functioning of the sodium-potassium pump and neuron regeneration.

## **DISSECTING GATA2 +9.5 ENHANCER STRUCTURE/FUNCTION IN HUMAN ERYTHROID CELLS**

Miao Cao, Emery Bresnick (Mentor)

HUDEP (Human Umbilical Cord Blood-Derived Erythroid Progenitor)-2 cells resemble normal human erythroid progenitors and are able to differentiate into mature erythrocytes. During HUDEP-2 differentiation, I demonstrated that GATA2 expression is significantly downregulated as seen in murine models. GATA2 is an essential transcriptional regulator of hematopoiesis, but how it is regulated in human systems is unknown. In mouse models, the +9.5 enhancer is critical for Gata2 expression in stem/progenitor cells. My objective is to generate HUDEP-2 cell lines with strategic mutations in the GATA2 +9.5 enhancer and establish the determinants of human GATA2 expression during differentiation. I used a ribonucleoprotein particle-based CRISPR/Cas9 method to edit the +9.5 enhancer and I am validating clonal cell lines with deletions in this region as a prerequisite to functional analysis.

## **PAPER OR SCREEN: CHILDREN'S LEARNING FROM DIFFERENT STYLES OF INTERACTIVE AND NON-INTERACTIVE BOOKS**

Weijia Cao, Emilee Wescher, Heather L. Kirkorian (Mentor)

As ebooks are becoming more popular with developing technology, one question that keeps parents and educators wondering is whether they lead to different learning outcomes in comparison to printed books. For this study, in order to understand the efficacy of word learning from different book styles, parents read their children aged 3 to 5 a book in one of four formats: interactive printed book, non-interactive printed book, interactive ebook, and non-interactive ebook. Children's word learning was tested after book reading. We hypothesize that children can learn more new words from ebooks than printed books and from interactive books than non-interactive books. Findings from the research should shed light on future book designing for children and preschool teachers' use of supplementary teaching materials.

## **NURSING INTERVENTIONS FOR ENVIRONMENTAL JUSTICE**

Liz Cardinal, Jessica LeClair (Mentor)

The purpose of a scoping review is to map out existing literature in an under researched topic. This scoping review serves to describe the range of and gaps in peer-reviewed literature regarding strategies nurses use to promote environmental justice. A scoping review begins with developing a primary question, "What is known about nursing strategies to promote environmental justice?". Researchers searched numerous databases to gather an initial body of 1,057 potentially eligible articles. After screening, 262 abstracts were identified as relevant to the research question. Data will be extracted from 66 articles and charted for analyzation by June 2020. Researchers will consult stakeholders for their perspectives on meaning of the findings and what is missing as to provide recommendations for conducting and publishing future research.

## **EXAMINING CAREGIVER PERSPECTIVES ON REHOSPITALIZATION FOR PEOPLE WITH ALZHEIMER'S DISEASE**

Kaitlyn Cardona, Andrea Gilmore Bykovskyi (Mentor)

Worldwide, there are 50 million people living with Dementia (PLWD) and 43.5 million family or friends providing care for them. PLWD experience a heightened risk of returning to hospital care shortly after discharge, or rehospitalization. Rehospitalization negatively contributes to excessive costs, burden, and risk for adverse outcomes. Our objective was to examine perspectives of caregivers of PLWD rehospitalization and discover ways to break the cycle. We conducted interviews with 44 caregivers of PLWD and performed thematic analysis in NVivo. Salient themes identified included: poor experiences with quality of care across acute and community settings, challenges balancing work and caregiving requirements, and specific services and supports that could reduce rehospitalization. Caregivers' perspectives provide tangible, actionable guidance for shaping policies and interventions for hospital care for PLWD.

## **IMPROVING UNDERSTANDING OF MIDLATITUDE CYCLOGENESIS THROUGH PARTITIONED QUASIGEOSTROPHIC OMEGA DIAGNOSTICS**

Libby Carso, Jonathan Martin (Mentor)

Cyclogenesis, the process by which extratropical cyclones are initially created and subsequently intensified, occurs in response to local maxima in upward vertical motion. The so-called quasi-geostrophic (QG) omega equation offers a rigorous means of diagnosing this vertical motion, attributing portions of the total QG omega to a number of distinct physical processes operating in the mid-latitude atmosphere. This work focuses on the rapid cyclogenesis that characterized an intense late autumn storm that developed over northeastern North America in November 2018. By partitioning the QG omega into various components, each corresponding to a distinct physical process, we aim to quantify the role of each in this cyclogenesis event. The results of this research will therefore produce new insights into the dynamics that drive mid-latitude cyclogenesis.

## **OLDER ADULTS' RECOLLECTION OF RED FLAGS AFTER AN EMERGENCY DEPARTMENT (ED) VISIT**

Nia Cayenne, Manish Shah (Mentor)

Upon discharge from the ED, older adults are given reasons to seek further care ("red flags"). Poor recollection may lead to adverse outcomes. We explored older adults' recollection of red flags after discharge. Participants were surveyed to assess their recall of red flags 4 days after discharge. Of 526 subjects, 34% reported at least one red flag. Older subjects were less likely to recall any red flags ( $p < 0.01$ ). Subjects with depressive symptoms ( $p < 0.01$ ), at least one functional impairment ( $p = 0.002$ ), or symptoms of cognitive impairment ( $p < 0.05$ ) were less likely to recall red flags. Older adults discharged from the ED poorly recall reasons to seek further care. Certain sub-populations are less likely to recall reasons, necessitating further research.

## **THE PREVALENCE OF CLOSTRIDIUM DIFFICILE IN THE WISCONSIN AREA AND THE ROLE OF DIETARY FIBER ON COLONIZATION**

Olivia Chao, Dr. Nasia Safdar (Mentor)

*Clostridium difficile* is an opportunistic pathogen, meaning it takes advantage of opportunities not typically available. Since antibiotics alter a human's microbiota, hospitalized patients are more likely to become infected with *C. difficile*. Studies have shown that a high-fiber diet can reduce the prevalence of multi-drug resistant organisms (MDROs). These findings suggest that a high-fiber diet could reduce the colonization of *C. difficile*. Throughout this study, I will discover whether fiber influences the prevalence rate of *C. difficile* in the Wisconsin area. Surveys administered by the Survey Health of Wisconsin (SHOW) will be used to determine the fiber intake of participants. The presence of *C. difficile* will be discovered by isolating colonies with *C. difficile* morphology, from stool samples, and then performing polymerase chain reactions (PCR).

## **TRAINING PERCEPTUAL FLUENCY WITH AND WITHOUT ANNOTATED FEEDBACK IN CHEM TUTOR**

Zhiyuan Chen, Martina Rau (Mentor)

Instruction in STEM often uses visual representations, as they can help students learn content knowledge by making abstract concepts accessible. One prerequisite for this is perceptual fluency: the ability to "see" visual information implicitly and effortlessly. Previous studies have suggested that training that supports perceptual fluency enhances the learning of content knowledge. We investigate whether perceptual-fluency training can be enhanced by visual feedback. To this end, we use an intelligent tutoring system, "Chem Tutor" for undergraduate students learning about foundational chemistry concepts related to atomic structure and bonding. As common instruction focuses on explicit learning processes but does not necessarily support implicit processes that yield perceptual fluency, this study is necessary to help students learn with visuals and to enhance their learning in chemistry.

## **GENERALIZATION OF SPEECH MOTOR LEARNING IN VOWEL SPACE AREA**

Taijing Chen, Ben Parrell (Mentor)

When speaking, we can produce a wide range of vowels by changing tongue position. Vowel space area (VSA) is a widely-applied metric that provides an working area index inside the mouth used during speech. A recent study has found that perturbing auditory feedback of vowel production towards vowel space center causes participants to adjust their vowel productions away from the center and expand their VSA. In the present experiment, we investigate if such learning can be generalized to untrained vowels. We push the perceived vowels towards the vowel space centers in training. We test how this learning generalizes to new untrained vowels. To date, we have found high variability across participants, and hypothesize a gradient generalization relied on the similarity between training and generalization vowels.

## **LEGAL CONSCIOUSNESS AND COGNITIVE FUNCTION IN OLDER ADULTS WITH AND WITHOUT TRAUMATIC BRAIN INJURY**

Macayla Church, Joseph Wszalek (Mentor)

Older adults with traumatic brain injury (TBI) face poorer social outcomes due to accelerated cognitive-communication impairments, outcomes which likely include overrepresentation in legal systems. Nevertheless, there is little empirical understanding of the relationships among TBI, cognitive communication, age, and legally relevant knowledge (“legal consciousness”). We will use grounded theory analysis of semi-structured interviews (a qualitative technique) and standardized cognitive assessments to examine whether TBI and age affect the content and quality of self-reported legal consciousness. Standardized cognitive assessments have been completed, and thematic concepts within participants’ interviews have been coded. The findings will support policy and interventions designed to make the US legal system more accommodating of adults with cognitive-communication deficits.

## **PARASYMPATHETIC NERVOUS SYSTEM REGULATION AND DIFFERENCES IN CHILDREN’S CONDITIONED LEARNING PROCESS**

Anisa Ciaciura, Seth Pollak (Mentor)

Although children demonstrate the ability to learn and use information in their environment to inform decisions about approaching potential rewards and avoiding potential threats, there is still little understood about the underlying mechanisms. In adults, resting parasympathetic activity has been linked to differences in sensitivity to cues. The current research examines whether children’s parasympathetic nervous system functioning is related to their ability to effectively approach potential rewards and avoid potential threats. RSA measures were collected from 60 children (8-9 years old) using an instrumental conditioning paradigm. Differences in resting parasympathetic activity supported the predicted direction and were related to differences in how children approached rewards and avoid threats. Results indicated that children with higher RSA demonstrated an increased likelihood of effectively using the cues learned.

## **BRAINY MOVEMENT STUDY FOR KIDS**

Diego Cisneros, Sonali Naik, Ali Riaz, Brittany Travers (Mentor)

In the U.S., approximately 1 in 59 children are affected by the neurodevelopmental condition, Autism Spectrum Disorder (ASD). Various sensory and motor symptoms in ASD have been linked to abnormalities in the brainstem. However, there is very limited information as to how the brainstem affects development in children, especially those with ASD. Through use of behavioral tasks as well as an MRI scan, this study investigates the relationship between the brainstem and sensory and motor functioning in children with ASD. Previous studies suggest that abnormalities in brainstem development may affect cortical and cerebellar formation, which in turn leads to ASD symptoms. By gaining a more comprehensive understanding of ASD development, this study aims to enhance quality of life for individuals with and without developmental disorders.

## **OPTIC NERVE PARAMETERS IN EVALUATION OF GLAUCOMA PROGRESSION**

Olivia Coffey, Kazuya Oikawa, Gillian McLellan (Mentor)

Glaucoma is characterized by optic nerve damage and it is critical to evaluate damage in living subjects without invasive procedures. The purpose of this study is to determine whether optic nerve parameters derived from non-invasive, advanced imaging techniques in cats with glaucoma is correlated with post-mortem histological evaluation of optic nerve damage. Images were acquired non-invasively via optical coherence tomography (OCT) in normal cats and cats with glaucoma in vivo. Optic nerve structural parameters were analyzed in OCT scans using Image J, and optic nerve axon counting was performed using published methods. The association between the OCT derived parameters and axon counts were evaluated by linear regression analyses. The results provide the correlation that validates the use of OCT to evaluate optic nerve damage.

## **IDENTIFICATION OF GENES NECESSARY FOR FISSIONING IN ASEXUAL PLANARIANS**

Kamber Cofta, Kamber, Phillip Newmark (Mentor)

One way asexual animals pass on genetic information is by fissioning. To further understand the mechanisms of fissioning, we are studying the regenerating planarian flatworm, *Schmidtea mediterranea* which exists in sexual and asexual strains. Asexual planarians have primordial gonads that contain somatic gonadal cells important for proper germ cell development. Our laboratory has found a novel gene encoding a hypothetical protein (hp) expressed in somatic gonadal cells in sexuals. To investigate its potential role for fissioning in asexuals, we performed colorimetric in situ hybridization revealing hp expression in somatic cells of the testes primordia. We will inhibit the function of hp and observe effects on fissioning. Understanding hp in asexuals will provide insights into the mechanisms of fissioning in planarians and possibly other asexual organisms.

## **BLACK & BROWN ASYLUM SEEKERS IN BRAZIL - DOES OUR MEDIA CARE ABOUT THEM?**

Shiloah Coley, Katherine Jensen (Mentor)

The media extensively covers refugees seeking asylum in the U.S. and Europe. There is far less coverage on asylum-seeking processes in developing nations, one of the largest cases for consideration being Brazil. The lack of attention paid to Brazil leads me to pose the following; how are Brazil's asylum processes represented in American media coverage? Which refugees seeking asylum are represented? Brazil solely accepted European refugees until 1967 and continued to deny refugee status to non-Europeans until the mid-1980s. I conduct a qualitative media analysis on coverage of refugees seeking asylum in Brazil by analyzing five of the most prominent U.S. news sources - The New York Times, The Washington Post, The Wall Street Journal, USA Today, and the Los Angeles Times.

## **EXAMINATION OF THE ROLE OF TRANSCRIPTION FACTOR 19 IN MODULATING PANCREATIC B-CELL APOPTOSIS**

Jamie Colón, Dawn B. Davis (Mentor)

Diabetes mellitus is one of the leading chronic health conditions in the United States. It is characterized by either autoimmune destruction of pancreatic  $\beta$ -cells or insulin resistance. Recent studies have demonstrated the potential role of transcription factor 19 (Tcf19) in modulating  $\beta$ -cell apoptosis and proliferation. However, little is known about Tcf19's specific role in diabetes. We will determine the effects of the lack of Tcf19 on  $\beta$ -cell death. Using Tcf19 knockout mice treated with the  $\beta$ -cell toxin streptozotocin, we will quantify cell death using TUNEL and compare results to a control group of wild type mice. This investigation will provide insight into the role of Tcf19 in diabetes pathogenesis by studying  $\beta$ -cell loss in the absence of Tcf19

## **EFFECTIVE PARENTING AND CHILD TEMPERAMENT: DOES CHILD SEX MATTER?**

Alanna Cornelius, Kristin Dowe (Mentor)

Many factors influence the development of child temperament. The current study measures child temperament and parenting practices to determine how a child's sex affects this relationship. Child temperament (positive, negative, regulatory) was assessed at 24-months via the Toddler Behavior Assessment Questionnaire; parenting style (authoritarian, authoritative) was assessed concurrently via the Child Rearing Practices Report. We predict that relations between parenting style and child temperament will differ based on the child's sex. Results from multiple regression models show that children did not differ in their regulatory temperament if their mothers exhibited more authoritative parenting; conversely, male children exhibited less regulatory behavior when mothers exhibited less authoritative parenting ( $\beta = -.986, p < .05$ ). This may suggest that regulatory behaviors differ for male and female children when mothers use less effective parenting practices.

## **AN UNCONVENTIONAL PROTEIN TRAFFICKING PATHWAY IN NEURONAL PROCESSES**

Ann Curme, Jon Audyha (Mentor)

Various missense mutations in TFG have been found in patients with neurological disorders characterized by the degeneration of spinal cord neurons. TFG plays an important role in the early secretory pathway, but its exact function in neurites is unclear as early secretory events are thought to take place in the neuronal cell body exclusively. Yet, we observe endogenously tagged TFG and other early secretory pathway proteins in neurites. Here, human induced pluripotent stem cells (hiPSCs) were differentiated into neurons to visualize the association of TFG with endoplasmic reticulum (ER)-associated transport carriers and endosomes in neurites using spinning disk confocal microscopy. Our observations suggest that an unconventional protein trafficking pathway exists in neurites.

## **PREVALENCE OF EATING DISORDER RESOURCES ON UNIVERSITY HEALTH CENTER WEBPAGES**

Maren Dale, Bradley Kerr (Mentor)

Among college students, up to 20% of women and 10% of men suffer from eating disorders (ED). Online ED screenings have shown to be effective at identifying individuals at risk of or with an eating disorder; however, the type and frequency of ED resources on official college websites remains unknown. This study examined the prevalence of online resources on university health center webpages. In this content analysis, five private and public universities from each state were randomly selected from Collegestats.org's comprehensive list of colleges. Variables will include demographic information, ED screenings, and prevention and intervention tips. Findings from this study will identify the prevalence of online resources for ED and inform efforts to improve these resources.

## **KINETOCHORE INTEGRITY AND CANCER**

Lauren Damgaard, Aussie Suzuki (Mentor)

Expansion microscopy (ExM) is one of the latest super-resolution microscopy methods in which biological samples are physically enlarged by expanding the structures using a polymer system. This method has a potential to study diffraction limited protein architectures within a cell, especially, we are interested in applying this method to study protein functions at a kinetochore, a macro-molecular protein complex on chromosomes where microtubules bind during chromosome segregation. However, we found that an existing ExM protocol did not provide sufficient expansion to study chromatin architectures such as kinetochores. Currently, we are working to refine and optimize an ExM protocol by quantifying the impact of different protein digestion periods in human and rat kangaroo tissue culture cells.

## **CHARACTERIZING BIO3/BIO1 IN BRACHYPODIUM DISTACHYON**

Timothy Davenport, Shih-Heng Su (Mentor)

Root growth stunting from exogenous cadaverine treatment is conferred within the Bio3/Bio1 gene of *Arabidopsis thaliana*. The knowledge of whether this response is universal to other plant models is still unknown. The purpose of my investigations has been to characterize the role of Bio3/Bio1 in *Brachypodium distachyon*. This task was explored through applications of exogenous cadaverine within *B. distachyon* single-nucleotide polymorphic lines within the Bio3/Bio1 gene. Exogenous biotin treatments in tandem with a cadaverine stress environment were also undertaken to observe possible cadaverine rescue effects as previously observed in *A. thaliana*. Future investigations shall employ golden gate cloning of the *Brachypodium* Bio3/Bio1 gene into *A. thaliana* to determine whether the effects of cadaverine are conferred within Bio3/Bio1 of *B. distachyon*.

## **WRITING IN THE SHADOWS: SUPPORTING YOUTH EXPERIENCING HOMELESSNESS THROUGH EDITORIAL WRITING**

Peyton David, Dr. Travis Wright (Mentor)

This project worked to introduce Madison middle schoolers experiencing homelessness to media resources for them to share their writing with the greater Madison area. Youth experiencing homelessness often have much less control over their living situation than adults do. Along with other stressors, this contributes to poor academic performance and achievement. This project was achieved through an after school curriculum twice a week for middle schoolers who are either experiencing or have experienced homelessness, to create a sense of stability and provide youth with an outlet and tools for self-advocacy. The end product will be a collection of their writing about how they view the world.

## **THE DISCUSSION PROJECT: ENCOURAGING HIGH-QUALITY PARTICIPATION IN COLLEGE CLASSROOMS**

Jadie Dawson, Madelyn Korbas, Michael J. Culbertson (Mentor)

Discussions in college are meant to expose students to course content and encourage them to leave with more understanding than when they entered the classroom. The Discussion Project study is investigating questions regarding what encourages participation and how discussion affects students by looking for high-quality discussion markers such as open-ended questions and student-to-student talk. Data from field notes of classroom observations and student interviews are analyzed qualitatively to find similar patterns throughout. Preliminary findings suggest that student participation in educational discussions is related to the diversity of students and their interest in the subject.

## **CHARACTERIZATION OF RETINAL FUNCTION IN DISEASE MODELS**

P.J. Derr, Dr. Raunak Sinha (Mentor)

Vision serves an essential role in forming a cohesive perception. Many diseases threaten vision by affecting the retina, the neural tissue lining the back of our eye that first absorbs and processes light. Some vision impairing diseases lead to degeneration of photoreceptors - sensory neurons that detect light. Although the pathophysiology of these diseases has been well studied, it has been difficult to dissect the deficits in retinal signaling at the level of individual neurons. My project is to determine how functioning of retinal output neurons called ganglion cells are altered in mouse models of Retinitis pigmentosa and Diabetic retinopathy. Using single cell electrophysiological techniques, I measured light evoked responses from well-characterized cell types and correlated physiological properties to changes in ganglion cell anatomy.

## **THE EVALUATION OF THE REPRESENTATION OF LAKE-EFFECT SNOW STORMS IN THE GREAT LAKES REGION AMONG EARTH SYSTEM MODELS**

Jacob Dirschel, Michael Notaro (Mentor)

The Great Lakes Basin has been a regional hotspot of climate change with rapidly warming lakes, declining ice cover, increased lake-effect snow, and rising air temperatures. I began my study with a thorough literature search on lake-effect snow and climate modeling. In phase two, I'm learning programming techniques, namely NCL, NCO, netview, unix, wget, and supercomputer resources in order to download, process, and extract subsets of data from netcdf model output. With these skills, I'll develop a Great Lakes Basin ensemble of HighResMIP datasets for regional analysis. In phase three, I'll plot and analyze the model output. The project goal is to assess how well high resolution global climate models within the HighResMIP program can represent lake-atmosphere interactions and lake-effect snowstorms in this region.

## **EMPOWERING FAMILIES AND UNCOVERING RESOURCES FOR YOUNG ADULTS WITH AUTISM SPECTRUM DISORDER AND THEIR FAMILIES**

Zoey Dlott, Leann Dawalt (Mentor)

Existing research has shown that young adults with autism spectrum disorder (ASD) have poorer outcomes compared to their peers with other developmental disabilities in areas such as independent living, employment, and socialization. However, we do not have a full understanding of what services and interventions are helpful and or needed to improve their outcomes. We will be interviewing young adults with ASD and their parents about their transition into young adulthood to identify needs as well as disconnections between service objectives and the goals of the young adults and their families. Our goal is to gain a greater understanding of the services young adults receive, explore their satisfaction, identify unmet needs, and empower and prepare families to advocate for needed services.

## **SYMPTOM ATTRIBUTION IN THYROID CANCER**

Amita Doiphode, Sara Fernandes-Taylor (Mentor)

Thyroid cancer almost never causes symptoms during a person's lifetime and have no impact on their health, quality of life, or life expectancy. The over-diagnosis of thyroid cancer can lead to over-treatment, exposing patients to unnecessary risk, while incurring significant costs. My research project investigates symptom attribution in thyroid cancer - primarily, it examines which symptoms are widely associated with the diagnosis of thyroid cancer in hopes to reduce these unnecessary expenditures. Transcripts of patient interviews at the time of diagnosis from an earlier study will be used as secondary analysis for the purpose of this research. Studying this correlation will give a greater understanding on which symptoms are correctly attributed to the nonfatal cancer in order to provide palliative care rather than extensive cancer treatment.

## **DEFINING THE MOLECULAR DETERMINANTS REQUIRED FOR RNA BINDING FUNCTIONS OF THE BICAUDAL-C (BICC1) TRANSLATIONAL REPRESSOR PROTEIN**

Sonam Dolma, Michael Sheets (Mentor)

Bicaudal-C is a regulatory RNA binding molecule that's essential for translational modulation. BicC1 represses mRNA translation, controlling the ability to make protein. The lack of or the defectiveness of the BicC1 protein can give rise to polycystic kidney disease, a disorder that is characterized by an abnormal collection of cysts in the kidney. Research on Bicaudal-C is significant due to its crucial biological function in repressing maternal mRNAs. Because of Bic-C's biological importance and its influence over embryonic development, the Sheets Lab studies the mechanism of how it recognizes and binds its specific mRNA targets. My project will be to define which of the amino acid residues in the KH2 domain are responsible for providing specificity for BicC1 binding to RNA by generating BicC1 mutants.

## **INVESTIGATING THE GENOME-WIDE DISTRIBUTION OF VARIANT HISTONE H3.3**

Mary Donoghue, Peter Lewis (Mentor)

Epigenetic regulation via loci-specific deposition of variant histone proteins is important for genomic stability and regulation. Histone variant H3.3 has been implicated in epigenetic memory of cell states under normal physiological conditions and in tumorigenesis when improperly regulated. Multiple factors are responsible for H3.3 deposition in distinct genomic loci. Histone chaperone HIRA deposits H3.3 at actively transcribed genes whereas H3.3 is deposited at heterochromatic loci by the ATRX-DAXX complex. Here we employ high-throughput sequencing in different genetic backgrounds to determine the genome-wide distribution of H3.3. We aim to characterize H3.3 enriched genomic loci as dependent on or independent from known assembly factors - HIRA and DAXX. We also explore the possibility that a novel chaperone may be contributing to the deposition of H3.3 into the genome.

## **CHARACTERIZATION OF TRIPLE PHOSPHOMUTAGENESIS MOUSE MODEL**

Holly Dooge, Hector Valdivia (Mentor)

Cardiac ryanodine receptor type 2 (RyR2) is the ion channel responsible for releasing the calcium necessary for heart contraction. RyR2 associates with kinases and phosphatases, suggesting phosphorylation is important to regulate the channel. Three phosphorylation sites have been identified in RyR2: S2030, S2808, and S2814. While it is known RyR2 is critical for cardiac activity, the effect of phosphorylation on RyR2's regulation is not well understood. To address this question, we generated a phosphodeficient mouse where the three sites are substituted by alanine (S2030A/S2808A/S2814A). We used western blots to confirm these sites are not phosphorylated and to measure the expression of proteins working with RyR2 to regulate calcium homeostasis. These experiments initially characterize the model and provide basis for further studies to assess cardiac function.

## **THE CAUSAL ROLE OF SLEEP ON RISK OF ALZHEIMER'S DISEASE**

Jingqi Duan, Hyunseung Kang (Mentor)

We test the causal role of sleep on the risk of Alzheimer's Disease by using the Alzheimer's Disease Neuroimaging Initiative. To assess whether there is a causal effect of irregular sleep on memory and executive function summary scores, markers to diagnose AD, we control for both non-genetic factors and genetic components. Methodologically, we use full matching and pair matching to group participants with normal (i.e. control) and irregular (i.e. treatment) sleep patterns. We assess the sensitivity of our causal conclusions to unmeasured confounding by conducting a sensitivity analysis with trimmed-M statistics. Our analysis indicates that there is statistically significant evidence that abnormal sleep patterns caused a decrease in executive function scores, but the causal conclusion is very sensitive to presence of a binary unmeasured confounder.

## **WILD-TYPE AND MUTANT FERONIA ARABIDOPSIS PLANT GROWTH UNDER VARIOUS LIGHT CONDITIONS**

Shree Dudhat, Miyoshi Haruta (Mentor)

The *Feronia* mutant seedling grows faster than the wild type under insufficient light conditions. However, the wavelength and intensity ranges that affect its growth are unknown. Preliminary experiments indicated that red and blue wavelengths affect growth. This study aims to identify which wavelength(s) and intensity of light cause the *Feronia* mutant to grow faster. *Feronia* mutants, wild-type plants, and red and blue photoreceptor mutants were grown under four different levels of red (R) and far-red (FR) light intensities. The ratio of R:FR determines various growth patterns in plants; thus, I am examining whether *Feronia* plays a role in growth regulation at different R:FR ratio conditions. Understanding R:FR ratio effects on the *Feronia* mutant can help develop crops that can grow even in dim light conditions.

## **AN AUTOMATED METHOD FOR HIGH YIELD MRNA EXTRACTIONS FROM CIRCULATING TUMOR CELLS**

Matthew Dwyer, Jennifer Schehr (Mentor)

The overall goal of the lab is to run experiments and test methods, with an emphasis on patient impact, to see if those methods are suitable for clinical implementation. Currently, tests are trying to see if cancer develops resistance to common anti-cancer treatments such as Enzalutamide. One of the pieces of lab equipment that we use to run these tests has an issue with sticking during the mRNA extraction of the Circulating Tumor Cells to the strips, in addition to clumping being present while mixing. The main question we have is why are we getting sticking/clumping and how can we prevent this?

## **THE RELATIONSHIP BETWEEN MULTILINGUAL DEVELOPMENT AND PROFESSIONAL DEVELOPMENT AMONG COLLEGIATE LANGUAGE LEARNERS IN THE CAREER ADVISING SETTING**

Sakuni Egodawatte, Ryan Goble (Mentor)

How do collegiate language learners construct professional identities with career advisors? Language learners largely aspire to use their language outside the classroom, and the demand for language skills in public/private sectors provides opportunities to sustain engagement with the target language beyond formal language learning. This study approaches students' multilingual development as it potentially overlaps with their professional development. Data consist of 50 audio-recorded advising appointments and follow-up interviews among learners of nine world languages. Narrative analysis of the transcribed data indicates that students generally resist being positioned as "fluent" users of language and are unprepared to identify transferable skills arising from language study. Findings show how students can navigate linguistic insecurity and leverage language learning by understanding the transferable skills that come from it.

## **UTILIZING BASE EDITING TO CORRECT IMPG2 MUTATIONS AND RESTORE IMPG2 FUNCTION**

Joseph Ekholm, Steven Mayerl (Mentor)

Retinal Degenerative Diseases are the leading cause of blindness. One specific RDD is Retinitis Pigmentosa (RP). A particular case of RP is caused by autosomal recessive mutations in Interphotoreceptor Matrix Proteoglycan 2 (IMPG2). IMPG2 is expressed by photoreceptors in the eye. Disease causing mutations of IMPG2 can be modeled in our lab using human pluripotent stem cell derived optic vesicles. To discover widely applicable, novel techniques we use a base editing technique which utilizes CRISPR/Cas9 without creation of double stranded DNA breaks. We propose a novel CRISPR/Cas9 base editing system to correct disease-causing IMPG2 mutations in patient-specific stem cell lines. The use of this innovative base editing technique provides support of the utility of the CRISPR/CAS9 system and potentiates further research into treating genetic diseases.

## **IMMUNOMODULATION OF THE ER+ BREAST CANCER MICROENVIRONMENT WITH RADIATION AND HORMONAL THERAPIES**

Sarah Emma, Zachary Morris (Mentor)

Low levels of mutation-created neoantigens and tumor infiltrating lymphocytes in metastatic ER+ breast cancer may contribute to a limited immune checkpoint blockade response. Radiation therapy (RT) may stimulate an anti-tumor immune response through the release of tumor-specific antigens and inflammatory cytokines, heightened recruitment of immune cells, and increased expression of genes associated with a type-1 interferon response. We hypothesized that combining RT and the anti-estrogen, fulvestrant, would increase immune susceptibility and alleviate immunosuppression in the tumor microenvironment. Immunogenic effects were evaluated in vitro and in vivo using the TC11 hormone-therapy resistant, ER+, murine breast cancer model. Upregulation of Oas2, Oas3, Mx1, and IfnB following RT was observed, and the combined treatment group showed increased tumor infiltration with CD8 T cells and decreased infiltration by MDSCs.

## **SEARCHING FOR NON-NATIVE CONFORMATIONS OF PROTEINS UNDER PHYSIOLOGICALLY RELEVANT CONDITIONS**

Kevin England, Silvia Cavagnero (Mentor)

Proteins have highly structure-dependent functions, so when proteins misfold or aggregate, they no longer have biological activity, resulting in many far-reaching implications. However, the mechanisms behind proper protein folding remain largely unknown and unexplored. The aim of this research is to expand the current scope of the protein conformational landscape to include non-native conformations, coined alternative native states, that lack natively twisted backbones. By employing various spectroscopy techniques, measuring structural changes of the model protein after extensive heating and cooling in a well-designed nonpolar buffer system allows us to probe for these non-native conformations. Proving the existence of alternative native states would fundamentally change the historic understandings of the kinetic and thermodynamic properties of polypeptide chains and introduce new paradigms in the protein sequence-structure-function field.

## **TRANSPORT OF MICROPLASTIC FIBERS IN WAVES: THE EFFECTS OF FIBRE LENGTH AND WAVE PROPERTIES**

Gabrielle Every, Nimish Pujara (Mentor)

Microplastic fibers that are shed from clothing, fishing lines, and the breakdown of other plastic waste contaminate lakes and oceans. This contamination poses a threat to small aquatic organisms and transfers across the food web causing harm to fisheries and humans. Surface waves are one mechanism by which microplastic fibers are spread through surface waters. We study this phenomenon using mathematical models that predict the motion of fibers in surface waves. The results show that the drift velocity decreases exponentially with rod length and is bound by Stokes drift for extremely small rods. From these results, we investigate the effect of other wave parameters which allows us to produce a map of microplastic drift velocity as a function of fiber length and wave properties.

## **ENGINEERING OF ACYL-COA REDUCTASES FOR IMPROVED PRODUCTION OF FATTY ALCOHOLS**

Sarah Fahlberg, Philip Romero (Mentor)

Fatty alcohols are chemicals useful in pharmaceuticals, cosmetics, and detergents. Unfortunately, production of fatty alcohols leads to many environmental issues, including deforestation for the establishment of vegetable oil production plantations. Alternatively, fatty alcohols could be produced by microorganisms through biosynthetic pathways. Acyl-CoA reductase (ACR) is a protein involved in multiple pathways that convert fatty acyl-CoA into alcohols. ACR's function could be improved through directed evolution, a protein engineering method. This project will assess the functionality of a set of ACRs that have gone through directed evolution compared to the original parents. The ACR's ability to catalyze fatty alcohol production will be assessed by purifying each protein and measuring kinetics and comparing the different ACR's abilities to produce fatty alcohols.

## **SINGLET FISSION ELECTRON ACCEPTOR FILM**

Benjamin Feingold, Zachary Armstrong (Mentor)

The generation of triplet excitons via singlet fission is a possible method for overcoming the Shockley-Queisser limit for solar cells. Despite extensive research efforts, the extraction of triplet excitons from singlet fission materials has proved difficult. Recently, perylene diimides (PDIs) have been demonstrated to preferentially accept electrons from triplet excitons generated by singlet fission over those from singlet excitons. Our project involved casting a blended film of TIPS-pentacene (singlet fission material) and a PDI (electron acceptor) onto glass slides and measuring the optical properties to look for charge transfer from triplet excitons. We also performed structural studies in the form of XRD and AFM to characterize the crystal packing and morphology of these blended films.

## **A COMPARISON OF TWO EDUCATIONAL TOOLS TO IMPROVE TICK CHECKS AT SUMMER CAMPS**

Hannah Fenelon, Bienneke Bron (Mentor)

As tick-borne diseases continue to rise in Wisconsin, public education becomes essential in prevention. Common advice is “check yourself for ticks,” but this may not be useful if people do not know what to look for specifically. This study was designed to compare two educational tools through counselors sharing images of ticks or resin blocks containing actual ticks with campers while describing risks and prevention methods. We evaluated the tools using a counselor post-education questionnaire and an end-of-the-week camper reported tick tally. The tool type did not change the training duration, but counselors reported increased camper engagement with the resin block in comparison to the images. Campers who experienced the resin block training tended to find a tick on themselves more than the image group.

## **ULTRACOMP BEADS**

Isabella Fernandez, Joshua Lang (Mentor)

The purpose of our project is to develop controls to confirm fluorescence microscopy methods are functioning properly over time. We use synthetic beads to mimic cells, coated with an antibody to mimic protein expression, held in the fridge after coating to assess stability. We also used another antibody on another channel to enable automated analysis. We took pictures of the beads with the fluorescent microscope, and used image analysis software - NIS Elements from Nikon to quantify fluorescence from the images. The results were that the beads became brighter over time but eventually stabilized, suggesting more time is needed after coating to allow bead saturation. Future directions will include evaluating the stability of beads coated with all antibodies used in testing patient samples.

## **USING RNAI TO EXAMINE COLOR GENES IN THE COLORADO POTATO BEETLE**

Emma Fischer, Sean Schoville (Mentor)

The Colorado potato beetle (*Leptinotarsa decemlineata*) is notable for its extensive phenotypic variation. Apart from the wild type, black, white, and beige mutants are observed. It is known that the pigmentation is determined by the melanin pathway for this species, though the specific genes remain unknown. We will use functional genetic approaches to study gene function related to color traits. Through gene knockdown by RNA interference, *L. decemlineata* pupae will have genes suppressed that we believe play a role in their melanin pathway. This knockdown will be completed using the technique of microinjection into the hemocoel of the individual. Following growth to adulthood, the resulting gene expression in individuals will be measured against control beetles both quantitatively and by phenotypic comparison to ensure successful knockdown.

## **THE RESTORATION OF SAND DUNES IN PUERTO RICO THROUGH CIVIC ENGAGEMENT**

Jillian Flanagan, John Zumbrennen (Mentor)

We are researching the restoration of sand dunes in Puerto Rico through civic engagement. There are other people on UW-Madison's campus that are doing similar work with ecological restoration. Our research is unique because we are not only focusing on the ecological perspective, but also adding a social science spin. The question we are asking is: How do different communities respond to and engage with ecological restoration? In order to answer this question we have generated a comparative analysis of local communities within Puerto Rico. We have found significant similarities and drastic differences between each place. This is helping us better understand how people are responding to ecological challenges and how we can best alleviate the situation.

## **RELATIONSHIP BETWEEN PARENTAL CONFLICT AND SEVERITY OF AUTISM SPECTRUM DISORDER**

Courtney Ford, Kim Drastal (Mentor)

Research suggests couple conflict is related to child behavior problems (Amato & Keith, 1991). Parents with a child with autism spectrum disorder (ASD) report an increased risk for parent conflict (Hartley et al., 2017). This study examines the relation between parental conflict and ASD severity. As part of an ongoing longitudinal study, 189 couples with a child with ASD (aged 5-12) completed the Couple Conflict and Problem-Solving Scale and the Social Responsiveness Scale to assess conflict and ASD symptomology. There was a significant positive association ( $r=.252$ ,  $p < .001$ ) between severity of parental conflict and severity of the child's ASD. It is likely that parent conflict and child behaviors are bi-directionally related. These results can help develop programs to support families of children with ASD.

## **PHYSIOLOGICAL CHARACTERIZATION OF GnRH NEURONS DERIVED FROM HUMAN EMBRYONIC STEM CELLS**

Benjamin Fordyce, Ei Terasawa-Grilley (Mentor)

Release of the gonadotropin-releasing hormone (GnRH) in the hypothalamus is critical for mammalian reproduction. Consequently, patients who do not have GnRH neurons are not able to conceive and need hormone treatments for their entire lives. Recently this lab was successful in generating GnRH neurons from human embryonic and induced pluripotent stem cells. This study evaluates characteristics of GnRH neurons derived from stem cells. Differentiated GnRH neurons were perfused with aCSF and GnRH in perfusates was measured by RIA. Results indicated that stem cell derived GnRH neurons released the GnRH peptide in a pulsatile manner with the frequency similar to that reported in vivo, and responded to physiological stimuli, such as kisspeptin, neurokinin B, estradiol, and high potassium. These findings are important for future application.

## **UNDERSTANDING DIFFERENCES IN THE IDENTIFICATION AND SERVICE EXPERIENCES OF RACIAL/ETHNIC MINORITY CHILDREN WITH AUTISM**

Tricia Francis, Haley Shultz (Mentor)

Little is known about potential disparities in the identification and services of children with autism spectrum disorder (ASD) from racial/ethnic minority groups. The present study compared age of initial ASD diagnosis, receipt of services, and adaptive behavior of children with ASD from racial/ethnic minority ( $n=34$ ) groups versus those who identified as White, non-Hispanic ( $n=39$ ). Independent sample t-tests indicated that minority children received a later diagnosis of ASD, were more likely to be taking medication, had lower adaptive skills, were less likely to receive respite care, and were more likely to have undiagnosed anxiety conditions. Parents of minority children with ASD were less likely to participate in family support groups than parents of White, non-Hispanic children. Findings add important information about racial/ethnic disparities in ASD.

## **STRESS AND ATTACHMENT IN CHILDREN WITH AN INCARCERATED PARENT**

Claire Frank-Carr, Victoria Millet, Julie Poehlmann-Tynan (Mentor)

Children with incarcerated parents are more likely to be exposed to additional adverse childhood experiences (ACEs, Turney, 2018); previous research has shown that more ACEs relate to later problematic health and well-being outcomes. The purpose of the current study is to better understand links among ACEs, children's post-traumatic stress symptoms, and attachment to their parents. We plan to examine 14 children (ages 7-12) with an incarcerated parent and their report of ACEs, feelings of attachment towards the incarcerated parent (Inventory of Parent Attachment), and trauma symptoms (Child Report of Post-traumatic Symptoms). The data we collected is part of a larger feasibility study focused on improving parent-child relations via a video visit intervention. Preliminary evidence indicates a positive correlation between adverse experiences and traumatic symptoms.

## **SMALL-SCALE MICROPLASTIC FILTRATION SYSTEM**

Hannah Franzblau, Vue Thao, Nimish Pujara (Mentor)

In 2018 alone, global plastic production reached 360 million tons. As a result, microplastic debris in bodies of water has become a growing problem, but their impact is poorly understood. An important step to developing effective methods to address this issue in Madison is to quantify the number of microplastics in our local beaches. The goal of this project is to design and fabricate a small-scale device to filter out microplastics from sediment. This instrument will be used to measure the amount of pollution in Lake Monona and Mendota. The resulting system will help reveal the severity of the microplastic pollution in the Madison Lakes.

## **LANGAUGE LEARNING AND CAREER PATHWAYS**

Che Fu, Ryan Goble (Mentor)

A common goal among college students learning an additional language is to use it in multilingual communities outside of class; however, language classrooms are oftentimes limited in capacity to facilitate this rather challenging goal. This study investigates how advanced language learners have managed to use the language in their lives and how they hope to continue developing their language skills beyond college - particularly in professional settings, which is especially important given they are no longer societally seen as college students, but as young professionals. Data include fifty audio-recorded career advising sessions and follow-up interviews with learners of nine languages. Narrative analysis of data transcripts shows the innovative ways they imagine prolonged engagement with their language after graduation and the challenges they face in doing so.

## **ROLE OF SUPEROXIDE DISMUTASE ENZYMES IN THE SEXUAL DEVELOPMENT OF CRYPTOCOCCUS NEOFORMANS**

Hunter Gage, Christina Hull (Mentor)

Cryptococcus neoformans is a fungal pathogen that causes over 500,000 deaths per year. Sexual development in Cryptococcus is a multistep process that results in the production of spores, which are infectious particles. Several steps in sexual development involve changes in cellular polarity and morphology. In other fungal species, these changes are influenced by the localization of reactive oxygen species (ROS). Superoxide dismutase (SOD) enzymes detoxify ROS, and are important for spore outgrowth in a related fungal species, Schizosaccharomyces pombe. However, the role of SODs in morphological changes during sexual development in Cryptococcus is unknown. Phenotypic analysis was performed on a  $\Delta$ SOD1 mutant to investigate defects in sexual development. Results suggest that SOD1 is involved in several polar processes during mating.

## **EMERGENCY PREPAREDNESS IN WISCONSIN HIGH SCHOOLS AMONG COACHES, SCHOOL NURSES, TEACHERS, PRINCIPALS AND ATHLETIC TRAINERS**

Anneliese Gall, Fatih Kunkul, Dr. Traci Snedden (Mentor)

Annually, sudden cardiac arrest (SCA) claims the lives of over 2,000 children and adolescents in the United States. Two-thirds of the deaths caused by SCA occur during exercise and is the leading cause of death in young athletes. Recognizing SCA and responding quickly in the school setting is critical to outcomes. The purpose of this study was to describe emergency preparedness among school nurses, teachers, principals, and athletic trainers (ATs) in Wisconsin high schools. A cross-sectional survey assessed CPR training, the presence of an on-site Automated External Defibrillator (AED), AED training, and school and participant demographics. Based on our findings, Wisconsin high schools included in this study reported high proportions of emergency preparedness specific to an onsite AED and related school staff training.

## **FLIMJ: FLIM IMAGE ANALYSIS FOR IMAGEJ**

Dasong Gao, Kevin Eliceiri (Mentor)

Fluorescence Lifetime Imaging (FLIM) has rapidly emerged as one of the most powerful imaging techniques for interrogating the cellular microenvironment for such changes as pH and protein binding. However, due to the great intricacy and measurement sensitivity involved in FLIM analysis, current FLIM toolkits, both lab-developed and commercial, requires the user's prior knowledge on the analysis workflow. This results in FLIM analysis often being more painstaking and error-prone. In this project, I created FLIMJ, the first open-source FLIM analysis framework for ImageJ that is transparent in implementation, algorithmically robust, functionally compatible and extensible, and user-friendly. The framework will greatly improve the software accessibility of FLIM analysis for biologists and therefore further increase the impact of FLIM as a modern biological imaging technique.

## **ION CHANNELS FROM BRUGIA MALAYI (OSM-9 AND TAX-4) RESCUE LOSS OF FUNCTION DEFECTS IN C. ELEGANS**

Elena Garnarcz, Tran To, Mostafa Zamanian (Mentor)

The mosquito-borne filarial parasitic nematode, *Brugia malayi*, causes lymphatic filariasis in millions of people around the world. Development of larval worms in mosquitoes and mating of adults in the lymphatic systems of definitive hosts requires patterned intra-host migration events. These likely depend on sensory behaviors such as chemosensation and mechanosensation, but the molecular basis for these behaviors are completely unexplored. Using comparative genomics, we identified two receptor ion channels in the *B. malayi* genome that we hypothesize function in worm sensation. As genetic tools are restricted in the parasite, we leveraged the free-living model nematode *C. elegans* by expressing *B. malayi* genes in loss-of-function knock-out strains that have easily assayed sensory defects, and we tested for rescue of these defects by the parasite homologs.

## **GBT440 INCREASES HEMATOCRIT AND IMPROVES LEFT AND RIGHT VENTRICULAR FUNCTION IN BERKELEY SICKLE CELL DISEASE MICE**

Ryan Gassner, Dr. Naomi Chesler (Mentor)

Sickle cell disease (SCD) is a hereditary blood disorder affecting millions of people in which red blood cells (RBCs) morph into a sickled shape and lyse easily driven by polymerization of hemoglobin. Chronically, SCD impairs cardiac function. GBT440 is an experimental treatment for SCD that prevents hemoglobin polymerization. We found 3 weeks of GBT440 treatment in the Berkeley mouse model of SCD increased hematocrit, left ventricular ejection fraction and stroke volume index, and tended to decrease RV pressure compared to untreated Berkeley mice. GBT440 also increased the pulmonary valve velocity time integral, which indicates improved right ventricular function. Taken together our data suggest GBT440 prevents RBC hemolysis associated with SCD and consequently improves biventricular function and may prove a viable treatment for human SCD patients.

## **HOW DO ZOOS TEACH? AN ANALYSIS OF EDUCATIONAL DISPLAYS IN INFORMAL SCIENCE LEARNING SETTINGS**

Cassandra Gauthier, Taylor Browne, Allyson Bennett (Mentor)

Children learn about science in a wide-range of settings. Zoos provide informal learning opportunities centered on animals' biology, behavior, and conservation. While education is a core part of zoos' mission, relatively few empirical studies have assessed the mechanisms and materials that most successfully promote learning and retention. Previous studies on zoos' educational effectiveness have shown little evidence of visitors' retention. We are conducting a comprehensive analysis of educational signs and interactive displays at the Henry Vilas Zoo. We will analyze the number, type, and content of displays at the zoo, categorizing their reading level and learning objectives (i.e., animal facts, conservation information, connection to human culture). Our results will provide the foundation for future study to evaluate how much knowledge people retain following zoo visits.

## **BIOCATALYTIC SYNTHESIS AND PURIFICATION OF NONCANONICAL GAMMA-HYDROXY AMINO ACIDS**

Eric Geunes, Jon Ellis (Mentor)

Noncanonical amino acids (ncAAs) have proven significant in the fields of research and medicine. However, current organic synthetic methods to produce such amphipathic molecules are limited by multistep syntheses that frequently involve harsh conditions and low selectivities. Protein biocatalysts provide an alternate route to the synthesis of complex molecules and can be engineered by directed evolution to improve activity. The enzyme UstD, a decarboxylative aldolase that uniquely forms gamma-hydroxy amino acids from aspartate and aldehyde substrates, was engineered to produce ncAAs of various properties with excellent selectivity under mild conditions. The resultant products were installed with a fluorenylmethoxycarbonyl (fmoc) group in order to allow purification by normal phase chromatography. UstD's efficient reactivity with a broad group of molecules demonstrate its promise as a useful biocatalyst.

## **NOVEL STRATEGIES TO TARGET BACTERIAL INFECTION: CHEMICAL MODULATORS OF BACTERIAL CELL-TO-CELL COMMUNICATION**

Rebecca Gillis, Michael Kuehne, Akshith Mandepally, Helen Blackwell (Mentor)

Quorum sensing (QS) is a bacterial cell-to-cell communication system that poses a significant threat in modern clinical settings. Through the use of chemical signaling molecules called autoinducers (AIs), bacteria are able to monitor the surrounding cell density and coordinate their gene expression, resulting in the production of things like virulence factors when their impact on the host is maximized. These factors pose a significant risk in patient infections and are increasingly difficult to target with traditional approaches due to antibiotic resistance. We are devising methods to combat this issue by exploring various aspects of the QS mechanism with the use of synthetic compounds that act as AI analogs.

## **EFFECTS OF ENVIRONMENTAL ENRICHMENT ON A RODENT MODEL OF TAUOPATHY**

Ryan Gorzek, Corinna Burger (Mentor)

Tauopathies are progressive neurodegenerative disorders characterized by pathology of the microtubule-associated protein tau. In aging human populations, cognitively stimulating activities reduce incidence of neurodegenerative dementia. Similarly, aged rodents housed in environmental enrichment (EE) have enhanced cognitive ability. To assess EE's ability to protect against a tauopathy-like insult, we housed rats in standard conditions (SC) or EE before hippocampal infusion of viral vectors carrying the human tau gene (AAV-hTau). Three weeks post-infusion, tau expression levels were 6- to 10-fold greater in AAV-hTau-infused animals than controls. Assessing spatial cognition, AAV-hTau animals housed in EE crossed the platform location more than SC animals in the Morris water maze, without differences in contextual fear memory. These results suggest EE might protect spatial cognition in a rodent model of tauopathy.

## **RESEARCH RELATED TO ASTROCYTES DIFFERENTIATED FROM STEM CELLS**

Julia Graham, Su-Chun Zhang (Mentor)

Research is related to studying astrocyte differentiation from embryonic stem cells and induced pluripotent stem cells. Characterization of cells from diseased Alexander stem cell line against healthy stem cells. Pairs of healthy and diseased cell lines created via CRISPR gene editing. Analysis done via immunohistochemistry and other molecular techniques.

## **THE IMPACT OF MATERNAL SLEEP DISORDERED BREATHING DURING PREGNANCY: CONSIDERATIONS OF PI3K-AKT-MTOR NEURONAL SIGNALING**

Kimberly Gums, Michael Cahill (Mentor)

Sleep disordered breathing (SDB), or sleep apnea often leads to intermittent hypoxia (oxygen deprivation). SDB is prevalent among pregnant women, which can impact offspring development. Using a maternal rat model exposed to intermittent hypoxia, we observed autism-relevant neuronal and behavioral aberrations in offspring, which were more severe in males. We investigated the expression of key mTOR components in the male offspring of the mothers exposed to nightly intermittent hypoxia. Our data suggests a differential expression of mTOR components in the prefrontal cortex of adult male hypoxic offspring when compared to controls. Future studies are aimed at determining if the abnormal expression in the mTOR pathway is observed in three-week old offspring or if these changes are due to compensatory mechanisms.

## **GEODESIGN TO GUIDE GREEN INFRASTRUCTURE PRACTICES FOR STORMWATER MANAGEMENT IN A CHANGING CLIMATE**

Celeste Gunderson, David Hart (Mentor)

With the increase in severe precipitation events due to climate change, cities across the world are addressing the pressing issue of stormwater management through green infrastructure adaptations. Using predicted climate trends developed by the UW-Center for Climatic Research, we will identify precipitation variables, time periods, and emission scenarios to inform the future precipitation scenarios which will affect stormwater management in Wisconsin. Literature will be reviewed to determine the infiltration capacity of green infrastructure practices and to develop mean quantities of stormwater infiltration for small, medium, and large installations. Applying a geodesign process using Esri GeoPlanner, we will then determine the number and location of green infrastructure practices needed by part of the UW-Madison campus to mitigate the predicted increase in annual rainfall.

## **EVOLUTION OF DHS ENZYMES IN PHYLOGENETICALLY RELATED PLANT SPECIES**

Anika Gupta, Hiroshi Maeda (Mentor)

The shikimate pathway is a metabolic pathway in plants and microorganisms that contributes to the biosynthesis of aromatic amino acids (AAAs), which function as precursors of numerous aromatic natural products. The first enzyme in this pathway, 3-deoxy-D-arabino-heptulosonate 7-phosphate synthase (DHS), was inhibited by AAAs to limit shikimate pathway activity in microorganisms and *Arabidopsis thaliana*, a model plant in modern research. A mutation of the *Arabidopsis* DHS2 (*AtDHS2*) gene deregulates this inhibition, allowing mutant plants to enhance chemical production. This research investigates if DHS inhibition by AAAs is conserved through evolution. Wild type and mutant DHS enzymes from plants closely related to *AtDHS2* will be biochemically quantified in the absence or presence of AAAs, determining whether this mutation will allow AAA production to increase.

## **VALIDITY OF SF-20 FOR PARENTS JAILED IN DANE COUNTY**

Alex Gupta, Julie Poehlmann-Tynan (Mentor)

The aim of this research project is to determine the validity of a measure of quality of life, the SF-20, for parents who are jailed in Dane County. The parent study, the Enhanced Visits Project, is being conducted to determine the feasibility of an intervention to improve outcomes for incarcerated parents and their children. The SF-20 was intended to be a quality of life assessment for patients and has been proven to be accurate for chronically ill patients and the prison population. Through data collected from incarcerated parents in the Enhanced Visits Project, the SF-20 will be correlated with other measures, such as the Adult Self-Report, in order to deem the SF-20 accurate in assessing the quality of life of the jailed population.

## **THE BOTANY GARDEN AND GREENHOUSE CURATION PROJECT**

Mary Gut, Ingrid Jordon-Thaden (Mentor)

The goal of the Botany Garden and Greenhouse Curation Project is to create a curated database of the living collection to organize specimens within the greenhouse and garden. We first collected as many of the plants flowering or bearing fruit as possible, recording their location and name. The specimens are pressed, mounted, and organized in the herbarium by family and genus. Then, their recorded scientific names were input onto a spreadsheet. Each collected specimen will be analysed to confirm their identification, or edited to reflect a more accurate name using identification keys. This project will create a complete public database to help the Garden and Greenhouse become a more accessible resource for world-wide biodiversity and research, and will support the sharing of botanical data globally.

## **THE CHANGING LANDSCAPE OF JUVENILE JUSTICE: A COMPARATIVE ANALYSIS OF MODELS OF JUVENILE JUSTICE**

Alexandra Hader, Ryan Owens (Mentor)

The United States incarcerates juveniles at a higher rate than other similar countries, yielding negative short-term individual effects and long-term societal impacts. The majority of justice-involved youth are incarcerated in state-run systems that vary widely in their structure and populations. In 2017, Wisconsin passed Act 185 to reform their state juvenile justice system in the hopes of producing better outcomes, including but not limited to, cost-effectiveness, lower recidivism, and parity in outcomes for youth of color to white youth. Using quantitative data from comparable states (Missouri, Illinois, and Iowa) that have undergone similar juvenile justice reform, this research aims to project future outcomes for Wisconsin's juvenile populations that become justice-involved and ramifications for the state as a whole.

## **OPTIMIZATION OF A NOVEL METHOD FOR THE IDENTIFICATION OF DRUGS TO PREVENT METASTASIS**

Robert Hall, Craig Atwood (Mentor)

Cancer kills ~600,000 people in the U.S. each year. The role of activin receptors and disintegrins in cancer metastasis have been reported. Suppression of activin signaling results in increased detachment of cells, a necessary step for metastasis. In this study, we suppressed ActRII signalling using siRNAs and measured the number of cells remained attached in a 48-well format. Our preliminary results show a significant reduction in the number of cells remained attached in wells treated with siRNAs. Based on these results, siRNAs can be used to identify agents which can suppress the upregulation of ADAM15 and inhibit cell detachment. Such molecules may have anti-metastatic potential. We are aiming to develop a high-throughput assay with multi-well plates to screen chemicals that prevent cell detachment.

## **MINDFULNESS, SLEEP, AND HEALTH BEHAVIORS IN DAILY LIFE AMONG COLLEGE STUDENTS**

Jake Hamelburg, Alexandra Barringer, Shari M. Blumenstock, Madison Blaydes, Lauren M. Papp, , Lauren Papp (Mentor)

Recent research based on retrospective, global assessment suggests college students with higher mindfulness qualities may be protected from risky substance use and their sleep may play a moderating role in promoting health. The current study is drawn from an ongoing longitudinal study on daily behaviors and health in college life. Inclusion criteria were being a freshman/sophomore; being 18-21 years; and, for the risk sub-sample, endorsing recent prescription drug misuse. Participants completed surveys, including the Mindful Attention Awareness Scale. On average, risk participants scored lower on mindfulness than non-risk participants. Following preregistration of study hypotheses, we will examine associations between mindfulness, sleep, and health behaviors in daily life, and test differential relations among constructs based on risk vs. non-risk status.

## **NEISSERIA GONORRRHOEAE LTGA REGULATION**

Vershawn Hansen, Ryan Schaub (Mentor)

In what infection conditions does liberated peptidoglycan (PG) fragments play an advantageous or disadvantageous role? Lytic transglycosylase A (LtgA) produces most of the PG monomers liberated from the *Neisseria gonorrhoeae* cell wall, including approximately half of the PG monomers released by the bacteria. *Neisseria gonorrhoeae* has recently been classified as a super-bacterium due to the rapid spread of antibiotic resistant derivatives and an overall dramatic increase in infection incidences. After exposing the bacteria to conditions that mimic infection conditions, or changing a single variable during in vitro growth, we will measure LtgA protein levels by western blot or ltgA transcript levels by real-time reverse-transcriptase PCR.

## **PHYLOGENETIC DISTRIBUTION OF TYROSINE-DERIVED METABOLISM WITHIN THE PLANT KINGDOM**

Caroline Hanson, Hiroshi Maeda (Mentor)

A wide array of chemicals evolved in the plant kingdom that aid in processes such as pollination, photosynthesis, and competition. Despite the usefulness of these compounds, few have been identified and little is known about the patterns of their phylogenetic distribution. This study further aims to identify other non-Caryophyllales lineages that have elevated accumulations of tyrosine-derived metabolites and to determine their phylogenetic distribution within the plant lineages. An initial screening to identify lineages of interest through gas chromatography-mass spectrometry (GC-MS) identified the orders Apiales and Lamiales to have elevated accumulations of tyrosine-derived metabolites; a secondary experiment sampling more species from these orders revealed unique patterns of their metabolite distribution. Currently, we are identifying genetic and biochemical factors that explain the observed distribution of these metabolites.

## **DESIRE: HOW EXPERIENCES OF WANTING RELATE TO WELL-BEING**

Lana Hantzsch, Paul Condon, Wendy Hasenkamp, Alexa Henriques, Karen Quigly, Lisa Feldman Barrett, Christine Wilson-Mendenhall (Mentor)

Throughout the day, we experience different desires. It might be something simple like wanting coffee or more involved, like wanting career success. In this study, we examined daily desires and how these experiences are related to well-being. When randomly alerted by phone, participants reported momentary experiences of desire, as well as indices of well-being, multiple times a day for ~10 days. In addition to enactable, concrete desires captured in past research (e.g. "Eating", "Sleep", "Leisure"), participants also reported abstract desires (e.g. "Peace of mind", "Focus"). When experiencing such desires not captured in past research (vs. previously studied enactable desires or no desire), participants tended to report lower well-being. This research is revealing the variety of desires that we experience and their differential relations with well-being.

## **INHIBITION OF MRNA TRANSPORT BY SUB2 OXIDATIVE STRESS SIGNALLING**

Cade Harkner, Aaron Hoskins (Mentor)

Sub2 (human UAP56) is an RNA-dependent ATPase involved in pre-mRNA splicing and nuclear mRNA export. Unlike other members of the DEAD-box ATPase family, Sub2 contains a well-conserved DECD motif with a cysteine amino acid replacing the alanine typically found within the DEAD-box. My project focuses on this DECD cysteine (C217) and a second cysteine (C258), which is located only 4.2Å away. This proximity suggests possible disulfide bond formation between C217 and C258 and a potential redox-sensing pathway within Sub2. I have used yeast genetics to show that the C217A mutation changes yeast growth under oxidative stress and this effect is suppressed by a C258A mutation. By further study of these mutations, I will uncover the purpose of Sub2's DECD motif.

## **DISTURBANCE-MEDIATED EFFECTS ON SOIL MICROBIAL COMMUNITY FUNCTION AND RESOURCE ACQUISITION IN SOUTHERN WISCONSIN**

Chastin Harlow, Erika Marin-Spiota (Mentor)

Human activities, such as forest management, have altered Earth's biogeochemical processes. Although the effects of climate change on the environment is extensively studied, an area of research that is not widely investigated is the ability of ecosystems to rehabilitate. This project looks at how disturbances affect soil microbial activity and biogeochemical cycling in an Aspen forest. We will examine carbon dynamics through a laboratory incubation, where we measure microbial decomposition directly through carbon dioxide production. After 30 days, we will measure changes in enzymatic activity and microbial biomass on the same soil, allowing us to better understand the impact of forest disturbance on microbial function and resource acquisition. These implications can be critical in understanding how recovering ecosystems may be permanently affected through human practices.

## **CREATING AN ALGORITHM TO ASSIST ACUTE-CARE PHYSICIANS IN DIAGNOSING LOWER EXTREMITY CELLULITIS**

Eddie Harwick, Michael Pulia (Mentor)

Cellulitis is an acute, bacterial skin infection with reported misdiagnosis rates of up to 30% in some emergency departments (ED). Misdiagnosis leads to unnecessary hospitalizations and antibiotic distribution. Currently, cellulitis is characterized by subjective features such as warmth, redness, and swelling which are present in other inflammatory diseases. An objective diagnostic is needed to reduce misdiagnosis rates. Thermal imaging technology has recently been purposed to aid physicians by assigning surface skin temperatures to patient's affected and healthy skin. This study aims to examine the utility of surface skin temperatures and use retrospective chart-review to identify characteristics of patients diagnosed with cellulitis in the ED. In turn, an algorithm can be formed to assist physicians in identifying non-cellulitis from cellulitis.

## **THE EFFECT OF PFAS COMPOUNDS ON ENDOTHELIAL DYSFUNCTION**

Sari Hattis, Barnabas Tsegaye Shiferaw, Sathish Kumar (Mentor)

PFOS and other per- and polyfluoroalkyl substances (PFAS) are environmentally persistent compounds that have recently been found in drinking water sources. PFAS have shown to have detrimental effects on pregnant women and their offspring by bioaccumulating in the placenta, specifically, lower birth weights, hepatomegaly and increased hypertension in both the mother and offspring. We tested different biomarkers of endothelial dysfunction caused by exposure to differing amounts of per- and polyfluoroalkyl substances (PFAS) using in vitro assays with Human Umbilical Vein Endothelial Cells (HUVECs). Our study aims to examine mechanisms and downstream events linked to adverse effects of PFOS on pregnant women by testing endothelial cell dysfunction, one of the best biomarkers for high blood pressure.

## **CHARACTERIZATION OF THE MECHANISM BY WHICH ARCA AND FNR ANTAGONIZE H-NS REPRESSION OF FEO, THE FERROUS IRON IMPORTER**

Megan Hazen, Erin Mettert (Mentor)

The Feo system is the primary transporter of ferrous iron (Fe<sup>2+</sup>) in *Escherichia coli*. Many pathogens, including *E. coli*, rely on Feo to compete with their mammalian hosts for iron, an essential element for colonization and virulence. Therefore, an in-depth knowledge of regulation of the Feo system is vital to understanding pathogenesis. My undergraduate thesis revealed that the regulatory protein, H-NS, acts as a repressor of the feo operon aerobically, though the mechanism of repression is unknown. Furthermore, during anaerobiosis, the transcription factors, FNR and ArcA, are required to activate feo expression, suggesting that these proteins may disrupt H-NS binding. I thus propose the use of EMSA and competition binding experiments to characterize the binding sites of H-NS, ArcA, and FNR on the feoA promoter.

## **URBAN LANDSCAPE'S INFLUENCE ON MACRO-INVERTEBRATE DIVERSITY IN MADISON'S URBAN GOLF COURSE POND**

Jiahang He, Daniel Preston (Mentor)

Urbanization is a global trend, and the artificial urban pond is also becoming common in the urban area, surrounded by a significant amount of artificial landscapes. So far, little is known about how the existence of landscape near the pond can influence the species diversity of the pond. Our project aimed to reveal the influence of landscape by researching on the number and diversity of macro-invertebrates in 15 urban golf field ponds located in Madison, Wisconsin. All macro-invertebrates were sorted and identified from the samples, then the data was analyzed. Through the research, we hope more people can realize the influence of artificial landscapes on the invertebrates live in natural and artificial freshwater urban ponds.

## **NEW APPROACH TO STUDYING POPULAR CLIMATE CHANGE VIDEOS**

Lingzheng He, Kaiping Chen (Mentor)

As one of the biggest online video platforms, YouTube provides 2 billion monthly active users with a huge amount of information and very probably misinformation. In this project, we focus on controversial topics such as climate change to systematically investigate the content and the sentiment of these videos. Under the guidance of Life Sciences Communication literature, this interdisciplinary project introduces the use of YouTube API to collect data at a large scale, and the application of structural topic models through the STM package to analyze the data. Thus far, preliminary findings in analyzing sampled video descriptions and transcripts indicate there exists a preference for certain topics of climate change videos. Our research contributes to the understanding and future discussions of online information.

## **EVALUATING BARRIERS AND FACILITATORS TO MENTAL HEALTH CARE IN YOUTH WITH TYPE 1 DIABETES**

Jadin Heilmann, Dr. Elizabeth Mann (Mentor)

Adolescents with type 1 diabetes are at an increased risk of mental health problems including depression, anxiety disorders, and eating disorders. While it is known that mental health directly affects clinical outcomes in diabetes, few adolescents with diabetes have access to mental health care. In this study, we investigate stakeholder perspectives on the barriers and facilitators to mental health problems and care in adolescents with type 1 diabetes through qualitative analysis of interviews with pediatric diabetes care team providers. We expect to find that a multifactorial population-based approach to the recognition and treatment of mental health problems is essential. This might involve adolescent support in the form of a multidisciplinary clinic with an emphasis on the roles of schools and parents.

## **QUANTIFYING GRADIENTS IN SYNTHETIC X-RAY MAPS OF GALAXY CLUSTERS IN SIMULATIONS OF AGN FEEDBACK**

Andrew Heinrich, Sebastian Heinz (Mentor)

The cooling flow problem in clusters highlights a difference between predicted and observed cooling in the centers of large clusters that can be explained by heat sources counteracting cooling. AGN jets have been proposed as the main heat source, but the mechanism by which the energy is transferred to the thermal cluster gas is unknown. One mechanism is turbulent heating, in which energy is transferred from bubbles inflated by the AGN to the intracluster-medium. X-ray observations can now reveal the turbulence spectrum in the ICM as a function of position in the cluster. We analyze simulations of AGN heating in Perseus and compare the results to observation to determine the distribution of turbulent driving by AGN jets and constrain the heating contribution to the cluster.

## **DIFFERENCES IN PRESSURE GENERATION BETWEEN SPONTANEOUS AND VOLUNTARY SWALLOWS THROUGH THE USE OF HIGH-RESOLUTION MANOMETRY**

Sarah Heinze, Timothy McCulloch, Suzan Abdelhalim, Chris Ulmnschneider, Glen Levenson, Michelle Ciucci (Mentor)

Purpose: Swallowing is a complex sensorimotor act that requires coordinated pressure generation along the aerodigestive pathway. Here, we test the hypothesis that purposeful (voluntary) and saliva (involuntary) swallowing have different pressure and timing characteristics as they are controlled differently by the central nervous system. Specifically, we predict that saliva swallows will show lower minimum pressures in the velopharynx and tongue. Method: High resolution manometry measures swallowing events with precision. Using a repeated measures design, we will measure pressure and timing events during purposeful and saliva swallows (n=50; 25 male) in regions of interest. Dependent variables will be compared with paired t-tests ( $\alpha < 0.05$ ). Results/Discussion: Analyses are going and will be presented. The overarching goal of this work is to improve diagnosis and treatment of swallowing disorders.

## **ASSESSMENT OF EFFECT OF NEUROPEPTIDES ON CRUSTACEAN HEARTBEAT WITH FORCE TRANSDUCER ANALYSIS**

Tessa Hellenbrand, Kellen DeLaney (Mentor)

Neuropeptides make up a diverse class of signaling molecules that are responsible for various functions and behaviors. However, little is known about the specific functions of many neuropeptides. The crustacean species, *Cancer borealis*, provides a useful model for neurobiology due to its simple nervous system which contains a small number of easily identifiable neurons. Additionally, their robust central pattern generators enable the in vivo cardiac rhythm to be analyzed in ex vivo applications. In this study, select neuropeptides shown to increase in abundance during feeding were analyzed for cardiac output via a force transducer. Two of the neuropeptides including an RFamide peptide and cryptocyanin peptide exhibited dramatic ex vivo influence on both the amplitude and frequency of rhythm of resting heart rates among several replicates.

## **SILENCING THE EXPRESSION OF ESTROGEN RECEPTOR ALPHA IN THE MADIOBASAL HYPOTHALAMUS OF FEMALE RHESUS MONKEYS**

Lukas Henjum, Samantha Williams, Becca Marrah, Sarah Novack, David Abbott (Mentor)

This study was designed to quantify the estrogen receptor alpha (ER $\alpha$ ) gene silencing in the mediobasal hypothalamus (MBH), specifically the ventromedial nucleus (VMN) and arcuate nucleus (ARC), of adult female rhesus monkeys. To do so, ER $\alpha$  immunostaining was quantified in a rostral-caudal order of rhesus monkey MBH sections obtained postmortem from females that were neurally infused with a virus to silence ER $\alpha$  expression (n=6) or with a control vector (n=4). Viral vector administration was monitored via MRI to ensure location-specific targeting of ER $\alpha$  in the MBH. This is one of the first studies examining ER $\alpha$  in female primates and our findings suggest likely ER $\alpha$ -specific neuroregulation in women and promise a novel therapeutic target for infertility and metabolic disorders.

## **DETERMINING THE AGE SIGNATURES OF HUMAN INDUCED NEURAL STEM CELLS**

Helen Heo, Darcie Moore (Mentor)

Advances in molecular techniques have allowed researchers to revert somatic cells (i.e. skin cells) to a pluripotent stem cell state through a process called reprogramming. However, reprogramming erases cellular and epigenetic age signatures of the donor cell, limiting the study of age-dependent diseases. Alternatively, direct reprogramming, such as taking a skin cell and transdifferentiating into a neuron, can maintain age signatures. Recently, direct reprogramming protocols have been established to create neural stem cells, a cell type which dysfunctions with age, suggesting this model may be effective in studying stem cell aging. However, whether directly reprogrammed stem cells maintain age is unclear. Thus, we currently are performing experiments to address this using mouse and human direct reprogramming strategies, measuring the maintenance of epigenetic and cellular age.

## AMERICAN EDUCATIONAL POLICY: THE FAILURE OF AN IDEAL

Max Herteen, Walter Stern (Mentor)

The American creed of equal opportunity is a widely echoed ideal in public and private discourse alike. In this project, I examine how this ideal in education has clearly been just that: an ideal. Although progress has undoubtedly been made, especially for women and African-Americans, public schools are not yet the “great equalizer” in American life. Barriers that ethnic minorities and women face have not been overcome by public schooling, and public schools have not created an equal playing field to promote social and economic mobility. The historical exclusion of women and African-Americans from decision-making and policymaking in educational reform, paired with persistent and pervasive inequality, racism, and discrimination, has meant that American public schooling has been at best selectively successful and at worst discriminatory.

### **WHY DOES THE T153I MISSENSE MUTATION IN THE KCNJ13 GENE CAUSE BLINDNESS?**

Joseph Heyrman, Katie Beverly, Jack Steffen, Bikash Pattnaik (Mentor)

The central purpose of this research is to understand the biological mechanism of the disease causing T153I mutation. Specifically, a novel missense mutation at the 153rd codon in the KCNJ13 gene has been identified in a patient with Leber’s Congenital Amaurosis. This gene encodes for a Kir7.1 ion channel which is localized to the RPE of the eye and critical for vision. There is little known about the biochemistry of the T153I mutation with regards to the functional outcome of the Kir7.1 channel. The goal is to uncover the function/dysfunction of the mutant channel using a cellular model. To accomplish this, whole-cell patch clamp electrophysiology will be used to test the function of a wild-type Kir7.1 (positive control), T153I mutant, or I153T reverse-mutant channel.

### **SINGLE ELECTRON EMISSION FROM HIGH VOLTAGE GRIDS IN THE LUX-ZEPLIN PHASE 2 SYSTEM TEST DETECTOR: TIME DEPENDENCE AND THE ‘TRAINING’ PHENOMENA**

Oliver Hitchcock, Kimberly Palladino (Mentor)

The LUX-ZEPLIN (LZ) experiment is a direct detection search for WIMP dark matter utilizing 10 tons of liquid xenon in a dual-phase time projection chamber. To maximize the detector’s sensitivity requires a comprehensive understanding of detector performance and backgrounds. One such background is the spurious emission of single electrons (SE’s) from LZ’s high voltage grids. Operation of the LZ System Test Phase 2 detector at SLAC has demonstrated a time dependent reduction in SE rates from high-voltage electrodes at constant voltages, a ‘training’ effect of undetermined origin. This work aims to quantitatively explore this effect in detail and explore potential origins of the training phenomenon. Studies of training in Phase 2 may inform the operation and performance of the LZ detector.

### **RGS6 MEDIATES VOLUNTARY RUNNING-ACCELERATED NEURONAL MATURATION DURING NEUROGENESIS**

Johnson Hoang, Xinyu Zhao (Mentor)

Physical activity such as voluntary running is known to increase adult hippocampal neurogenesis. Specifically, voluntary running has been shown to accelerate maturation of adult-born new neurons in mice, however the underlying mechanism remains unclear. Here, we investigated gene expression changes in adult-born hippocampal neurons in response to voluntary running in mice. We identified Rgs6, a G protein regulator, as a key regulator that mediates running effects on adult new neurons. RGS6 overexpression mimicked the positive effect of voluntary running on neuronal maturation while Rgs6 knockdown abolished this effect. Our work has unveiled a novel mechanism underlying running-induced accelerated neuronal maturation in adult neurogenesis.

## **PARENTING PROGRAMS IN JAIL: EXAMINING FATHER-CHILD RELATIONSHIPS AND CHILD BEHAVIOR**

Allison Hoekstra, Amber Lahti, Pajarita Charles (Mentor)

There are over 2 million people incarcerated in the US, approximately half of which are parents. Being in jail or prison may significantly compromise the quality and maintenance of parent-child relationships. Designed specifically for this population, Parenting Inside Out  $\rightarrow$  is an evidence-based parenting skills training program meant to bolster these relationships. Using participants from the Dane County Jail (n=15), our project looks descriptively at demographics of fathers and children, levels of father-child contact, and perceived impacts of the program on children. We use bivariate regression to explore the extent to which parental perceptions of child behavior after contact changes from pre- to post-intervention. Our findings have implications for future practice, policy, and research that promote optimal development for criminal-justice-involved parents and their children.

## **GENDER DIFFERENCES IN DEFINING AND PRIORITIZING KEY COMPONENTS OF PEDIATRIC FACULTY AND RESIDENT WELL-BEING**

Emily Hoffins, Sarah Webber (Mentor)

This study aims to create conceptual models of academic pediatrician well-being and identify differences amongst women and men pediatric physicians. Current physician well-being research lacks insights on pediatricians' perceptions of well-being; but, understanding pediatrician's components of well-being will help prevent burnout, increase workplace satisfaction, and optimize care provided to children. Using Concept Mapping technology, pediatricians will brainstorm key components of physician wellness, then participate in ranking activities to produce a conceptual model demonstrating the well-being elements they find most important. This model will be presented back to the participants in hopes of diving deeper into physician well-being components and discussing potential implications for the workplace. We anticipate the study will produce models emphasizing differences in physician well-being priorities between genders and other demographic factors.

## **MAKING ACCURATE REDUCED LANGMUIR PROBE MEASUREMENTS**

Drue Hood-McFadden, Cary Forest (Mentor)

A triple Langmuir probe is the simplest diagnostic tool to measure the electron temperature and ion density of a plasma. Proposed experiments on the Big Red Ball vacuum vessel require simultaneous measurements of those plasma parameters and the magnetic field at the same location, made via B-dot coils. The currents from the triple probe produce magnetic fields perturbing the fields in the experiment. This systematic error can only be corrected post-hoc in data analysis. This project will calculate the idealized mutual inductance, and experimentally measure the "cross talk" between the Langmuir and magnetic measurements. The results will be used to improve the measurements in the upcoming experiments.

## **DEFINING THE MOLECULAR INTERACTION OF IQGAP1 WITH MAP4: THE SCAFFOLDING PROTEINS OF PI3K-AKT SIGNALING**

Hudson Horn, Richard Anderson (Mentor)

IQGAP1 is known to scaffold multiple signaling pathways, including the PI3K-Akt pathway which regulates key cellular events promoting cancer progression. Recently, we have demonstrated microtubule-associated protein 4 (MAP4) as a novel interacting partner of PI3K, playing a role in intracellular trafficking. As IQGAP1 associates with microtubules and multiple components of the PI3K-Akt pathway, a link between IQGAP1 and MAP4 was investigated. An interaction was confirmed via a co-immunoprecipitation assay that showed *in vivo* association of IQGAP1 with MAP4 in different cancer cell lines. Following, the binding regions were defined. As the PI3K-Akt pathway is one of the most commonly dysregulated pathways in cancer, defining the molecular interaction between IQGAP1 and MAP4 is essential in developing a more complete picture of this important pathway.

## **CREATING COMPLETE BONES FROM FOSSIL FRAGMENTS: THE USE OF MODERN HUMAN CRANIA TO TEST THE ACCURACY OF RECONSTRUCTION METHODS**

Lily Houtman, John Hawks (Mentor)

The study of human evolution is limited by an incomplete fossil record. Skeletal fragments, historically reconstructed by anatomists, shape views on ancient hominins. Modern reconstructions, based on 3D scans of fossils, are generated by a statistical range of confidence. This study tests whether 3D morphometric alignment can place skeletal fragments into their biological positions. I will produce 3D scans of ten human crania. One will be digitally split into fragments, and nine will act as references. 3D landmarks will be collected on all crania and a Procrustes alignment will be carried out on the resulting data. These results will be compared to the morphology of the complete cranium. This approach will be repeated, giving a statistical range of confidence for 3D reconstruction using this method.

## **POTENTIAL SEX DIFFERENCES IN SOCIAL PLAY BEHAVIOR IN YOUNG COMMON MARMOSETS**

Harry Howard, Ricki Colman (Mentor)

An important component of the behavioral repertoire of common marmosets (*Callithrix jacchus*) is social play, a behavior most frequently exhibited by immature animals. Previous studies have obtained conflicting results regarding sex differences in the frequency of this behavior in young marmosets. The behaviors of 12 female and 13 male marmosets were observed for an average of eight fifteen-minute periods at three-month intervals, from the ages of 5 to 17 months. We found that males spent significantly more time engaging in social play behavior than females at 11 months of age, but sex differences were insignificant at 5, 8, 14, and 17 months of age. This study suggests that juvenile male marmosets may engage in more social play behavior than females during certain periods of development.

## **FLUORESCENT TAGGING OF NYLON-3 POLYMERS AS HOST-DEFENSE PEPTIDE MIMICS**

Sean Huth, Lei Liu (Mentor)

Cationic Nylon-3 polymers have been shown to act as host-defense peptide mimics with potent antimicrobial activity. The exact mechanism of action of said polymers is currently not fully understood. To elucidate their mechanism, fluorescent tags would allow for experiments such as fluorescent microscopy or flow cytometry to be performed. Crucial to the tagging process is to measure the effect of tags on the potency or toxicity of the polymers. Initially a pre-polymerization coumarin-based tag was attempted, but after many approaches with limited success a post-polymerizational approach proved to be successful. Further optimization will be required to utilize fluorescent Nylon-3 polymers as mechanistic probes as well as for tracking polymers in vivo.

## **REDUCING CHILDREN'S INTERGROUP BIAS THROUGH PARENT-LED INTERVENTIONS**

Nicole Huth, Dr. Patricia Devine (Mentor)

White children begin expressing racial biases early in development (Hailey & Olson, 2013). Although some researchers argue that prejudice-reduction interventions would be most effective early in childhood (Rutland & Killen, 2015), existing interventions produce short-term outcomes that often fail to translate beyond intervention-specific measures. This research aims to strengthen child-targeted interventions by training parents to implement bias reduction strategies with their children. Parents will engage in an educational session aimed to empower their sense of responsibility for their child's racial socialization, read a storybook about intergroup relations with their children (ages 6-7 years), and facilitate discussions about racial attitudes. We will code the parent-child conversations and measure children's racial attitudes to examine the effectiveness of parent-training on child prejudice reduction compared to a control group.

## **AI IN AFRICA**

Sheriff Issaka, Reginold Royston (Mentor)

Like all technological innovations, AI promises remedies to perennial global problems. However, AI is primarily set and developed in the global north to address needs germane to those societies. AI as a science requires comprehensive and cohesive data sets for optimization; data sets that sparsely exist in Africa. Hence, what resources are AI going to leverage for its advancement in Africa? Under our current examination are the techniques used to collect and collate AI data, primarily across West Africa. Ultimately, we want to explore ingenious ways Africans are using AI to resolve 'African problems.' By the end of this research, we should be equipped to wholly evaluate and make recommendations about the conditions and methodologies necessary to generate impactful applications of AI in Africa

## **PRE-DIABETIC CHANGES IN PANCREATIC ISLETS: ARE THEY INDUCED BY BRAIN GENE SILENCING OF ESTROGEN RECEPTOR ALPHA IN FEMALE MONKEYS?**

Aiden Jacobs, David Abbott (Mentor)

A staggering 40% of the United States population is overweight or obese. Type 2 diabetes (T2D), commonly the result of obesity-induced metabolic dysfunction, may be induced by weight gain related hyperlipidemia. An underlying genetic predisposition or pancreatic defect may account for increased circulating lipids which induce T2D. Few studies, however, focus on women, especially estrogen's action mediated by ER in the brain, known to improve insulin-glucose homeostasis and diminish weight gain in female rodents. Investigation of pancreatic islet morphology, in concert with metabolic testing, in overweight female ER gene knockdown rhesus monkeys (*Macaca mulatta*) will provide novel insight into the progression of obesity-related pancreatic dysregulation in a female nonhuman primate that is likely translatable to women.

## **USING THE QUANTIFICATION OF ENDOTHELIAL CELL VASCULAR NETWORKS IN VITRO TO OPTIMIZE THE TRANSPLANTATION OF STEM CELL-DERIVED PANCREATIC BETA CELLS.**

Vansh Jain, Sara Sackett (Mentor)

Diabetes affects millions around the world, causing major health complications and even death. Despite the promise of pancreatic cell replacement therapies, stem cell-derived beta cell transplantation has not yet reached routine clinical application, although clinical trials are underway. Insufficient vascularization, lack of necessary growth factors, and incomplete matrix environments have been identified as issues that affect the viability of transplanted cells. We seek to use endothelial cells in vitro to form vascular networks that would support stem cell-derived beta cells in vivo after transplant. We aim to compare different combinations of growth factors and cell media to ascertain an optimal technique for prevascularization. This could be used to optimize beta cell replacement approaches, which could one day be used in a clinical therapy for diabetes.

## **IMMUNOHISTOCHEMICAL ANALYSIS OF EPITHELIAL CELL COMPOSITION IN THE MOUSE PROSTATIC URETHRA**

Asha Jain, Petra Popovics (Mentor)

Benign Prostate Hyperplasia (BPH) is non-cancerous prostate enlargement that can result from epithelial cell proliferation, which constricts the urethra and causes lower urinary tract dysfunction (LUTD). The purpose of this study was to identify the percentage of basal and luminal epithelial cells in an aging and a hormone-induced (T+E2) mouse model of LUTD. Immunohistochemistry was performed on prostatic urethra tissue using basal cell marker p63. In urothelium, there was significantly higher percentage of luminal cells in aging (51.43%) versus young (31.84%,  $p=0.0125$ ). There was an increasing trend in percentage of luminal cells in T+E2 (37.75%) versus UNT (31.84%,  $p=0.1115$ ). This suggests that there is an increase in prostate luminal cells in the urothelium in LUTD.

## **MICROBIAL ACCELERATION OF THE OXIDATION OF PYRITE**

Megan Janquart, Eric Roden (Mentor)

The oxidation of pyrite releases sulfate, metals, and acidity into the environment, resulting in poor water quality. Chemolithotrophic bacteria use inorganic materials, such as pyrite, as an energy source when fixing carbon. Previous studies have shown the acceleration of sulfide oxidation when mediated by chemolithotrophic bacteria in direct contact with pyrite in circumneutral-pH conditions, prior to acidification. This experiment seeks to demonstrate if bacteria can also accelerate pyrite oxidation indirectly in the same pH conditions. We will monitor and compare sulfate, metal, and pH release with time in experimental reactors containing Wisconsin groundwater with native groundwater microbial communities, and geologic aquifer material containing pyrite isolated or not isolated in dialysis bags. This experiment will further our knowledge of the bacterial mechanism involved in pyrite oxidation.

## **IMMUNE CELL RESPONSE IN OBESE POPULATIONS THAT COULD PROMOTE LUNG METASTASIS**

Amanda Janquart, Lisa Arendt (Mentor)

Obese women are at an increased risk of metastatic breast cancer. Obesity induces chronic inflammation in the body. The objective of this study was to identify if changes in immune cells recruitment could make the environment more suitable for breast cancer metastasis in the lungs. Naïve female mice were placed on control diets or high fat diets to induce obesity. Their lung cells were examined for changes in immune cell populations under obesity using fluorescent microscopy, flow cytometry, and cell markers CD11b+, F4/80+, and Ly6G+. We observed a significant increase in the number of myeloid-lineage cells, macrophages, and g-MDSC in the obese lungs with fluorescent microscopy, suggesting obesity alters myeloid-lineage populations in the lungs and may prime the lungs for metastasis.

## **HEIGHTENED STRESS RESPONSE IN ZEBRAFISH DUE TO MUTATION IN KLC4**

Marcel Jean-Pierre, Liz Hanyes (Mentor)

The development of the nervous system is a complicated process that is not well understood. Careful organization of microtubules and motor proteins within neurons is critical for correct wiring and proper functioning of neuronal circuits. Kinesin-1 is a motor protein involved in movement of cargo across the nervous system and is controlled by different (KLC) genes. A mutation in one of these genes, KLC4, results in defects in axon morphology and microtubule organization. Adult zebrafish with this mutation in KLC4 exhibit a high stress response in comparison to their wild type control. To test stress, a novel tank test is utilized. Data gathered confirms the presence of a different behavioral phenotype due to the increased likelihood of freezing behavior in the KLC4 mutants.

## **DEVELOPING A RHESUS MACAQUE (MACACA MULATTA) MODEL FOR HUMAN ENDOMETRIOSIS-ASSOCIATED OVARIAN CANCER RESEARCH**

Hanna Jens, Manish Patankar (Mentor)

Research suggests having endometriosis increases the risk of certain types of ovarian cancer. The process of malignant transformation of endometriosis to endometriosis-associated ovarian cancers (EAOC) is ongoing. Recently, the Wisconsin National Primate Research Center instigated ER knockdown in the hypothalamus of female rhesus macaques. Following ER knockdown, macaques developed ovarian neoplasms and endometrial lesions that preliminarily appear similar to such lesions in humans. Immunohistochemistry and RNA sequencing experiments are underway to determine if these neoplasms are comparable to EAOCs in humans. We hypothesize that human and non-human primate ovarian neoplasms have similar histologies and genetic expression. With sufficient evidence, the rhesus macaque with ER knockdown in the hypothalamus may prove a novel animal model for EAOC research.

## **VAPING-RELATED RESOURCES FOR HIGH SCHOOL STUDENT ATHLETES WITHIN STATE HIGH SCHOOL ATHLETIC ASSOCIATION WEBSITES**

Juhi Jhaveri, Denise Mohrbacher, Traci Snedden (Mentor)

Vaping has become a public health concern for adolescents and is related to a number of respiratory conditions. The purpose of this study was to evaluate vaping resources that are available within state high school athletic association websites. Fifty state high school athletic association websites were examined to determine what scope of vaping-related resources were available. Each website was reviewed for vaping resources and identified in four categories: vape specific information, vaping bylaws, positions statements and a link to the NFHS vaping article. It was concluded that few state athletic association websites contain vaping-related resources although its prevalence on the rise. Further research should examine the presence of vaping-related resources both online and in print.

## **EXTRACTION AND MASS SPECTROMETRIC ANALYSIS OF METALLOTHIONEIN PROTEINS IN A CRUSTACEAN MODEL**

Mason Job, Chris Sauer, Lingjun Li (Mentor)

Metallothionein proteins are family a small of proteins which bind metals such as zinc and copper, using their many cysteine residues. This makes them important for the transportation and regulation of metals. Efficient extraction of metallothionein proteins is necessary for analyzing the protein by mass spectrometry (MS). MS allows for both structural and quantitative data to be collected. This project focuses on extraction methods for metallothionein from blue crab. Different extraction techniques and buffers were used to determine the most effective means for extracting metallothionein from the blue crab, evaluating the recovery of a spiked in rabbit metallothionein protein with similar properties. This work lays the foundation for studying metallothionein proteins in relation to environmental toxicology.

## **PEDIATRIC INJURIES ASSOCIATED WITH HOVERBOARD IN THE UNITED STATES: 2015 THROUGH 2018**

Bonnie Johnson, Traci Snedden (Mentor)

As hoverboards continue to gain popularity concerns about their safe use are increasing, most especially in children. A recent study noted a 10-fold increase in injuries from 2015 to 2016 with children being injured more frequently and with greater severity than adults. However, no study has used a nationally representative sample to evaluate pediatric hoverboard injury across the United States. Findings from our national study revealed < 1% (n = 6) were documented as wearing a helmet. Body parts most seriously injured were the lower arm (17.8%), wrist (17.4%), and head (13.8%). The most frequent diagnoses were fractures (41.4%), By characterizing the specific injuries and characteristics resulting from pediatric hoverboard use, preventative measures can be initiated to decrease the frequency and severity of the injury.

## **PARENT IMPRESSIONS OF CHILD DEVELOPMENT AND THE IMPACT OF MATERNAL MENTAL HEALTH**

Emily Johnson, Roseanne Clark (Mentor)

Parent report figures prominently in child developmental monitoring, making it essential that parental impressions reflect a child's true level of functioning. This study examined the convergence between maternal report and direct assessment of child social-emotional development, as well as the impact of maternal stress and depression on the degree of convergence. A common parent-completed screening tool was used as a measure of parent report, while child functioning was directly assessed via a coded and videotaped parent-child interaction. Correlational analyses were performed to measure convergence and moderation by maternal stress and depression. These yielded no significant results, though a positive correlation was observed between maternal depression and child risk of social-emotional challenges, highlighting the connection between maternal mental health and child developmental outcomes.

## **THE STRUCTURE OF CORPORATE PEER GROUPS**

Max Jytyla, Michael Campeau, Yaron Nili (Mentor)

Corporate peer groups are a deeply valued tool among investors to contextualize a firm's performance against others of similar standing and industry. However, the ability of a firm to construct a misleading peer group remains concerning, particularly among companies operating in different industries and those with shared corporate leadership, creating a possibility for anti-competitive behavior among these firms. Our research examines these structures by collecting and analyzing the peer groups, industry codes, and board members of the firms in the S&P 1500, with a focus upon firms in the same peer group while sharing board members or operating in different sectors of industry.

## **PHOSPHORYLATION OF SPC29 WITH MPS1 IN VITRO**

Bridget Kaiser, Amanda Drennan (Mentor)

The spindle pole body (SPB), the microtubule-organizing center in *S. cerevisiae*, is necessary for chromosome separation during mitosis. The SPB is arranged into layers of protein crystalline arrays, with Spc29 and Spc42 proteins layers at its center. Here, we will test the efficacy of *C. albicans* and *S. cerevisiae* Mps1 kinase catalytic domains in phosphorylating *S. cerevisiae* Spc29 in vitro. We will engineer clones that code for the expression of either *S. cerevisiae* or *C. albicans* Mps1 catalytic domains, and express and purify the protein from these plasmids. Finally, we will evaluate the kinase activity of Mps1 on Spc29 under various conditions using gel shift (to evaluate overall phosphorylation) followed by trypsin digest and mass spectrometry (to establish phosphorylation of specific residues).

## **ANALYSIS OF THE ELECTROPHYSIOLOGICAL ARRHYTHMIA MECHANISMS OF ARVC VIA MULTIPARAMETRIC FLUORESCENT OPTICAL MAPPING**

Manasa Kalluri, Lee Eckhardt (Mentor)

Mutations in genes that encode cardiac ion channels can disrupt action potentials and lead to severe arrhythmias. The clinical syndrome Arrhythmogenic right ventricular cardiomyopathy (ARVC) is an inherited condition characterized by ventricular arrhythmias in the absence of ischemic or hypertensive disease. These life-threatening arrhythmias can be induced by heightened levels of physical stress and may lead to sudden cardiac death. Arrhythmia prevention is paramount since the disorder can present as several genetic variants of unknown etiology. The goal of this experiment was to use optical mapping to analyze electrophysiological differences (measured by Ca transient activity) between ARVC and control patient-specific iPS-CM models. Studying patient-specific models is crucial in characterizing cellular arrhythmia mechanisms on an individualized basis, and can provide a basis for drug screening.

## **INVESTIGATING THE ROLE OF YEAST MITOCHONDRIAL YLR253W AND YPL109C IN OXIDATIVE PHOSPHORYLATION**

Keith Kamer, Zack Kemmerer (Mentor)

The ancient UbiB family of proteins exist in all three domains of life. In yeast, there are three UbiB family members (COQ8, YLR253W, YPL109C), while the human genome contains five UbiB family genes, ADCK1-5. Importantly, these mammalian homologs have connections to human health, with mutations resulting in various diseases and tissue-specific tumor viability. The Pagliarini Lab has made significant progress on one of these UbiB proteins, COQ8, elucidating structurally important motifs. Through conserved ATPase activity, COQ8 maintains the biosynthetic complex responsible for producing Coenzyme Q, a key redox-active lipid required for mitochondrial energy production. However, the other UbiB proteins remain poorly characterized. Using blue native PAGE and in-gel activity assays, my projects aims to understand how YLR253W and YPL109C function in mitochondrial oxidative phosphorylation.

## **CYTOSKELETAL DYNAMICS OF PHOTORECEPTOR TERMINALS**

Yochana Kancherla, Timothy Gomez (Mentor)

A prospective treatment for photoreceptor (PR) degeneration is transplantation; however, little is known about the development of PRs. Through studying the intrinsic and extrinsic mechanisms of PR development, specifically the extension of neurites, it is possible to make PR transplantation a viable treatment. Axon guidance occurs through attractive and repulsive cues sensed by the growth cone, or the terminal end of an axon. Previous studies show that cytoskeletal components are essential for axon guidance and can be disrupted using pharmacological agents. PR terminals at day 80 have been shown to respond differently compared to traditional growth cones. The aim of this study is to study PR terminals at day 40, when they appear similar to traditional growth cones.

## **ON WHOSE BEHALF DO MEMBERS OF CONGRESS ADVOCATE?**

Hope Karnopp, Maggie Nead, Julia Derzay, Devin Judge-Lord (Mentor)

Public and scientific knowledge of elected officials largely relies on highly-visible actions such as voting records. Key government decisions occurring behind the scenes have thus far eluded study. Our research analyzes the correspondence between members of Congress and executive branch agencies. We obtain 400,000 letters and emails through Freedom of Information Act requests and classify them to determine who legislators represent - individual constituents, nonprofits, or companies. We find that legislators primarily advocate for individual constituents even as they gain power and influence. By merging these data with information about legislators such as their political party, campaign contributions, committee membership, and seniority status, we estimate which qualities most affect representation. In addition to advancing the study of legislator behavior, this database will promote public transparency.

## **CHROMATIN TETHERING DOMAIN IN HCMV**

Misa Kawamitsu, Donna Neumann (Mentor)

Human Cytomegalovirus (HCMV) is a common beta-herpes virus that establishes a lifelong infection in ~90 percent of the world's population. Our lab previously showed that HCMV contributes to tumor progression by inducing resistance to temozolomide (TMZ), a standard chemotherapy used to combat glioblastoma multiforme- the most aggressive and deadliest form of brain cancer. We hypothesized that the chromatin tethering domain (CTD) of HCMV is responsible for this increased viral persistence in glioblastoma cells, allowing the viral genome to move to daughter cells following mitosis. To test this hypothesis, we infected glioblastoma cells with both a wild-type HCMV strain (AD169), and a mutant virus lacking the CTD (IE19) and experimentally measured genome persistence, viral gene expression and tumorigenicity over time. Our results are presented here.

## **THE HISTORY OF MEN'S ENGAGEMENT EFFORTS AT UW-MADISON**

Sebastian Kelnhofer-Maldonado, Sebastian Atwood, Nona Gronert (Mentor)

Men's engagement in violence prevention is not a new phenomenon. Men have been involved in and with feminist movements dating as far back as the 1970s. The question then becomes how did this movement come to the University of Wisconsin-Madison? Our goal is to show how and why men became involved in anti-violence work in order to recommend where men's engagement efforts should follow for the future. University Health Services has engaged men by means of a course offered through the School of Social Work, Greek Men for Violence Prevention (GMVP), and community-based peer-facilitated programs. These programs were designed to educate men on their role in ending violence through bystander intervention and other violence prevention strategies.

## **IMAGING THE TUMOR MICROENVIRONMENT IN PROSTATE CANCER USING TISSUE-BASED CYCLIC IMMUNOFLUORESCENCE**

Alisha Kennedy, Douglas McNeel (Mentor)

In 2019, prostate cancer accounted for 20% of cancer diagnoses in males. Presently approved treatments for castration-resistant prostate cancer have a small median survival benefit. A strong correlation exists between tissue architecture, disease progression, and treatment response. We sought to image the tumor microenvironment to illustrate internal structures and localization of phenotypic surface markers that label tumor and immune cell population subsets within a single biopsy section to pinpoint in what capacity certain immune cells are shaping the microenvironment. We used tissue-based cyclic immunofluorescence with formalin-fixed, paraffin-embedded tumor biopsies mounted on glass slides to create highly multiplexed bioimages of a single biopsy section. The newly developed methods will aid us in understanding the microenvironment and how its changes in developing tumors are manipulated by immunotherapy.

## **MODULAR AQUAPONICS SYSTEM: COMMUNITY DEVELOPMENT, CAREER EXPLORATION, AND STEAM LITERACY ENHANCEMENT FOR UNDER-DESERVED YOUTH**

Akshat Khanna, Lesley Sager (Mentor)

Our team aims to provide interactive materials and tools in order to guide Gompers Elementary School students with the construction and maintenance of an indoor, self-sustaining vertical aquaponics system. Using this prototype, we will examine how learning by doing promotes curiosity and improves STEAM literacy. It is anticipated that potential year-round interdisciplinary activities of this aquaponic system will generate active and engaged learning, which have been shown to increase understanding of engineering concepts among disadvantaged youth on final assessments. We will collaborate with Gompers Grows and Gompers Elementary in order to test the project's ability to build community. Ultimately, we hope to provide new opportunities for multi-sectoral career exploration, and discover the project's capacity for expansion beyond North Madison.

## **AVAILABILITY OF SPANISH CONCUSSION SPECIFIC RESOURCES WITHIN WISCONSIN PUBLIC HIGH SCHOOL WEBSITES**

Christian Kiepke, Traci Snedden (Mentor)

During the 2018/19 academic year, approximately 180,000 Wisconsin high school students, some known as English Language Learners and from Spanish-speaking only families, participated in high school sports. As part of the Wisconsin Concussion Law, student athletes and their parents must review and sign an information sheet specific to concussion as all student athletes are at risk. However, only 5.9% (n = 20) school websites contained concussion resources in Spanish with 56.9% (n = 194) having the option to translate the website to Spanish. Urban schools were more likely to include Spanish resources while rural schools were more likely to have the option to translate to Spanish. Additionally, fewer school websites with higher percentages of free and reduced lunch eligible students had resources available in Spanish.

## **METHODS OF ULTRASONIC VOCALIZATION ANALYSIS IN A RODENT MODEL OF PARKINSON DISEASE**

Jiwon Kim, Michelle Ciucci, Jesse Hoffmeister, Michelle Ciucci (Mentor)

Rats produce ultrasonic vocalizations (USVs) to communicate. USVs are used extensively in research to model human communication, and communication impairment in conditions such as Parkinson disease (PD). Like human vocalization, USVs can be recorded and acoustically analyzed to examine the effect of disease and intervention. It is crucial to determine the best method of measuring acoustic properties of USVs in terms of accuracy and efficiency. Traditional software analysis programs are time-consuming and rely on extensive personnel training. Alternatively, a new software called "DeepSqueak" implements machine learning, allowing for significant automation of analysis and greater accuracy. This study compares the reliability and accuracy of analysis between DeepSqueak and gold-standard software. Logistical factors including learning curve and program adaptability are also examined.

## **THE ROLE OF HYPOTHALAMIC NEUROESTRADIOL IN THE ESTROGEN-INDUCED LH SURGE IN MALE ORCHIDECTOMIZED RHESUS MONKEYS**

Alex Kim, Ei Terasawa (Mentor)

Gonadal steroid hormones, estradiol and testosterone, are known to modulate activity of gonadotropin releasing hormone (GnRH) neurons in the hypothalamus as well as gonadotropes in the pituitary. Recently, this lab found that the neurosteroid estradiol is synthesized in the hypothalamus and plays a significant role in the estrogen-induced GnRH and LH surge in ovariectomized female rhesus monkeys. However, a similar role of neuroestradiol in male monkeys is unknown. This study will test the hypothesis that administration of letrozole, which blocks the estradiol synthesis from testosterone, attenuates the estrogen-induced LH surge in orchidectomized male monkeys similar to seen in females.

## **DEVELOPMENT OF INDUSTRIALLY RELEVANT CHARACTERIZATIONS OF METAL ADDITIVE MANUFACTURING FEEDSTOCK**

Aaron Kim, Frank Pfefferkorn, Jacob Manders, Marcus Jackson (Mentor)

The objective of this work is to determine the optimal metric for optical particle size characterization of powders for additive manufacturing by analyzing a novel powder generation technique. The current standard for characterization of particles (ASTM F1877-16) suggests an equivalent diameter metric but there is no correlation with this metric and the results of a sieving analysis. To address this gap in the literature, ball milling experiments will be conducted, and particle size distribution will be analyzed based on four different metrics. The metrics will be evaluated based on their ability to predict the sieved particle distribution, which is the primary metric for powder size characterization in additive manufacturing machines. The study of these parameters gives more effective parameter characterization to the additive manufacturing industry.

## **DIAGONALIZED SINGULAR VALUE DECOMPOSITION FOR ENHANCED IMAGE COMPRESSION**

Ben Kizaric, Matt Maloy (Mentor)

Digital images are ubiquitous, but the memory needed to store / transmit image information is great, creating a need for compression methods to reduce the memory needed to store an image without significant quality reduction. This study proposes an enhanced method using the singular value decomposition (SVD) of a diagonal version of an image to improve compression performance. This is evaluated using an implementation and computer simulation of this method and other existing methods that determines the quality and storage footprint of a compressed image. The study finds clear reduction in storage requirements at a comparable image quality compared to existing SVD-based methods. The implications of this smaller file size include reduced costs of storing images and faster, more progressive transmission of image data.

## **TESTING AND INTEGRATION OF THE CURRENT AND FUTURE CAMERA FOR THE SCT**

Robijn Kleijwegt, Justin Vandenbroucke (Mentor)

The Cherenkov Telescope Array (CTA) is the next generation of ground-based gamma-ray instruments that are ten times more sensitive than previous instruments and have an unprecedented accuracy in detecting high-energy particles. The Schwarzschild-Couder Telescope (SCT) is a medium-sized telescope that will become part of CTA studying energies ranging from 150 GeV - 5 TeV. The camera of the SCT is undergoing an upgrade that will result in a fully populated focal plane with a total of 177 camera modules. The Front-End Electronics (FEE) module is the central component of each camera module and to ensure proper execution, a set of environmental, functionality, interface, and performance requirements must be met. This research broadens our understanding of the testing process and performance of the FEE modules.

## **INVESTIGATING THE ROLE OF EPIGENETIC FACTORS IN CHROMATIN ACCESSIBILITY**

Katie Klimpel, Xuehua Zhong (Mentor)

Chromatin compactness is a dynamic process, changing from open to closed states by many different biological factors. It acts as an upstream control of gene expression and allows for transcription factors to bind to different genomic locations. We will use the Assay for Transposase Accessible Chromatin (ATAC-seq) method to identify specific regions of the genome that are open. To understand how chromatin is changing in response to different factors, we will investigate how chromatin remodelers and epigenetic factors, such as DNA methylation or histone modifications, affect chromatin openness. We are also interested in the affect environmental influences, such as heat stress, have on chromatin. Overall, the goal of this project is to understand the role of molecular and environmental factors in regulating chromatin dynamics.

## **EFFECTIVENESS OF BIOFEEDBACK IN CHILDREN WITH BLADDER BOWEL DYSFUNCTION**

Kaitlin Knocke, Dr. Walid Farhat (Mentor)

Bladder Bowel Dysfunction (BBD) is a common clinical entity that represents more than 40% of Pediatric Urology consults. Bladder Bowel Dysfunction describes a spectrum of urinary and bladder symptoms such as urinary tract infections, constipation, diurnal enuresis, and encopresis that can cause physical and psychosocial stress in young children and their families. In clinical practice, it is treated by constipation management, urotherapy, and biofeedback, whereby children learn how to contract their bladders and relax their sphincters to rehabilitate their bladder. The purpose of this research is to evaluate the effectiveness of biofeedback treatment and to determine how many sessions are needed for optimal results. The methodology used will rely on reviewing medical records and examining the outcome of the biofeedback sessions.

## **THE LEGACY OF ANCIENT GREEK AND ROMAN BUILDING TECHNIQUES IN MODERN BUILDINGS IN MADISON, WISCONSIN**

Lillian Kobs, William Aylward (Mentor)

While scholarship concerning classical influences on architecture abounds, there is a general lack of interest in the traditional practices of building assembly that have been transmitted since Greco-Roman antiquity. Understanding these practices is key to reconstructing a monument's history. This project conducts archival research of photographs, building plans, and historical reports, and compares nineteenth- and twentieth-century construction practices in the historical buildings of Madison, Wisconsin to Greco-Roman methods of construction in monumental stone, especially focusing on hoisting techniques. This comparison will provide insight into how Madison buildings were influenced by technical aspects of classical architecture and which techniques masons preserved over others. This study endeavors to broaden our understanding of the nuanced legacy and reception of ancient Greco-Roman architecture in the monuments of Madison, Wisconsin.

## **DEVELOPING A MOBILE TOOL TO FOSTER CITIZEN ENGAGEMENT WITH WISCONSIN'S FLORA**

Maddy Kobs, Catherine Woodward (Mentor)

It is becoming increasingly important for citizens to engage with the plants of Wisconsin as climate and land-use changes accelerate. The development of a mobile plant identification application will help foster a connection to Wisconsin flora and provide a data collection tool for users to submit images, locations, and phenological information for Wisconsin species. In partnership with the Wisconsin State Herbarium, I have compiled a database for the app, using online databases and field guides on the habit and characteristics of approximately 1,400 species of herbs and forbs. Interacting with plants in physical environs will educate app-users of varying botanical familiarity, and citizen-science can fill pressing knowledge gaps on the effects of the threats faced by Wisconsin vegetation.

## **SIFT: SATELLITE INFORMATION FAMILIARIZATION TOOL**

Katherine Kolman, David Hoese (Mentor)

Advances in meteorological satellite instrument technology can produce higher resolution imagery that is increasingly difficult to analyze with traditional visualization software due to its large size. In an effort to provide a fluid, lightweight, and easy-to-use analysis experience for forecaster training courses, the Satellite Information Familiarization Tool (SIFT) was created. SIFT is an application for visualizing satellite imagery that includes various tools for inspecting the data. Currently, features such as automated testing and resampling functionality are being developed, enabling SIFT to visualize data from even more satellite instruments. After more than two years from initial development, a dozen training courses, and more than 210 trainees, SIFT has proven itself to be an invaluable tool to train forecasters.

## **CLUSTERING ANALYSIS OF GALAXIES AND STATISTICAL METHODS**

William Korbitz, Eric Wilcots (Mentor)

Cluster analysis of galaxy clusters is an important problem in astrophysics to understand how galaxies evolve and interact with each other. We identify statistical methods used in machine learning methods to pre-process data to be clustered and assess the results of our clustering algorithm. This methodology is applied to our previous results studying the Antlia cluster and utilized in an unsupervised learning algorithm to return cluster analyses of different galaxy clusters. We aim to then use these results as the underpinnings for further analysis of galaxy clusters.

## **INVESTIGATION OF THE SOLAR CYCLE AND SEASONAL EFFECTS ON HYDROGEN BALMER-ALPHA EMISSION IN THE UPPER ATMOSPHERE**

Nikaan Koupaei Abyazani, Arianna Ranabhat, Susan Nossal (Mentor)

The Sun goes through natural cycles of high and low solar activity called the solar cycle. This increase and decrease in solar activity has a substantial impact on Earth's upper atmosphere. Particularly, radiation from the Sun excites hydrogen atoms in the thermosphere and exosphere. Hydrogen emission data from 400 kilometers and above was taken using the Wisconsin H-alpha Mapper Fabry-Perot. Our main focus is to plot data recorded during the winter months of the last two decades. We are now transitioning to analyzing data from summer months and investigating how atomic hydrogen emission varies with season.

## **A BRONZE DAGGER CASTING: COMPARING THE LOST WAX AND SAND-CASTING METHODS**

Jacob Kracke-Bock, J. Mark Kenoyer (Mentor)

This research project focused on comparing the lost-wax and sand-casting methods of bronze casting. It is important to understand this technology due to its widespread use and its historical impact. The lost-wax and sand-casting methods were compared by creating a Greek and a Mongolian/Chinese dagger using one method for each dagger. The comparison focused on the time and steps of each method. Alongside that, one dagger was made with 10% tin and the other with 5% tin and 5% lead. This allowed for the comparison of the differences in hardness, color, and durability of the compositions. Through this project, the efficiency of each method and the outcome of using different compositions of bronze was learned.

## **CAREER: CONSTRAINING THE CHEMICAL EVOLUTION OF GALAXIES WITH MANGA**

Jalyn Krause, Adam Schaefer, Cameren Swiggum, Christy Tremonti (Mentor)

As gas cools and collapses within galaxies, stars form and evolve, ultimately ejecting chemical elements back into the gas surrounding it. Our goal is to examine this process of 'chemical evolution' using 800 spiral galaxies from the Sloan Digital Sky Survey IV MaNGA data. We measure oxygen abundances (O/H) using galaxies' strong optical nebular emission lines and find they have smoothly decreasing radial (O/H) gradients, on average. However, visual inspection concludes ~5% of the galaxies display a slope change in their (O/H) profile. Here we report the work of our autonomous classification process which quantifies the slope changes. With this more robust sample, we explore the physical origin of these anomalies, including enhanced star formation, pristine gas inflows, and mixing due to mergers.

## **GLOBULAR FUSION PROTEINS, SALTS, AND SOLUTES AS STABILIZERS OF THE S. CEREVISIAE PROTEIN SPC42**

Kasey Kroiss, Amanda Drennan (Mentor)

The *S. Cerevisiae* spindle pole body is a model system for studying microtubule organizing centers, which dictate the trajectory of microtubules during mitosis. The first protein to arrive at the site of a new spindle pole body is Spc42. Spc42 organizes into a hexameric array in the nuclear envelope of the cell. Studying Spc42 in vitro has proved difficult because it exists mainly as an insoluble dimer in solution, while organization of stable hexameric Spc42 requires a molecular platform for assembly. Spc42 has been truncated, fused to globular proteins, and dialyzed into specific salts and solutes to solubilize the protein in vitro. Here, we propose to investigate salt and solute stabilization of full-length Spc42 fused to the globular protein GFP.

## **ANALYZING MYOFIBRIL DISARRAY OF HYPERTROPHIC CARDIOMYOPATHY USING THE SCANNING GRADIENT FOURIER TRANSFORM METHOD**

Rachel Kruepke, Alana Stempien, Wendy Crone (Mentor)

Hypertrophic cardiomyopathy (HCM) is a heart condition that can be caused by a genetic mutation in cardiac myosin binding protein C (cMyBP-C), which contributes to significant myofibril disarray and may greatly hinder the heart's ability to properly contract. HCM model cell lines were created by the Ralphe Lab using CRISPR/Cas9 genome editing. These cell lines were used with a cell culture platform developed in the Crone Lab that employs micropatterned lanes of different width to explore how myofibrillar alignment changes as a function of lane width. Alignment is quantified with Scanning Gradient Fourier Transform (SGFT) algorithm to investigate sarcomere alignment within the myofibrils of heart cells to determine if decreasing lane width promotes alignment more gradually in cells with low cMyBP-C expression as compared to healthy control cells.

## **DEVELOPING A PROTEOMICS PLATFORM FOR HUMAN INDUCED PLURIPOTENT STEM CELL CARDIOMYOCYTES AND ENGINEERED CARDIAC TISSUE**

Andreas Kyrvasilis, Ying Ge (Mentor)

Engineered cardiac tissue (ECT) derived from human induced pluripotent stem cells has become a promising method for modeling inheritable cardiovascular diseases. At the same time, mass spectrometry-based top-down proteomics have emerged as a powerful tool to robustly characterize proteins constituting the cardiac sarcomere and their various isoforms. In this study, we employed mass spectrometry-based proteomics strategies to assess sarcomeric protein isoform expression and post-translational modifications in human stem cell-derived ECTs. We found that ECTs can be characterized functionally, permitting integration of physiological properties with top-down proteomics data, and that our proteomics-based strategy can be used for assessing the cardiac sarcomere in induced pluripotent stem cell-derived ECTs.

## **INTERACTIVE SCIENCE-BASED ACTIVITIES FOR COMMUNITY ENGAGEMENT: HOW ANIMALS INFORM WHAT WE KNOW ABOUT HUMAN BIOLOGY AND BEHAVIOR**

Camille La Liberte, Lara Klein, Jazmine Ramos, Allyson J. Bennett (Mentor)

Comparative psychology is the field that studies similarities and differences between humans and other animals. One area of study involves examining the interplay between brain, behavior, and development. Children and adults are often interested in learning about how we function, how brains work, and other animals. Materials for teaching this content in formal and informal learning spaces are uneven. Our research focuses on designing innovative and interactive educational outreach materials for community audiences. Our materials engage the audience in learning about how the comparisons of humans and nonhuman animals can inform our understanding about developmental processes. We have created materials including comparisons of human and monkey brain structure and function, developmental timelines for key brain regions, and coloring book activities for children.

## **ENGINEERING LYSINS FOR TARGETED MICROBIOME MANIPULATION**

Claudia Lagoa-Miguel, Philip Romero (Mentor)

Perturbations to the composition of species within the human gut microbiome has been linked to several diseases including cardiovascular disease(CVD). However, we currently lack tools to reliably manipulate the dynamics of complex microbial ecosystems. TMA producers *C. sporogenes*(CS) and *C. asparagiforme*(CG) have recently been shown to increase the risk of CVDs in mice. Our work aims to engineer lysins with high target specificity by exploiting their modularity through domain shuffling(chimeras) and directed evolution. We tested a panel of wild-type and chimeric lysins against CS, CG, and other gut microbes by lysate assays. From these results, two lysins were chosen for further characterization testing their ability to reduce TMA levels within simple synthetic microbial communities of and other human gut microbes.

## **VOCAL LOUDNESS IMPROVES WITH LARYNGEAL EXERCISE IN A PINK1-/- RAT MODEL OF EARLY-ONSET PARKINSON DISEASE**

Emily Lambert, Dr. Cynthia A Kelm-Nelson (Mentor)

Over 10 million people worldwide are diagnosed with Parkinson disease (PD); a degenerative disorder that significantly impairs vocal communication. Interventions aimed at mitigating vocal deficits show promise; however, our limited understanding of the disease mechanisms prevent the optimization of behavioral therapy. We use a rat model (Pink1<sup>-/-</sup>) to study the complicated progression of early-onset vocal deficits in PD and to determine the effects of targeted laryngeal exercise. We hypothesized that an 8-week laryngeal exercise paradigm would ameliorate vocal deficits seen in this model. Male Pink1<sup>-/-</sup> rats (n=25) were randomly assigned to an exercise (n=12) or non-exercise (n=13) conditions. Results revealed that laryngeal exercise significantly improved vocal intensity (loudness) compared to non-exercise Pink1<sup>-/-</sup> and WT rats.

## **NUT ENDOCARPS FOR PRODUCTION OF BIOFUELS**

Leta Landucci, Rebecca Smith (Mentor)

Nut endocarps are the recalcitrant and membranous layer comprised largely of lignin that encompasses and provides protection to the seed of a fruit. In this study we investigate the viability of endocarps as incredibly energy-dense bio feedstock for the production of biofuels, a renewable hydrocarbon source of energy. We provide a comprehensive analysis of the lignin from various species that together may be used to understand the relative character of a wide breadth of phylogenetically diverse endocarps. Among the lignins characterized were: the shells of almond, brazil nut, hazelnut, hickory nut, macadamia, pecan, pistachio, walnut, and yellow mango. Herein, we investigate fundamental characterizations of these samples within the context of their utilization as bio feedstock in energy production.

## **HEART RATE VARIABILITY MODERATES SYMPATHETIC AROUSAL IN RESPONSE TO EYE CONTACT**

Andrew Langbehn, Paula Niedenthal (Mentor)

Eye contact facilitates cooperation and engagement during social interactions. The present study continues an ongoing investigation into the effects of baseline heart rate variability (HRV) on electrodermal activity (EDA) in response to direct gaze. Participants (N = 200) viewed 56 unique face stimuli in two blocks (67% direct gaze, 67% averted gaze) testing two competing hypotheses: the down-regulation hypothesis and the social sensitivity hypothesis. Previous findings supported the sensitivity hypothesis. However, we expect that a co-occurrence of these hypotheses is possible. We predict a replication of the initial study's findings as evidenced by those with high HRV exhibiting high, initial sympathetic arousal in response to direct gaze. However, we also expect a time course analysis of EDA to reveal decreasing levels of arousal over trials.

## **THE ENERGY IMPACTS OF PHOSPHORUS MINING VERSUS RECOVERY**

Dru Larson, Andrea Hicks (Mentor)

I will be studying the effects of phosphorus mining and the potential to offset this application with recovery from wastewater treatment plants instead. We will consider both the environmental and economic implications for both, while citing multiple sources pertaining to this field of study. In doing so, we will be able to determine the feasibility of the alternative, while addressing the problems and risks of doing so. This will accumulate into a formal report that will highlight our findings and in addition a visual display.

### **“BECAUSE I WANT TO HELP PEOPLE”: CAN A PROSOCIAL UV INTERVENTION INCREASE PROSOCIAL MOTIVATION?**

Alexander Latham, Judith Harackiewicz (Mentor)

The utility value intervention (UVI), in which students reflect on the usefulness of academic topics, has been shown to improve academic performance in science courses. However, little research has surveyed the UVI's capacity to influence goals outside of the classroom. In an ongoing study, Harackiewicz and colleagues examine whether a “prosocial” version of the UVI - which prompts students to consider how course material can be used to help others - is particularly effective for students who are especially concerned with helping others. In the present research, I examine whether a prosocial UVI can also affect the degree to which all students endorse prosocial goals. Student motives and open-ended responses are being analyzed, results offer insight into gender differences and intervention effects on extrinsic motivation.

### **TOXOPLASMA GONDII PARASITE INFECTION**

Jonathan Le, Xinyu Zhao (Mentor)

Toxoplasma Gondii (T. Gondii), is a parasite affecting millions of individuals around the world from the transmission of feline feces to the host causes many neurological side effects. T. Gondii reproduces only in cats but mice infected with the parasite can carry the dormant bradyzoites cysts in the brain. The question remains whether T. Gondii preferentially infects neurons or glia. Using a modified T. Gondii parasite expressing mCherry and modified Cre recombinase. Cre is secreted into parasite-infected cells. With Ribotag mice designed to express an HA-tag in the presence of cre, we can visualize T. Gondii infection in the mouse brain. With these tools, we have quantified whether T. Gondii infects neurons or glia and the region the parasite preferentially infects.

### **EXPLORING DEEP LEARNING METHODS FOR IMAGE TRANSLATION IN STEM SIMULATION**

Nick Lawrence, Dane Morgan (Mentor)

The use of accurate scanning transmission electron microscopy (STEM) image simulation methods require large computation times that can make their use infeasible for the simulation of many images. Other simulation methods based on linear imaging models, such as the convolution method, are much faster but are too inaccurate to be used in many applications. We have developed multiple deep learning models that input convolution images and output more accurate predictions of a multislice image but they are not yet accurate enough for application. We found that a Generative Adversarial Network performs best, performing at the level of polynomial models published in previous research.

### **STORAGE AND MEASUREMENT OF LIQUID HELIUM IN THE FIELD**

Morgan Lee, Dan McCammon (Mentor)

The objective of this project is to create “thumpers” as well as to measure the rate in which liquid helium boils off of a cryogenic dewar. Thumpers are designed to measure the amount of liquid helium present, via Taconic oscillations. The oscillations occur because of the thermal gradient within the thumper sticks. Having thumper sticks will rattle when Taconic oscillations are occurring. By observing these Taconic oscillations and the thermal gradient allows for the amount of liquid helium to be accurately measured. Using a flowmeter and boil-off calorimetry to determine the hold time of a dewar will test the storage of liquid helium. Figuring out the storage and measurement of liquid helium will ultimately help with the overall project of sending a rocket to detect X-rays.

## **SPINNING THE CARTONERA PUBLISHING PARADIGM THROUGH SOCIO-POLITICAL TIDES: TWO CASE STUDIES FROM ARGENTINA**

Adeline Lennon, Ksenija Bilbija (Mentor)

In Argentina, a grassroots publishing endeavor known as Eloísa Cartonera was born in 2003 during a devastating economic crisis and flourished under the far left-wing government of Nestor, and later Cristina Kirchner. Other small editorials, such as Sofia Cartonera, got started in 2012 in Córdoba. In 2015, the country saw a drastic shift from the Kirchner regime to the center-right president Mauricio Macri. Through field research in Buenos Aires and Córdoba, I hope to answer the following fundamental questions: How has the production of cartoneras been affected by the political shift in Argentina? How does a press like Sofia Cartonera, supported by the university structure, function differently than an independent publisher such as Eloísa? Can a social movement grow stronger through a disapproving government?

## **IMPROVED READOUT OF ELECTRON SPIN STATE IN NITROGEN-VACANCY CENTERS IN DIAMOND VIA SPIN-TO-CHARGE CONVERSION**

Sam Li, Shimon Kolkowitz (Mentor)

The nitrogen-vacancy (NV) center is an atom-like defect that is naturally trapped by its host diamond lattice. Even at room temperature, the NV center's electron energy levels are sensitive to their local environmental factors, such as magnetic, electric, and temperature fields, making them excellent nanoscale probes that are used in fields ranging from physics to biology. Our research group aims to better understand the properties of the NV center and to develop novel techniques for nanoscale magnetometry. One of the key steps is to improve the fidelity of measurements of the NV electron spin state. My project is to implement a spin-to-charge technique to convert the state of the electron spin to a longer lived charge state, which will improve the measurement signal-to-noise ratio.

## **ICECUBE MUON FLUX SIMULATOR**

Runze Li, Justin Vandenbroucke (Mentor)

In this research, a muon flux simulator is written in python to simulate the expected atmospheric muon flux that IceCube Neutrino Observatory should detect. The first part of this program is a Monte Carlo simulator, which simulates randomly generated atmospheric muon according to the energy and angular flux spectrum observed by IceCube, and the second part is a muon trajectory simulator, which applies an improved Euler method to simulate the trajectory of relativistic muons under the effect of geomagnetic field and energy loss in ice. These two parts together get the atmospheric muons that reach the detector, which represent the expected muon flux IceCube should detect. The result will be used to analyze problems like the azimuthal muon flux asymmetry observed in current data.

## **PARENTS' PERCEPTIONS OF CHILDREN'S RACIAL BIAS: THE ROLE OF CONFIRMATION BIAS**

Makayla A. Liebeck, Kristin Shutts (Mentor)

Past research has shown that parents believe their children are unlikely to show racial bias, and that their own children are markedly less biased than other children. In the present study, I evaluated whether parents perceiving their children as better than average is caused by differences in information processing when parents view their own child versus another child. Children completed a social preference task. Then, depending on condition, parents watched a video of their child completing the task or a video of a different child completing the task. After viewing the video, parents were asked to report what they saw in the video. This study will provide an understanding of one of the possible mechanisms at play when missing children's racial biases.

## **CHARACTERIZING IONIZING RADIATION RESISTANCE IN A UNIQUE EXPERIMENTALLY EVOLVED ESCHERICHIA COLI LINEAGE**

Jessica Liu, Steven Bruckbauer, Illissa Jasmine Lancaster, Emma Steigerwald, Michael Cox (Mentor)

The Cox lab has previously demonstrated that *Escherichia coli* can withstand extreme amounts of ionizing radiation (IR) using high-energy electron beam radiation via a clinical linear accelerator (Linac). These four populations of *E. coli* display significant increase in resistance to IR and are valuable in understanding the molecular basis of IR resistance. Sequencing data from the first 50 rounds of selection reveal two mutational pathways taken to IR resistance where three lineages, (IR9, IR11, IR12) follow one pathway that includes the loss of the  $\phi$ 4 prophage and gain of *rpoB*, *recD*, and *recN* alleles while IR10 does not lose the  $\phi$ 4 prophage and gains *recA* and *recD* variants. I will determine which mutations contribute to IR resistance in IR10-100 using IR and hydrogen peroxide.

## **MACHINE LEARNING TO IDENTIFY SITES OF BLEEDING ON ANGIOGRAMS**

Lynn Liu, Mingren Shen, Pankaj Kabra, Dane Morgan (Mentor)

Gastrointestinal (GI) bleeds occur when vasculature within the gastrointestinal track bleeds into the visceral lumen. Interventional radiologists often use angiograms to detect on-going GI bleeding sites and determine what immediate treatments are needed for the bleeding patients. This project seeks to develop a method to help interventional radiologists to efficiently identify active extravasation on arteriograms before embolization. More specifically, our research focuses on investigating the feasibility of machine learning (ML) tools in classification and localization of angiographic bleeds. We propose to use multiple data analysis methods and train well-suited machine learning neural networks such as Convolutional Neural Network on our datasets generated from UW-Hospital.

## **GENE IDENTIFICATION OF OBESITY-INDUCED DIABETES**

Lareina Liu, Brian Yandell (Mentor)

Local expression quantitative trait loci (eQTL) could be used as a classifier to predict eQTL genotypes, but sometimes the prediction fails due to mix-ups in the genotypes and the complexity in gene mapping. Traditional genetic studies usually have limited ability to detect and correct the mix-ups, therefore, this project aims to identify and analyze the relationship between genotypes and clinical phenotypes, including 10-week insulin and binary indicators for agouti and tufted coats, as well as statistical approaches to correct sample mix-ups with eQTL based on gene expression profiling in six tissues in an F2 intercross between mouse strains B6 and BTBR. The project also involves R package extension, aiming to solve glitches in transforming high-dimensional genomic dataset between R/ql and R/ql2 efficiently.

## **THE EFFECTS OF INTRASPECIFIC GENETIC VARIATION IN POPULUS TREMULOIDES ON BELOWGROUND MICROBIAL COMMUNITIES AND SOIL ORGANIC MATTER POOLS**

Olivia Lopez, Erika Martín-Spiotta (Mentor)

Anthropogenic disturbances to forests can alter the intraspecific genetic diversity of plant communities through selective pressure or random changes in the frequency of different genotypes. Changes in genetic diversity within a species can have effects on ecosystems and their function. I propose to analyze the effects of genetic variability in *Populus tremuloides* on belowground soil communities and resources. From disturbed and control experimental stands, I plan to measure soil microbial biomass, enzymatic activity, nitrogen (N) mineralization and nitrification, soil organic carbon and total nitrogen. This study will shed light on the ways in which belowground communities in specific are impacted by changes in genetic and phenotypic diversity due to forest disturbance, a phenomenon that is not uncommon in contemporary society.

## **MIDWEST REVIEW EDITORIAL AND MARKETING INTERNSHIP**

Malee Lor, Christopher Chambers (Mentor)

Marketing is a broad field, so effective strategies for promotion and sponsorship are crucial. Editorial assessment, production, and distribution contribute towards successful development of a product. The use of online submission software, book store consignments, and referential research is essential. An advisory board and sponsors are elements that enable successful production and promotion of a literary magazine. Literary magazines establish niches that connect readers and writers. They intertwine works of prose, poetry, art, and much more. The existence of literary magazines is critical due to the challenging marketing and frequent unprofitable results. Literary magazines have evolved from print to online accessibility. This renders low-cost production, but traditional values of ownership in reading are overshadowed.

## **DIETARY INTERVENTIONS IN FRAGILE X MODELS**

Gregory Lyon, Cara Westmark (Mentor)

Diet plays a significant role in the lives of all humans, especially those suffering from Fragile X syndrome. Fragile X syndrome, which has no current cure, causes a multitude of learning disabilities and is believed to be the leading genetic cause for autism. By gathering data on how mice with Fragile X syndrome react to various diets, these results can be applied to those who struggle daily with the symptoms of Fragile X. Specifically, some preliminary results have already shown that a ketogenic diet can greatly reduce seizures in mice that carry the Fragile X genotype. Future data will provide information on how soy, ketogenic, and casein diets affect energy levels, bone density, obesity rates, memory, and overall mental capability.

## **FABRICATION ON GRAIN SIZE IN SUPERCONDUCTING CIRCUITS**

Pumeng Lyu, Robert McDermott (Mentor)

The superconducting quantum circuits involving Josephson junction are leading candidates for quantum computers. The main obstacle of quantum computers is that fluctuations in Josephson junctions degrade performance. For Josephson junctions using Al/AlO<sub>x</sub>/Al layers, the oxide layer between aluminum grains generates fluctuations. However, if we add and cool the silicon wafer to let aluminum film grow at very low temperature, aluminum grains will be smaller and smoother, there will be more conduction channels, and fluctuations in each channel have little effects. With support from Professor McDermott's team, we design and add silicon wafer with Josephson junctions on it. We cool the junctions and the fluctuations in Josephson junctions of superconducting quantum circuits will be decreased.

## **ROLE OF THIOREDOXIN IN NEUTROPHIL-MEDIATED INFLAMMATION AND GROWTH OF TUMOR-INITIATING CELLS**

Stella V. Ma, Anna Huttenlocher (Mentor)

Neutrophils are crucial for host defense, but also highly infiltrate tumors, though their role in cancer remains controversial. Neutrophils also mediate wound repair, by, for example, promoting cell proliferation, which may explain neutrophil pro-tumorigenic behaviors. Wounds produce reactive oxygen species (ROS) that mediate inflammation. Antioxidant proteins such as thioredoxin (Txn) limit wound-derived ROS dissemination, and Txn is implicated in inflammatory diseases and cancer. My goal is to determine the role of Txn in neutrophil interactions with wounds and tumor initiating cells. I wound the tails of larval WT and Txn-knockout zebrafish and induced tumor-initiating cells by expressing oncogenic Ras in zebrafish epithelial cells, and used fluorescent microscopy and molecular assays to analyze neutrophil behavior. This research provides insight into the role of Txn in inflammation.

## **MATERIALS SIMULATION TOOLKIT FOR MACHINE LEARNING (MAST-ML)**

Aryan Malik, Benjamin Afflerbach (Mentor)

As machine learning methods are taking on an increasingly important roles in the materials research community, there is a need for the development of machine learning software tools that are easy to use. A software where even non-expert with no programming skills can apply and use machine learning techniques and models in their field of work. This research project introduces the Materials Simulation Toolkit for Machine Learning (MAST-ML), an open source Python-based software package designed to broaden and accelerate the use of machine learning in materials science research. MAST-ML provides a simple structure for executing a multi-step machine learning model workflow. Using Python, I streamline and accelerate this execution by constantly updating this software with the latest or optimized machine learning models.

## **PLAY, IMAGINATION, & LITERACY EDUCATION**

Vishal Kumar Manchala, Tam Thanh Doan, Siena Rose Laws, Dawnene D. Hassett (Mentor)

This research examines the role of imaginative play in children's early literacy learning. We present various playful opportunities involving reading, writing, storytelling, and designing to elementary students in their classrooms, and we study how these imaginative activities enable them to weave unique narratives into the realities of their classroom work. We document how this enhances creativity, problem-solving, and storytelling in their writing, and how it enhances memory reconstruction, connections, empathy, and general comprehension in their reading. Our overall purpose is to listen to children's voices as they engage in imaginative work and uncover the ways in which children use imaginative play for their intellectual, social and emotional growth, thus placing imagination and play as central components of early literacy curriculum and instruction.

## **CHARACTERIZATION OF PARTICLE SIZE DISTRIBUTION IN COMMINATION OF 316L**

Jacob Manders, Dr. Frank Pfefferkorn (Mentor)

The objective of this work is to quantify a distribution function for ball-milled powder created from machining chips for additive manufacturing. Ball-milled powder has already been found to be a viable feedstock for additive manufacturing processes and has the potential to contribute to overall sustainability in manufacturing. Characterizing the distribution of the ball-milled particles will enable improved prediction of yield for ball-milled powders, allowing for process optimization. Ball milling experiments with varying process parameters will be conducted and log-normal, gamma, Weibull, and Rayleigh distributions will be evaluated for goodness of fit. Successfully modeling the powder size distribution is an important step towards developing efficient sustainable remanufacturing processes conducive to industrial implementation.

## **EVALUATION OF AR VARIATION IN TUMOR-DERIVED EXOSOMES IN PROSTATE CANCER**

Jasmine Martinez Soto, Joshua Lang (Mentor)

Tumor-derived exosomes are emerging as a promising liquid biopsy. Exosomes are vesicles secreted by all cell types that carry similar biological contents as their parent cells. As such, tumor-derived exosomes could accurately reflect genetic makeup of multiple tumor clones. In prostate cancer, the androgen receptor (AR) is the target of hormone therapy, however, emergence of AR splice variants can confer treatment resistance. This study will evaluate AR variant expression in tumor-derived exosomes. Exosomes from patients with metastatic prostate cancer will first be isolated using mini size exclusion chromatography and then analyzed by looking for standard exosome markers using Western blot. After the presence of exosomes has been confirmed, AR variant expression will be analyzed by qPCR to better comprehend correlation to treatment resistance.

## **“LETTING GOD TAKE CARE OF IT”: A QUALITATIVE ANALYSIS OF END OF LIFE DECISION MAKING TERMINOLOGY**

Shereen Massey, Lindsey Ripens, Kristen Pecanac (Mentor)

Our study aimed to identify the discourse people use to describe their experiences with end-of-life healthcare decisions. We sent out a survey to a random-based sample of 4,000 Wisconsin residents. Of this sample, we used inductive content analysis to qualitatively analyze 104 surveys that included descriptions of end-of-life decisions. We identified 6 main categories: death is inevitable; type of treatment; treatment choice (ending treatment actively, passively, or choosing life); diagnosis of physiological situation; treatment function; and end-of-life decision with subcategories decision implication, agency/responsibility, and questioning ethics. The study's findings are important for understanding how people make sense of such difficult times in their lives. This in turn is helpful for healthcare providers by better informing their perspective when advising people in these situations.

## **CELLULAR DAMAGE CAUSED BY FRANKLINIELLA OCCIDENTALIS FEEDING INCREASES SALMONELLA ENTERICA PERSISTENCE ON TOMATO PLANTS**

Matthew Maurice, Jeri Barak-Cunningham (Mentor)

In the past decade, the frequency of salmonellosis outbreaks caused by the consumption of contaminated raw produce has increased. Studies conducted by the Barak lab have found that areas with macroscopic feeding damage caused by adult western flower thrips (*Frankliniella occidentalis*) support greater *S. enterica* populations than undamaged leaves. In my study, we sought to establish if macroscopic damage induced by adult *F. occidentalis* support *S. enterica* populations differently from sites damaged by active, second instar larvae. During my study, no significant difference was found between the two, highlighting the necessity to take care of *F. occidentalis* infestations no matter what stage they are in.

## **POOR PROVIDER COMMUNICATION STYLE CAN MAKE URBAN LOW-INCOME ADULTS STOP TALKING**

Cierra McCoy, Chatay Vang, Claire Weissenfluh, Rick Volland, Linda Oakley (Mentor)

Without realizing it, busy health care providers can create communication barriers for patients that make it difficult to talk about personal health concerns. For diverse, low-income patients in urban communities, poor communication can increase the risk of poor treatment outcomes. We surveyed volunteer residents of a low-income housing community (N=28) by asking how the communication style of their healthcare provider made it difficult to talk to the provider. Most (75%) said their healthcare provider gives them a chance to talk, but a significant subgroup (33%) said they were not satisfied with the way their healthcare providers communicated. And (25.9%) said “at least once” their healthcare provider said something that made them stop talking. Nurses can educate patients in communication strategies to prevent retreating to silence.

## **I-TALK AS A MARKER OF SELF-FOCUSED NEGATIVITY IN A SHORT ONLINE STUDY**

Addison McGhee, Christine Wilson-Mendenhall (Mentor)

Recent research suggests that using first-person singular pronouns (“I-talk”) is a marker of self-focused negativity. I-talk is consistently associated with depression symptoms and negative emotionality. Because methods for investigating I-talk vary substantially across studies, we examined whether these findings replicate in a short online paradigm. Participants wrote about whatever came to mind for 7-10 minutes. We observed a small, positive correlation between I-talk and depression symptoms, and between I-talk and negative emotionality. The self-generated thought produced during “stream of consciousness” writing may be particularly well suited for assessing I-talk as a marker of negativity in a short period of time. Future directions include examining the psychological correlates of I-talk further, to investigate whether I-talk signifies negative emotionality broadly or particular forms of self-focused negative processing.

## **SEMI-AUTOMATIC GUIDEWIRE SEGMENTATION TOOL FOR THE TRAINING OF DEEP LEARNING ALGORITHMS**

Matthew (Max) McLachlan, Martin Wagner, Ph.D. (Mentor)

Advanced processing of x-ray fluoroscopy images containing guidewires would be facilitated by applying deep learning algorithms. However, algorithm training requires large amounts of manually annotated images, substantially limiting the training efficiency. A semi-automatic segmentation tool was developed to accelerate this process. The algorithm tracks guidewire intensity patterns on sequential frames, based on an initial manual annotation followed by an automated search. The search exploits knowledge of device shape and redundancy across images. Accuracy was quantified as the mean Euclidean distance between semi-automatic segmentation and manual reference. Preliminary tests using 57 reference frames from 2 porcine studies yielded errors within 3.5 pixels (STD=1.7 pixels). Phantom guidewire data is required for further validation. The segmentation tool is expected to facilitate future research in deep learning-based image processing.

## **SONIC HEDGEHOG REGULATION OF FREM1 IN THE CRANIAL NEURAL CREST AND MIDFACIAL DEVELOPMENT**

Matthew McLaughlin, Robert Lipinski (Mentor)

Facial malformations are among the most common human birth defects. However, our understanding of specific mechanisms that drive facial development is limited. The Sonic Hedgehog (Shh) signaling pathway is a master regulator of facial morphogenesis, and its disruption causes craniofacial malformations. Here, I present Frem1 as a target of Shh signaling in cranial neural crest cells (cNCCs). Frem1 was expressed concomitantly with Shh target Gli1 in vivo in the cNCC mesenchyme that forms the upper lip and palate, and SHH peptide induced expression of Frem1 in cNCCs in vitro. Next, I will explore the effect of Frem1 deletion on cNCC function. These studies reveal a novel Shh target in cNCCs that may be operational in driving subtle and overt facial abnormalities.

## **EPIGENETIC MODIFICATION AND THERAPEUTIC RESISTANCE OF PROSTATE CANCER TUMOR CELLS**

Marina Melby, Sydney Plante, David Kosoff (Mentor)

Prostate cancer is the second leading cause of cancer-related death in men, so it's important to continue researching it and its treatments. Recent research has shown that non-cancerous cells, including immune cells, blood vessels, and other support cells within tumors play a critical role in the response of tumor cells to treatment in prostate cancer. With the development of microfluidic devices to mimic the tumor microenvironment, epigenetic modifying agents can be applied to change the gene expression of macrophages, which can inhibit immune response, leading to increased t-cell migration. Microfluidic devices will also allow the microenvironment to be analyzed to study therapeutic resistance and to develop a new way to target these pathways. This will help further the understanding of how the cells communicate.

## **FACTORS INFLUENCING NICU PLACEMENT IN RHESUS MACAQUES**

Mili Meredith, Emilia Meredith, Allyson J Bennett (Mentor)

Experience in a Neonatal Intensive Care Unit (NICU) can affect developmental outcomes in humans and other primates. Monkeys raised in nurseries often differ from mother-reared monkeys in behavior and physiology. The goal of my project is to identify clinical and health factors that influence NICU placement for infant rhesus macaques, as well as potential for heritable characteristics. To accomplish this, information from an electronic database over a 7-year period will be analyzed. In this first phase of the research, I have analyzed archival data on the length of time spent in the NICU and parentage of NICU monkeys. The next step will examine the clinical record to identify the contributing factors for NICU placement. The analysis will produce foundational information for future study.

## **PROGRESS TOWARDS A MULTIPLEXED OPTICAL LATTICE ATOMIC CLOCK**

Brett Merriman, Haoran Li, Shimon Kolkowitz (Mentor)

Optical lattice clocks are currently the most precise and accurate devices ever built. We will present our current progress towards constructing a multiplexed optical lattice clock and plans for differential measurements using strontium atoms in dual optical lattices. We will discuss the design and construction of an efficient blue laser cooling system for the 461 nm  $1S_0 - 1P_1$  transition of strontium and tests of its frequency stability and bandwidth, and our recent work on building a cost effective and low-noise photodetector. We will present realization of a two-stage magneto-optical-trap (MOT) achieving micro-Kelvin atomic temperatures and the fast, efficient trapping of all four stable strontium isotopes. We will then discuss next steps and our plans for testing fundamental physics with the multiplexed optical lattice clock.

## **HELICON PLASMA PHYSICS AND EXPERIMENTAL METHODS**

Drake Miller III, Oliver Schmitz (Mentor)

Roughly 99.9% of the known universe is made up of plasmas. A plasma can be defined as an ionized gas that exhibits specific behaviors. It has been found that plasmas can be confined using magnetic fields. To better understand plasma characteristics, a plasma will be generated using the Helicor device and several diagnostics will be performed. Results will describe magnetic field confinement, plasma spectroscopy, and several other experimental methods. Additionally, these results will provide information on the future of plasma physics research and applications. Plasma physics is the basis for many different applications and phenomena, such as fusion energy and studies on the Interstellar Medium. Therefore, exploring plasma behavior may strengthen the comprehension of many other sciences and provide additional data on energetic interactions.

## **PERCEIVED SYMPTOM CLUSTER EXPERIENCES AMONG PATIENTS WITH CANCER**

Sarah Miller, Mia Warren, Jen Stevens, Loyda Braithwaite, Kristine Kwekkeboom (Mentor)

Recent studies indicate that cancer patients experience an average of eight symptoms concurrently. This research project focuses on determining the feasibility of an app designed to collect data about a patients' symptoms and how they are related. We will specifically focus on patients' reports of symptom clusters and their perceived causes. The data collected will be used to analyze patterns between the symptoms patients experience. Currently, clinicians have a difficult time treating cancer patients' symptoms due to the difficulty of discovering complex symptom interactions. Using data collected from the app along with future studies, we hope to discover symptom interaction patterns and analyze how they differ among patients. Acknowledging these patterns will help to promote effectiveness of cancer treatment and, consequently, improve patient experiences.

## **CAFFEINE ABOLISHES TRKB RECEPTOR-DEPENDENT RESPIRATORY-RELATED SPINAL MOTOR FACILITATION IN ISOLATED NEONATAL RAT BRAINSTEM-SPINAL CORDS IN VITRO**

McKayla Miller, Stephen Johnson (Mentor)

Caffeine is the main treatment for apnea of prematurity because it stimulates breathing, reduces duration of respiratory support, and increases infant survival. Caffeine has multiple neuronal effects, but it is a well-established adenosine A<sub>2a</sub> receptor (A<sub>2a</sub>R) antagonist. In adult rats, A<sub>2a</sub>R blockade increases the magnitude of intermittent hypoxia-induced, TrkB receptor-dependent, long-term facilitation of phrenic motor output. In neonates, it is not known whether caffeine blocks A<sub>2a</sub>R and enhances TrkB receptor-induced facilitation of respiratory motor output. To test this question, neonatal (P0-P3) rat brainstem-spinal cords were isolated and respiratory-related motor output recorded from C4-C5 ventral spinal roots. Bath-applied dihydroxyflavone (DHF, TrkB receptor agonist, 5-10  $\mu$ M, 9-min, n=22) increased respiratory motor burst amplitude by  $13 \pm 3\%$  relative to baseline at 75 min following drug application, compared to vehicle dimethylsulfoxide time controls, which decreased burst amplitude by  $11 \pm 4\%$  relative to baseline (n=15; p<0.001). Against a background caffeine application (50-250  $\mu$ M; 15 min) that overlapped a DHF application (5-10  $\mu$ M, 9 min), respiratory burst was decreased by  $7 \pm 4\%$  relative to baseline at 75 min following drug application (p=0.577 compared to time controls). The lack of DHF-induced spinal motor facilitation with caffeine pretreatment could be due to decreased endogenous signaling in neonatal rat A<sub>2a</sub>R (ie, little or no crosstalk inhibition), or other caffeine effects, such as phosphodiesterase inhibition. If TrkB-dependent spinal motor facilitation is beneficial in neonates, then caffeine administration may compromise one compensatory mechanism during apnea of prematurity.

## **NON-CONTACT NEONATAL MONITORING SYSTEM TO AID WITH PATIENT CARE**

Rajat Mittal, Amit Nimunkar (Mentor)

This research project involves researching and developing non-contact monitoring technology to ensure safer usage of medical devices in a hospital setting and in the NICU. Currently, devices including blood pressure cuffs and cardiorespiratory monitors are used, however, these are often uncomfortable for the babies and restrict their movement. To combat these issues, a non-contact method to monitor vital signs of infants is desired. To develop this type of device, various non-contact technologies were compared to gain a more in-depth background on the subject. A Raspberry Pi connected to a microphone was used to monitor sound frequencies. This method was chosen because babies often cry at different frequencies depending on the reason for crying. Additionally, camera monitoring was used to track respiration and heart rate.

## **INDONESIAN CONDITIONAL CASH TRANSFER: DO THEY CHANGE TIME PREFERENCE AND EDUCATIONAL ASPIRATION?**

Yassier Mohammed, Dr. David Hansen (Mentor)

Conditional cash transfer programs are designed to break the intergenerational transmission of poverty through incentives and conditions. This paper aims to contribute to our knowledge of the underlying mechanisms via which conditional cash transfer programs affect non-monetary behavior. Using Indonesia Family Life Survey Wave 4 and 5, we explore whether participation in Bantuan Siswa Miskin affects parent's time preferences and aspirations for their children's education by leveraging Difference-in-Difference model. If the program changes underlying individual time preferences, this paper expects to see a sustained increase in intended outcomes even if the conditional transfers ceased. We find that it does not because the impact is statistically insignificant. Hence, the parents may no longer choose to send their children to school once the program were to stop.

## **USING INDUCED PLURIPOTENT STEM CELL MODELS OF DOWN SYNDROME TO MODEL ALTERED INTERNEURON POPULATIONS IN THE HUMAN DOWN SYNDROME BRAIN**

Sruti Mohan, Anita Bhattacharyya (Mentor)

Down Syndrome(DS) is a genetic disorder caused by trisomy21, and can lead to abnormalities in pyramidal neurons and interneurons. Previous studies in the Bhattacharyya Lab have revealed differences in interneuron population in in-vivo human brain sections, specifically in Parvalbumin, Calretinin, and Somatostatin subtypes. This particular study focuses on the development of interneurons in the DS brain and tests how the in-vitro models compare with in-vivo samples. Induced pluripotent DS stem cell models (iPSC) will be differentiated into interneurons and analyzed at different development stages (Day 45, 60, 80 [N=3]) using stereological methods. Preliminary results have shown decreased Calretinin density in in-vivo DS samples and in-vitro iPSC-DS models. We will investigate whether the density of somatostatin neurons differentiated from iPSC models corroborates our brain staining data.

## **GERI-RES IN PRACTICE**

Eramis Momchilovich, Barbara Bowers (Mentor)

High RN turnover in long-term care facilities is a chronic issue leading to poor patient outcomes. Nurse Residency programs have been shown to decrease turnover in acute care settings but have not previously been implemented in long-term care. Researchers are working to decrease RN turnover through the long-term care Nurse Residency program, Geri-Res. This study's purpose was to explore how this educational tool affected participating nurses' practice. Directed content analysis of preliminary results found that, of the 16 clinical topics included in Geri-Res, Cognitive Impairment, Communicating with Families, Pharmacological Considerations, and End of Life stood out as having the most significant practical implications for RNs. Further research is needed to determine how effective Geri-Res is in reducing RN turnover.

## **UNDERSTANDING THE RELATIONSHIP BETWEEN GVHD PROBABILITY AND T CELL STIMULATORY CAPACITY IN DIFFERENT HSCT GRAFT SOURCES**

Isabel Monti, Jenny E Gumperz PhD (Mentor)

Hematopoietic stem cell transplantation (HSCT), a treatment for autoimmune diseases, is able to prolong life. HSCT removes the diseased immune system and replaces it with a healthy one at the risk of graft-vs-host disease (GVHD). Based off of our humanized mouse model, bone marrow (BM), a HSCT source, had the lowest survival rate. However, we found that the mobilized blood (MB), another HSCT source, produced more IFN $\gamma$ , an inflammatory cytokine, when T cells were stimulated. Flow cytometry has shown us that BM CD33+ myeloid cells have a greater stimulation capacity than MB. This project will further investigate the stimulatory capacities of T cells and the interaction between mononuclear cells and T cells to see if there is an effect on T cell response.

## **CASE-BASED COMPARISON OF CHARACTERISTICS AND OUTCOMES OF CAREGIVERS PARTICIPATING IN THE 5MINUTES4MYSELF PROGRAM: WHO BENEFITTED FROM PROGRAM PARTICIPATION?**

Morgan Moore, Elizabeth Larson (Mentor)

Caregivers of children with Autism Spectrum Disorder (ASD) experience increased emotional distress which allows for increased susceptibility to stress, anxiety, and depression. The FiveMinutes4Myself application combined individualized lifestyle consultations with a coach into a mobile wellness joint intervention program tailored to a caregiver's lifestyle. The study reviews a preliminary analysis of pre- and post-intervention scores on mindfulness, stress, and cytokines between responders versus non- responders of the program and create a case-based profile of each participant. The methodological approach taken is a mixed methodology based on both qualitative (lifestyle consultations) and quantitative (questionnaires and cytokines) methods. The study strives to improve the utilization of mindfulness to help reduce caregiver strain experienced by parents and guardians of children with autism spectrum disorder (ASD).

## **INVESTIGATING THE BINDING PROPERTIES OF THE NOVEL SMALL MOLECULE 3132 TARGETING MYOTONIC DYSTROPHY**

Jarod Moyer, Sam Butcher (Mentor)

Traditionally, therapeutic drugs have been small molecules that target proteins; however, RNA molecules have begun to emerge as potential targets for drugs. The mechanisms involved in the targeting and binding of small molecules to RNAs in relation to disease generally remains unknown. The goal of this project was to investigate the binding of a novel small molecule (3132) that targets the CUG repeat RNA hairpin structure associated with myotonic dystrophy. This structure displaces the splicing regulatory protein MBNL1.† The novel small molecule, which has shown therapeutic effects in vivo in drosophila models of DM1, was synthesized by collaborator Steve Zimmerman's lab. It is hypothesized that the compound specifically hydrogen bonds to the CUG repeats. This hypothesis was investigated using nuclear magnetic resonance spectroscopy.

## **A SURVEY OF THE MENTAL HEALTH IMPACTS OF DATING VIOLENCE AT UW-MADISON**

Madison Mueller, Hanna Jens, Juliana Brandt, Alexa Guelig, Theresa M. Duello, PhD (Mentor)

National data shows intimate partner violence is prevalent on college campuses. Toxic relationships negatively impact mental health, which affects students' ability to succeed in college. The reported incidence of dating violence at UW-Madison has increased at a rate of 2.6 occurrences per year since 2013. We hypothesize many students at UW-Madison experience negative mental health effects as a result of toxic personal relationships and are unlikely to report the abuse. UW-Madison students' responses to surveys modeled after the CTS2 and CARDI tests will allow us to determine the prevalence of dating violence and mental health effects of relationship abuse on campus. Increased awareness of dating and intimate partner violence by UW-Madison students and faculty will enable the development of innovative strategies to address this problem.

## **PREDICTING GRAZING LAND IN THE UNITED STATES**

Regan Murray, Tyler Lark (Mentor)

Grazing land in the United States has many applications within the environmental sciences, including grassland management and restoration, carbon sequestration, biofuels, and more. For this reason, there is an exigence for a greater understanding of the spatial distribution of grazing land. Past efforts and research have tackled this issue, however these have either been done on a local scale or with coarse resolution satellite data. This research seeks to fill that gap in data on grazing land in the United States. Using a compilation of existing local and regional data sets, Census of Agriculture statistics, and widely accepted land cover databases, this project will construct a probability map of grazing land in the United States.

## **FAMILY HEALTH HISTORY**

Madison Mushnick, Corrine Voils (Mentor)

Less than 50% of the high risk population for colorectal cancer receives proper care. The objective of this research is to determine whether collecting family health history through Metree, an electronic database entered by patients themselves, helps improve whether people are getting screened according to guidelines. Patients from the VA in Madison and Durham are chosen and then record their FHH in Metree. Subsequently their results are entered into the medical record, electronic medical record abstraction takes place to compare the FHH in Metree to the FHH recorded previously and to see if screenings were done consistent with recommendations. This study reveals if a large healthcare system like the VA can benefit from FHH collected by patients with risk appropriate screenings ordered.

## **ORGANIZING CELLS FOR RETINAL REPLACEMENT**

Jamie Mustful, Allison Ludwig (Mentor)

Worldwide, 285 million people are visually impaired; 39 million of them are completely blind. Cell replacement solutions are being researched, and though transplanting cells in suspension is the simplest approach, there are limitations that make this method less favorable for all potential patients. Scaffolds (engineered cell-organizing units) may be the solution. We use rat models to test survival of stem cell-derived photoreceptor precursors transplanted on the scaffolds and compare them to bolus-delivered transplants. We hypothesize that scaffolds can be successfully delivered to the retina, and that cells on scaffolds will survive transplantation. This hypothesis will be tested with histology of transplanted eyes, including cryosectioning, immunostaining, and confocal microscopy. Results from this study will inform future investigations comparing scaffold transplants to bolus-delivered transplants.

## **BRAINY MOVEMENT STUDY**

Sonali Naik, Diego Cisneros, Ali Riaz, Brittany Travers (Mentor)

In the U.S., approximately 1 in 59 children are affected with the neurodevelopmental condition, Autism Spectrum Disorder (ASD). Various sensory and motor symptoms in ASD have been linked to abnormalities in the brainstem. However, there is very limited information as to how the brainstem affects development in children, especially those with ASD. Through use of behavioral tasks as well as an MRI scan, this study investigates the relationship between the brainstem and sensory and motor functioning in children with ASD. Previous studies suggest that abnormalities in brainstem development may affect cortical and cerebellar formation, which in turn leads to ASD symptoms. By gaining a more comprehensive understanding of ASD development, this study aims to enhance quality of life for individuals with and without developmental disorders.

## **THE FORMAT AND EFFECTIVENESS OF CHILDREN'S BILINGUAL STORYBOOKS**

Nena Nakum, Haley Vlach (Mentor)

Bilingual storybooks have been used to support second language learning in mono- and bilingual children. These storybooks can take a variety of formats. For instance, each sentence is displayed in the first (L1) and second (L2) language (e.g., "Mary has a little llama. Maria tiene una llamita") or the L2 translation equivalents are embedded in an L1 sentence frame (e.g., "Mary has a llamita"). To date, researchers have not assessed the prevalence and effectiveness of these formats. In the present study, we will conduct a content analysis on existing bilingual storybooks. Following this analysis, we will investigate which format is most effective in L2 word learning in English monolingual and English-Spanish bilingual preschoolers in the Madison area.

## **WILD YEAST PROGRAM**

Rishitha Nalabothu, Dr. Chris Hittinger (Mentor)

Budding yeast of the subphylum Saccharomycotina are industrially important organisms that are used in brewing, bio-fuels, and biosynthesis applications. Yeasts can also be found in virtually every ecosystem and the yeast subphylum contains more genetic diversity than angiosperms or chordates. Despite this, much of yeast genomic biodiversity remains unexplored. Filling in gaps in yeast biodiversity will help in the development and engineering of yeasts with biotechnologically valuable traits. One way to add to the genomic resources available for yeast applications and discover novel useful strains and species is to collect and analyze "wild" yeast isolates from nature. In this work, I collected a variety of samples from nearly undisturbed locations in Illinois and isolated yeast in three different temperatures to identify them.

## **WHOLE SLIDE IMAGING IN DIGITAL CYTOLOGY**

Sydney Nauman, Kaitlin Sundling (Mentor)

The widespread implementation of the Papanicolaou (Pap) test drastically transformed cervical cancer from the leading cause of death for women [United States] to an uncommon disease. The Pap test currently relies on glass slides and traditional microscopes. Some automated methods are available to improve efficiency; however, cytotechnologists and pathologists still generally review glass slides to provide a diagnosis. Converting glass slides to digital images enables the utilization of new computational methods including machine learning. New methods that require digital images may greatly improve diagnosis due to quality and representation of the cell. My project aims to evaluate and enhance the sharpness in digital images as well as improve the procedure for diagnosis by human cytotechnologists and pathologists through computational algorithms.

## **VOICES HEARD BIOMARKERS PROJECT**

Marina Navarro, Cameron Jones, Aidi Ma, Mia Ann Farias, Jennifer L. Dykema (Mentor)

Research literacy refers to an individual's understanding of the fundamental components of the research process (e.g., that "participation is voluntary"). Research literacy can be a potential barrier to participating in medical research. Further, the way people interpret terminology may vary depending on socioeconomic factors contributing to the underrepresentation of underserved groups in research. We analyze data from 410 telephone interviews from the Voices Heard Survey to explore how research literacy scores vary by education, gender, and race/ethnicity. We also analyze how levels of cognitive problems indicators, produced during the administration of the survey questions, vary by respondent's demographics. Preliminary results indicate some important and fundamental misunderstandings about dimensions of the research process with important implications for an individual's potential participation in research.

## **DRIVERS LICENSES FOR ALL IN WISCONSIN**

Michelle Navarro, Benjamin Marquez (Mentor)

Wisconsin does not grant drivers licenses to undocumented immigrants. Community organizations in Wisconsin, such as Voces de la Frontera, have been building a campaign to get vital community members and leaders throughout the state to address this issue. The goal of this project is to address the campaign that advocates for the livelihood and safety of undocumented immigrants, along with those who share the road with them. We aim to address the implications of this issue by conducting interviews with organizers, community members, and undocumented individuals and families. The project also will use data and case studies compiled from states who grant driver licenses for all.

## **ALTERATION OF A-SNAP AND NSF PROTEIN TYPES AND LEVELS TO MODULATE SCN RESISTANCE IN TRANSGENIC SOYBEAN**

Emma Nelson, Andrew Bent (Mentor)

Soybean is a crop of high global importance. Soybean cyst nematode (SCN) is the most destructive pathogen of soybean. The *Rhg1* locus in soybean encodes  $\alpha$ -SNAP and NSF proteins that, when expressed at appropriate locations and levels, can provide SCN resistance. The Bent Lab has discovered multiple mechanisms of this host-pathogen relationship. The present project is testing, via transgenic plants with altered types and levels of  $\alpha$ -SNAP and NSF proteins, specific hypotheses regarding resistance mechanisms. The work may also generate plants with enhanced disease resistance against SCN. Performing this research will provide us with knowledge that will be important in the future to construct soybeans that are able to resist SCN, ensuring our capacity to feed the rapidly growing human population.

## **ROLE OF VCUG IN CHILDREN WITH HYDRONEPHROSIS**

Clara Nemr, Lauren Gadek, Clara Nemr, Walid Farhat (Mentor)

Hydronephrosis is the retention of urine in the kidneys and is traditionally assigned a grading system. One cause of hydronephrosis is VUR, a condition where urine refluxes into the kidneys; VUR is thought to be an extremely detrimental condition to the kidneys. A voiding cystourethrogram (VCUG) is an invasive imaging procedure used in VUR diagnosis. VCUG is a painful and traumatic test for children. Currently, the standard protocol is to require a VCUG in cases of high-grade hydronephrosis. The purpose of this study is to evaluate the number of VCUGs in the neonatal period in relation to hydronephrosis grade. Imaging data will be analyzed to determine if the number of VCUGs performed is appropriate as suggested by the recommended protocol.

## **COMMUNITY BASED PROJECT: PROMOTING ENGAGEMENT AMONG STUDENTS OF COLOR**

Sarah Neufcourt, Jocelyn Lewis, Thomas Brown (Mentor)

Vincent High School, Milwaukee, WI is comprised of 97% students of color with an enrollment of 88.7% coming from an economically disadvantaged background. The graduation rate for Vincent High School, is much lower than the national average, sitting at around 60%. There is a great deal of evidence that dropping out of school is a process of disengagement from school and learning that occurs over many years. Our community based project is designed to promote students academic achievement, intellectual engagement and self-motivation through providing an environments that facilitate experiences of autonomy, competence, and relatedness while promoting self-esteem, responsibility, reflection and exploration. Our program focus on increasing access to college programs and activities in Science, Technology, Engineering, Agricultural, and Mathematics to create opportunities for active participation.

## **INTEGRATIVE STRUCTURAL BIOLOGY BY COMPUTATIONAL CALCULATIONS**

Huong Nguyen, Karly Vandorsten, Ira Manthey, Woonghee Lee (Mentor)

Nuclear Magnetic Resonance (NMR) Spectroscopy is one of three major biophysical techniques alongside Cryogenic Electron Microscopy (Cryo-EM) and X-ray Crystallography used to determine atomic-level three-dimensional structural models of biological macromolecules which are complementary to each other. <sup>13</sup>C/<sup>15</sup>N labeled protein samples are used to acquire multidimensional NMR spectra from radio pulse sequences in magnetic fields generated by NMR spectrometers. Our lab, NMRFAM (Nuclear Magnetic Resonance Facility At Madison), is focused on increasing the accuracy and speed at which NMR spectra can be analyzed and calculated in a (semi-)automated manner using computational techniques and supplementary data from other biophysical processes. To accomplish this, we create, test, and evolve both older and new techniques using known and unknown proteins' structures with the world-leading software packages developed by NMRFAM.

## **CELLULAR INVESTIGATION OF GUANINE QUADRUPLEX RESOLUTION**

Thanh Phuong Nguyen, James L. Keck (Mentor)

Guanine quadruplexes (G4) are a large group of evolutionarily conserved higher order structures composed of guanine-rich sequences that form stacked G-tetrads around a cationic core. Studies have implicated G4s in positive and negative transcriptional regulation along with the pilin antigenic variation system of the pathogenic *Neisseria gonorrhoeae*. Previous work done in the lab had confirmed the importance of *tolC* (an outer membrane channel of efflux systems), *recA* (homologous recombination), and *rep* (an ATP-dependent DNA helicase) in NMM-stabilized G4 resolution within *Escherichia coli*. We hypothesize that there are more pathways within the *E. coli* genome that would resolve or stabilize G4s if they are overexpressed in the absence of the previously mentioned pathways. If discovered, they can be further studied as possible therapeutic agents.

## **DEVELOPMENT OF A NON-RADIOACTIVE, ANTIBODY-FREE G PROTEIN-COUPLED RECEPTOR/LIGAND SYSTEM FOR EQUILIBRIUM AND KINETIC COMPETITION BINDING ASSAYS WITH THE PARATHYROID HORMONE 1 RECEPTOR**

Kevin Nguyen, Sam Gellman (Mentor)

G protein-coupled receptor/ligand equilibrium affinity and binding kinetics are traditionally measured using radioligand assays that often require expensive, short-lived reagents, washing steps, and radiation-associated safety and handling issues. Stoddart et al. developed an antibody- and radioisotope-free system relying on bioluminescence resonance energy transfer from a NanoLuc enzyme-tagged receptor to a fluorescently labeled ligand. Our current work extends this system to receptors including the parathyroid hormone 1 receptor and glucagon-like peptide 2 receptor. We report the successful synthesis and testing of a NanoLuc-parathyroid 1 hormone receptor fusion protein to be used in future equilibrium and kinetic competition binding assays involving ligand analogs backbone-substituted with  $\beta$ -amino acids.

## **IMPACTS OF ANIMAL ASSISTED INTERVENTIONS (AAI) ON CLINICIANS IN HEALTH CARE SETTINGS: A LITERATURE REVIEW**

Phuoc Hong Nhan, Anne Ersig (Mentor)

The aim of this literature review was to evaluate the extent to which animal assisted intervention (AAI) benefits clinicians in health care settings. Database searches identified nine relevant articles. We identified the methods, design and measures for each, and compared findings across studies. We found few studies on the influence of AAI on clinicians. The literature review revealed that having therapy animals in the workplace may have three general benefits for clinicians: stress reduction, decrease in burnout and compassion fatigue, and an increase in social interactions among clinicians in the work environment. Moreover, there are also residual benefits for staff caring for certain patient populations, such as cognitive impairment (i.e. dementia). We plan to develop a study to evaluate the impact of AAI on clinicians.

## **A QUANTITATIVE EXPLORATION OF PARENTING GUILT AND INTENSIVE PARENTING**

Siri Nibhanupudi, Margaret Kerr (Mentor)

Parenting guilt is considered a ubiquitous influence on parents everywhere, but there have been few studies quantitatively exploring guilt outside of a specific context, such as work. Like other emotions, guilt has the potential to adversely influence parenting and the parent-child relationship. Our project aims to quantitatively investigate how parenting guilt varies across demographic factors and among associations with related constructs. We plan to develop open-ended survey questions to further explore parenting guilt before piloting it to a diverse group of parents using Amazon's MTurk, which will combine our newly developed questions with existing measures regarding parenting experiences that range from guilt to stress. This study will inform us of factors that both interfere with and better the parenting experience for people of various backgrounds.

## **@HOME: BARRIERS TO CAREGIVING OF CHILDREN WITH MEDICAL COMPLEXITIES AT HOME**

Sofia Noejovich, Reid Parks, Dhivya Umachandran, Nicole Werner (Mentor)

Children with medical complexity (CMC) require family caregivers to provide high levels of care in the home, an environment not designed for healthcare. The relationship between the home as healthcare delivery setting and CMC health remains poorly understood. A human factors engineering (HFE) systems approach provides a mechanism for conceptualizing the home as a work system, which allows for the identification of system barriers. This research identified barriers to caregivers' ability to provide safe and effective in-home care to their CMC. We conducted in-home interviews (N=30) with family caregivers and performed a content analysis of interview transcripts guided by a HFE model. Results will provide an enumerated list of system barriers that can be used to guide the design of interventions to support CMC caregivers.

## **A LAKE IS BORN! CATALOGING APPEARANCE OF NEW LAKES IN THE YAHARA WATERSHED OVER THE LAST TEN YEARS**

Emma Noraian, Dominick Ciruzzi (Mentor)

Over the last ten years, Wisconsin has experienced some of the wettest years on record. It is imperative to understand how this increase in precipitation is impacting the landscape in the context of a changing climate and changing land uses. Using GoogleEarth Historical Imagery, new lakes in the Upper Yahara Watershed were cataloged and their areas calculated. We found 163 new lakes that did not exist in 2006 but did in 2018. The total area of new lakes is equal to the footprint area of just over 620 Olympic-sized swimming pools or 155 football fields. It is important to consider how new lakes will affect water resource management, agriculture, and ecohydrology now and in the future.

## **MAPPING ZHIGUAI**

Grant Nordmark, Catherine Ge, Rania Huntington (Mentor)

This project examines the stories from Ertan Lei Zeng, a collection of folklore stories taken from all around China published in 1603, and attempts to map these stories using the mapping program QGIS. The ultimate goal is to better our understanding of the culture and imagination of the Ming Dynasty by finding patterns between the location of these stories and their themes. This is done through deciphering stories to find approximate locations, entering them into QGIS, and using its tools to find relationships in the data. This project takes inspiration from Professor Timothy Tangherlini's work at UCLA, who similarly mapped the folklore stories of Denmark. The final product will be a comprehensive interactive map of tales from this and similar story collections.

## **ENHANCING IMMUNOGENICITY IN IMMUNOLOGICALLY COLD ER+ BREAST CANCER USING ESTROGEN RECEPTOR BLOCKADE AND RADIATION THERAPY**

Erin Nystuen, Amber Bates (Mentor)

ER+ breast cancers are immunologically "cold" with low tumor mutation burden and few tumor-infiltrating lymphocytes. Application of immune checkpoint inhibitors (ICIs) to ER+ breast cancers has proven ineffective. Radiation therapy (RT) can increase immune susceptibility of "cold" tumors. We hypothesized that combining RT and a selective ER degrader (SERD), fulvestrant, would cooperate to relieve immunosuppression, increase tumor immune susceptibility, and facilitate response to ICIs. Using a murine breast cancer model of ER+ breast cancer (TC11), we examined effects in vitro and in vivo. 25,000 TC11 cells were transplanted to caudal mammary fat pads of female FVB/N mice. A therapeutic intervention study was performed using combinations of fulvestrant, 8Gy RT, and/or anti-PDL1. Preliminary data indicate RT and fulvestrant together primed a greater response to anti-PDL1 ICIs.

## **PANCREATIC ISLET MORPHOLOGY IN PRENATALLY ANDROGENIZED INFANT AND ADULT PCOS-LIKE RHESUS MACAQUES IN RELATION TO TYPE 2 DIABETES**

Charlotte O'Sullivan, Aiden Jacobs, Caitlyn Mcquiston-Keil, David Abbott (Mentor)

Female fetal testosterone exposure induces polycystic ovary syndrome (PCOS)-like traits in adult female monkeys. Pancreatic islet morphology of such prenatally androgenized (PA) monkey infants (n=4) and adults (n=6) were compared to controls (n=5, n=6, respectively). PA infants had smaller islets (p=0.021) and tended (p=0.069) to exhibit increased densities of islet numbers, demonstrating altered islet morphology before type 2 diabetes (T2D) and metabolic defects emerge in adulthood. While there were no significant differences between PA and control adults, 50% of PA adults exhibited insulin resistance with accompanying T2D or elevated basal glucose and diminished functional islet area. Islet extra-cellular fibrin-plaque may thus reflect prior pancreatic insult preceding impaired adult beta cell function.

## **SUBJECTIVE AND OBJECTIVE MEASUREMENTS OF FUNCTIONAL SPEECH INTELLIGIBILITY OF CHILDREN WITH CEREBRAL PALSY**

Abby Olivieri, Phoebe Natzke, Katherine Hustad (Mentor)

Approximately 50% of children with cerebral palsy (CP) experience dysarthria, a motor speech disorder associated with reduced speech intelligibility. In childhood, reduced speech intelligibility may interfere with participation in social and educational settings. There is a critical need to develop efficient, cost-effective measures for evaluating speech performance in children with CP in order to improve communication outcomes. This study seeks to determine differences between measures of speech intelligibility by comparing a parent report tool, the Intelligibility in Context Scale (ICS), with ratings made by naïve listeners. Participants include 40 children with CP and dysarthria, their parents, and 80 adult listeners. Findings provide insight on the use of the ICS in comprehensive evaluation of speech performance for children with CP.

## **ENDOSOMAL TRAFFICKING IN HUMAN CORTICAL NEURONS DOWNSTREAM OF RTK SIGNALING IS DEFECTIVE IN TUBEROUS SCLEROSIS**

Massimo Onesto, Timothy Catlett, Timothy Gomez (Mentor)

Growth cones at the distal tips of developing axons transduce extracellular chemoattractants and repellents into guided motility throughout developing organisms. We examine mechanisms that control normal human cortical neuron development and dysregulation of these signals in Tuberous Sclerosis Complex (TSC). TSC is a neurodevelopmental disorder caused by pathological variants of the genes encoding TSC1 or TSC2, resulting in improper neuronal connectivity. Our lab has shown that TSC2<sup>+/-</sup> neurons fail to respond to the chemorepellent EphrinA1 in several quantifiable measures. Immunoassays in TSC2<sup>+/-</sup> growth cones suggest normal EphrinA1-EphA4 internalization, but defective endosome trafficking of EphrinA1 from early endosomes to late endosomes. This research aims to improve our understanding of receptor tyrosine kinase endosome trafficking and show how defects in these processes can lead to neurodevelopmental disorders.

## **CULTURAL GATHERING: THE ACADEMIC AND SOCIAL BENEFITS OF ETHNIC IDENTITY DEVELOPMENT THROUGH COUNTERSPACES**

Carlos Ortega, Stephen Quintana (Mentor)

Students of Color who attend predominantly White institutions (PWI) continuously search for space where they belong in their attempt of overcoming marginalization and oppression in secondary education. The growth in research has supported the theory that context and environment play a role in assisting these individuals to overcome obstacles in their studies. This paper will add to the understanding of a specific setting, “counterspaces.” Counterspaces have been defined as a setting, community, or organization that helps develop students of color ethnic identity, in turn, benefitting them socially and academically. The paper will observe a specific counterspace at a predominantly white institution (PWI) by surveying and interviewing students who both attend the counterspace and PWI.

## **COLORING GALAXIES WITH HYDROGEN**

Calvin Osinga, Elena D’Onghia (Mentor)

We use the cosmic hydrodynamic simulation Illustris TNG to cross-correlate atomic hydrogen (HI) abundance with galactic luminosity and color. The correlations improve our understanding of the universe’s HI distribution in three major ways. First, current experiments select HI galaxies to observe based on their luminosity and color. Using TNG, we quantify that selection bias, shedding light on their constraining power and commenting on the extensions of observed HI to cosmic HI abundance at those redshifts. Second, these correlations provide insight into galaxy evolution. The processes that create red galaxies also tend to strip HI, and measuring the changes in these correlations across several redshifts can quantify the closeness in this relationship. Finally, we can determine at what scales HI power spectrum becomes color-dependent.

## **SYSTEMATIC REVIEW - DESCRIBING THE BARRIERS TO CARE AMONG LATINX INDIVIDUALS**

Rahima Osman, Maria Mora Pinzon (Mentor)

The purpose of my research project is to describe the barriers that Latinx individuals experience in the process to obtain a diagnosis and health services for Alzheimer's disease. I participated in a systematic review, which consists on compiling articles that meet the following criteria: related to Dementia or Alzheimer's disease among Latinx individuals living in the US or its territories (Puerto Rico) and mentions a barrier to access provided to overcome these barriers. Out of 231 articles, only 21 are relevant to the research question. Next step is to extract results of these articles in a database for further analysis. This topic is important because it addresses issues that are affecting a large amount of Latinx individuals, and can help to provide better healthcare services.

## **ACETYLCHOLINE SIGNALING IN MAMMALIAN HEART REGENERATION**

Andi Pan, Ahmed Mahmoud (Mentor)

After heart injury, adult mammalian hearts have limited regeneration, while newborn mammals can fully regenerate their heart. Unraveling mechanisms of heart regeneration in neonatal mice will facilitate development of treatments for adult heart disease. My study hypothesizes that after myocardial infarction, acetylcholine from cholinergic nerves activates distinct macrophage lineages through the  $\alpha 7$ -nicotinic acetylcholine receptor ( $\alpha 7$ -nAChR), thereby triggering cardiomyocyte proliferation and heart regeneration. Using  $\alpha 7$ -nAChR knockout mice, immunohistochemistry (IHC) and trichrome staining, I found that the loss of the  $\alpha 7$ -nAChR receptor on macrophages impaired cardiomyocyte proliferation and exacerbated fibrosis as compared to wild-type mice. The study of mechanisms for heart regeneration will bring us closer to the goal of reactivating proliferation of adult cardiomyocytes after heart injury.

## **INVESTIGATING BACTERIOPHAGES IN THE FUNGUS GARDENS OF LEAF-CUTTER ANTS**

Olivia Panthofer, Cameron Currie (Mentor)

Bacteriophages are viruses that selectively infect bacterial host cells, disrupting the host cell's metabolic processes and replication machinery to generate phage progeny. Through this parasitic behavior, phages lyse host cells, distribute progeny, and have the capability to shape an environment's bacterial community dynamics. Leaf-cutter ants (LCA) are dominant Neotropical herbivores that feed leaf substrate to a mutualistic fungus, which serves as the colony's primary food source. The resulting fungus gardens have an established and unique bacterial community that is known to be involved in critical processes such as pathogen defence, plant detoxification, and nitrogen fixation. In this study, we attempted phage isolations from LCA colonies and analyzed LCA bacterial metagenomes with the goal of gaining a foundational understanding of phage-bacteria dynamics in fungus gardens.

## **THE EFFECTS OF DROUGHT ON AMERICAN PRAIRIE GRASSES**

Andres Paredes-Vincent, Megan Grejczyk, Kimberly O'Keefe (Mentor)

North American grasslands are experiencing increased climate change-induced drought, which is crucial to study because water limitation can alter the abundance and distribution of grasses. Our goal is to understand the difference in photosynthetic rates in response to drought among common grass species. We will do so by measuring levels of photosynthesis bi-weekly for two groups (well-watered and drought) for a period of one month. This will be repeated for two species of grass, including switchgrass (*Panicum virgatum*) and Indiangrass (*Sorghastrum nutans*), which were collected from The Konza Prairie Biological Station in Manhattan, KS and were grown in a growth chamber in Madison, Wisconsin. We will also measure water stress, differences in growth, and photosynthetic biochemistry at the end of the experiment.

## **FACILITATING OLDER ADULT DAILY CARE AND ACTIVITY PREFERENCES IN LONG TERM CARE SETTINGS**

Jillian Parks, Dr. Tonya Roboberts (Mentor)

Person-centered care (PCC), providing care consistent with preferences, improves care and quality of life for residents in long-term care (LTC) settings. However, research has shown that not all LTC settings can fully implement PCC, and little is known about the barriers staff face to fulfilling resident daily care and activity preferences to provide PCC. The purpose of this study is to describe barriers to fulfilling LTC resident preferences. Semi-structured interviews are being conducted with staff from nursing, social work, dietary, and activity departments in two LTC settings to describe their barriers fulfilling resident daily care and activity preferences. Thematic analysis will be used to analyze the data. Results will describe barriers to fulfilling resident preferences and implications for optimizing PCC will be discussed.

## **USING RE-OS AND SM-ND ISOTOPES TO DETERMINE THE AGE AND PROVENANCE OF PALEOPROTEROZOIC HURONIAN SUPERGROUP DIAMICTITES**

Liv Parsons, Annie Bauer (Mentor)

The early Proterozoic is a critical period of time due to multiple events that have great implications for early life, particularly the Great Oxidation Event and the Huronian “Snowball Earth” glaciation. For this reason, the relative timing of events is of great interest. In this study, we used a Re-Os geochronometer to determine the depositional age of Huronian Supergroup glacial diamictites. This age can be used to correlate with other glacial deposits to infer the global extent of this glaciation. In addition to the radioisotopic age, we collected Sm/Nd data to infer the provenance of the sediments, which has implications for Paleoproterozoic tectonic models and weathering.

## **CHARACTERIZATION OF EZH2 IN THE HIPPOCAMPUS POST STATUS EPILEPTICUS**

Anna Patterson, Avtar Roopra (Mentor)

Approximately 50 million people worldwide have Temporal Lobe Epilepsy, making it the 4th most common neurological disorder. Epilepsy is a central nervous system disorder marked by a pattern of repeated seizures. Current treatments mitigate single seizures but do not modify or stop disease progression. Our lab has identified the histone methyltransferase, Enhancer of Zeste Homolog 2 (EZH2) as a driver of transcriptional changes in the hippocampus after Status Epilepticus (SE). To characterize how and where EZH2 functions in the brain, I am using an immunofluorescence approach to determine in which cell type EZH2 is found. Once this is determined, we can construct a novel EZH2 knockout mouse line, better understand EZH2’s role in recurrent seizures, and guide treatments for epilepsy toward more preventative approaches.

## **CHARACTERIZING MULTI-DRUG RESISTANCE TRANSPORTERS**

Lydia Paulow, Nathan Thomas (Mentor)

Antibiotic resistance is an increasing problem in our world due to the plethora of drugs on the market and their common misuses. Our lab seeks to understand the mechanism of multidrug efflux pumps, which are a common cause of antibiotic resistance. The model we have created agrees with experimental observations of these pumps in the presence of drugs, but does not explain the transporters’ actions when a drug is not present. We believe this issue involves the ion channel gating in our protein, EmrE. By using microbiological spotting assays, we can test various mutations of EmrE to determine which mutations are important for channel gating. Once this issue is solved, we can further understand how efflux pumps work and then address antibiotic resistance transporters.

## **PROBING JOSEPHSON JUNCTION BARRIER PROPERTIES**

Jadrien Paustian, Scott Lynch, Robert McDermott (Mentor)

Josephson Junctions are the key component of superconducting quantum computing. The properties of a superconducting quantum computer are contingent first upon the physical properties of the Josephson junctions. The most crucial property of a Josephson junction is the Josephson effect, in which superconducting Cooper pairs tunnel through a potential barrier. This is the effect that is exploited by quantum circuits. Using a 1970 paper by Dynes et al., we demonstrate that by measuring the conductance of a junction at different bias voltages, we can probe for meaningful differences in barrier properties. Furthermore, the conductance measurements can reveal unusual conductance structures in the junction that are not a result of random error.

## **DIGITAL NUCLEAR REACTOR SIMULATION**

Alejandro Perez, Jun Wang (Mentor)

In 2011, a nuclear power plant disaster occurred in Okuma, Japan, creating dismay in nuclear energy development worldwide. While it can be dangerous, nuclear energy has the ability to reduce carbon dioxide emissions and is more efficient than burning fossil fuels. The purpose of this project is to run performance monitoring and safety analysis to provide complete assessments of nuclear power plants. We will be using system analysis module codes (SAM) alongside MOOSE software (an open-source, parallel finite element framework) being developed by Idaho National Laboratory to provide thermal hydraulics and heat transfer analysis for heat pipe sodium cooled micro reactor. These results will include the core temperature distribution, sodium coolant mechanisms research, and safety performance analysis of nuclear power plants.

## **DOES HYPOTHALAMIC ESTROGEN RECEPTOR ALPHA REGULATE BODY WEIGHT IN PREPUBERTAL FEMALE RHESUS MACAQUES?**

Sona Perlin, David Abbott (Mentor)

Beige adipose tissue (BAT) plays an important regulatory role in female metabolism. Dysfunctional or insufficient BAT is emerging as a contributor to the human obesity epidemic, and possibly to increased obesity in prepubertal females. Thermogenesis is a key mechanism contributing to energy homeostasis, generating heat from metabolizing free fatty acids (FFAs). When thermogenesis declines, otherwise metabolized FFAs remain stored in white adipose tissue (WAT), contributing to obesity. In mouse models, estrogen receptor alpha (ER  $\alpha$ ) enables the majority of estrogen regulation of thermogenesis-enhancing genes such as UCP-1. To test whether thermogenesis is subject to ER  $\alpha$  regulatory mechanisms in a female primate model, we silenced ER  $\alpha$  gene expression in hypothalamic metabolism-regulating neurons of prepubertal female rhesus macaques, and investigated the metabolic and adipose tissue gene expression consequences.

## **USING TRANSGENIC MICE TO PROFILE GENE EXPRESSION IN PV NEURONS**

Stephanie Pham, Yu Gao (Mentor)

Parvalbumin (PV) neurons are inhibitory neurons that regulate neural activities within the neurological network through inhibition of local excitatory neurons. The use of transgenic mice is an effective way to distinguish specific cell types with the complex mammalian brain, allowing for cell type-specific investigations. To profile gene expression in PV neurons, we crossed two transgenic mouse lines: PV-Cre mice, a mouse line that expresses Cre specifically in PV neurons, and Ribotag mice, a Cre-dependent ribosome HA-tagging mouse line. The resulting double transgenic mice, PV-Cre::Ribotag, allow the isolation of translating mRNA specifically from PV neurons to profile gene expression of PV neurons in the mouse brain.

## **SELECTING Z~3 DROPOUTS FROM THE HEROES SURVEY**

Alex Pigarelli, Amy Barger (Mentor)

The HEROES (Hawaii EROSita Ecliptic-pole Survey) encompasses 45 deg<sup>2</sup> of deep (~26th magnitude) imaging near the North-Ecliptic Pole. The imaging consists of 7 broadband filters and 2 narrowband filters spanning a wavelength range of 3,650Å and 12,200Å using the Subaru Hyper-Suprime Cam (HSC) on the Subaru 8.2m Telescope and the 3.6m Canada-France-Hawaii Telescope (CFHT). This survey contains 24 million detected sources. Photometric redshifts for a subset of these sources can be determined using the Lyman-Break Technique. Specifically using the u', g', and r' band imaging, galaxies that meet color excess criteria (strong detection in g', no detection in u') are assigned a redshift between z=3.006 and z=4.003. Within a comoving survey volume of 5.534205\*10<sup>8</sup> Mpc<sup>3</sup>, 65,203 u' -band dropout galaxies have been identified.

## **THE EMERGENT ECOLOGY OF AUTOCATALYTIC PROCESSES AT LIFE'S ORIGINS**

Alex Plum, David Baum (Mentor)

The origin of life is much more than a historical problem. Beyond "How did life originate on Earth?", we ask more generally "How can life emerge from nonlife?". Reduced to its essence, life can be characterized by an ability to self-propagate and a capacity for open-ended evolution. Here, we study autocatalytic processes whose constituent chemicals collectively catalyze their continuous recreation and whose dynamics emulate those of ecology. Simulating autocatalytic processes over a 2D mineral surface, we explore their lifelike character and develop a framework for more clearly discerning their ecological dynamics so as to ultimately ascertain their potential for adaptive evolution. This approach may inform experimental work as well as provide critical insights into life's origins and its propensity to arise elsewhere in the Universe.

## **REDUCED QUADRICEPS RATE OF ACTIVATION POST-ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN ELITE COLLEGIATE ATHLETES**

Jeremy Portillo, Mikel Joachim, Keith Knurr, Jennifer Sanfilippo, Dr. Daniel Cobian (Mentor)

An anterior cruciate ligament (ACL) rupture contributes to persistent lower limb dysfunction and elevates re-injury risk in athletes. Impairments in lower limb neuromuscular function, particularly of the quadriceps muscles, may result, generating long-term abnormal movement patterns. Therefore, the purpose of this study is to investigate quadriceps rate of activation (QRA) in collegiate athletes post-ACL reconstruction (ACLR) during running and jumping, in comparison to an isolated knee extension (IKE) task. An assessment of asymmetries in QRA between surgical and non-surgical limbs post-ACLR will be performed for each task. This study will determine how QRA in both the surgical and non-surgical limb change over the course of one-year post-surgery. Additionally, the relationships between QRA and knee joint kinetics and kinematics during athletic tasks will be explored.

## **"GOOGLE IT": RELATIONSHIP BETWEEN GOOGLE SEARCHES ON COLON CANCER SCREENING TESTS AND STATE-LEVEL SCREENING RATES**

Kaylee Pribnow, Jennifer Weiss, Bryn Sutherland, Jennifer Weiss (Mentor)

One third of adults in the United States are not up to date with colorectal cancer screening. Google Trends quantifies Google search volumes. The goal of this study was to examine the relationship between state-level RSVs for screening rates. Google Trends searches by screening modality were conducted for 1/1/2013-12/31/2016. State-level screening rates were obtained from the Behavioral Risk Factor Surveillance System data. Correlations between state-level screening rates and RSV for each modality were evaluated. There was a moderately strong positive correlation between state-level screening rates and RSVs for colonoscopy and a weak positive correlation for Cologuard<sup>®</sup>. State-level screening rates correlate with Google Trends RSVs for colonoscopy and Cologuard<sup>®</sup>. Screening awareness campaigns in states with lower screening rates should include education of available screening options.

## **APPLICATION OF ASPERGILLUS ORYZAE AS A FUNGAL INHIBITOR OF LISTERIA MONOCYTOGENES**

Shea Prouty, Matthew Lukasik, Tu-Anh Huynh (Mentor)

*Listeria monocytogenes* is a ubiquitous food-borne pathogen especially relevant in the dairy industry. *L. monocytogenes* has the ability to grow in high salt and low temperature environments commonly found in dairy processing. Furthermore, *L. monocytogenes* can form biofilms on processing equipment which have an increased resistance to stress, sanitation, and antimicrobials. *Aspergillus oryzae* is a food-grade fungus commonly used in the fermentation of soybeans for soy sauce. It has recently been discovered that *A. oryzae* produces secondary metabolites that, when developed into a fungal extract, can inhibit the growth of *L. monocytogenes* including biofilms. In this project, the activity and stability of *A. oryzae* inhibition of *L. monocytogenes* will be investigated including inhibition at different pH and NaCl concentration.

## **PHENOTYPING ANAEROBIC GROWTH IN Y1000+ YEAST SPECIES**

Ritika Punathil, David Krause (Mentor)

The Y1000+ project aims to explore genetic diversity and phenotypic diversity in over a thousand species of budding yeasts. We are screening this large collection of species for the ability to grow anaerobically, which is not currently known for all the species. We are using an anaerobic plate reader to get quantified growth rates instead of simple growth and no growth data. These experiments will help us better understand what genes are required for anaerobic growth in yeast and how anaerobic growth evolved

## **MOLECULAR PATHWAYS INCREASING THE EFFICIENCY OF HUMAN $\Gamma$ T CELL IMMUNOTHERAPY**

Najhee Purdy, Jenny Gumperz, Dana Baiu (Mentor)

Gamma-delta T cells are innate lymphocytes that are able to perform immunosurveillance independent of the major histocompatibility complex (MHC). These cells recognize infection and early tumor formation by recognizing ligands that are upregulated due to cellular stress and neoplastic transformation. These cells do not need to be patient specific because they are MHC independent. This is useful because these cells can be given to cancer patients as an immunotherapy with minimal risk of rejection. The specific aim of this project is to investigate three different pathways used by human gamma-delta T cells to recognize and kill virally infected human lymphoma cells. The results of this study will provide information on which pathway should be of focus to make this immunotherapy more effective for clinical use.

## **GENDER AND COMPLETE STREETS**

Hans Purisch, Karla Ponce, Carolyn McAndrews (Mentor)

A Complete Street is an urban design concept that aims to consider all demographic factors in making city streets safe, comfortable, and efficient for all people. A Complete Street also accommodates pedestrians, cyclists, public transportation riders, and cars drivers. Our research aims to look specifically at gender within the context of a complete street. The research consists of reading academic papers on gender and urban mobility (eg bikes, cars, walking) and drawing wider conclusions from those findings. These existing papers acknowledge gender differences in varying aspects of mobility. Gender is an important aspect to consider in public space because men, women, and gender expansive people have different needs and preferences, and not accommodating these needs can lead to discomfort, or in more serious cases violence.

## **COMPUTATIONAL TOOL DEVELOPMENT FOR 3D MESH STATISTICS ANALYSIS**

Yuehan Qin, Kalin Kiesling (Mentor)

In nuclear engineering, 3D mesh models, in which surfaces and volumes are represented by multiple small triangles, are often used to represent large complex devices where particle transport is simulated. Therefore, it is important to have 3D models that are well designed. This project works on continuing the development of a computational tool to evaluate the geometric attributes of 3D models using Python. Previously, several parts of the computational tool considering surfaces and volumes have been done, and statistics of triangles and surface features will be added. By analyzing statistical output from the computational tool, one can evaluate the quality of 3D models and make further improvements.

## **INVESTIGATING THE ATYPICAL EXPRESSION OF NEUROGENIC AND GLIOGENIC GENES IN TRISOMY 21 IPSCS**

Drew Quiriconi, Anita Bhattacharyya (Mentor)

A prominent structural abnormality in the cerebral cortex of individuals with Down syndrome (DS) is a scarcity of neurons and an abundance of astrocytes relative to a non-DS control, although it is not known what mechanism underlies this disparity. An explanation for this pattern may lie in alterations in the temporal sequence of brain cell formation that occurs prenatally. We hypothesized that the altered ratio of neurons to astrocytes in DS cortical tissue is caused by a premature end of neurogenesis and subsequent beginning of gliogenesis due to altered expression of these and other genes, ultimately leading to atypical cortical development and intellectual disability. To test this hypothesis, this study utilized induced pluripotent stem cells to demonstrate the atypical temporal expression of key “switch” genes.

## **CHARACTERIZING AGN ACTIVITY: X-RAY AND SPECTROSCOPIC OBSERVATIONS OF THE SSA22 FIELD**

Brandon Radzom, Amy Barger (Mentor)

Beacons of the early universe, Active Galactic Nuclei (AGN) are some of the most luminous objects known. AGN are produced by the accretion of infalling matter onto supermassive black holes (SMBHs) residing at the centers of galaxies. However, not all AGN can be detected at optical wavelength, since in some cases most of the accretion power is absorbed by gas and dust surrounding the SMBH. To find these AGN, astronomers must turn to hard (2-8 keV) X-rays, which can penetrate the obscuring material and hence provide a direct probe of the AGN activity. For my senior thesis, I am utilizing X-ray data and optical spectroscopy to characterize the time-accretion history of roughly 300 AGN in the SSA22 field.

## **THE EFFECTS OF VOLCANO EMISSIONS ON GEOCORONAL HYDROGEN BALMER-ALPHA EMISSIONS IN THE NORTHERN HEMISPHERE**

Arianna Ranabhat, Nikaan Koupaei, Susan Nossal (Mentor)

We are investigating how the solar cycle, a major source of natural variability in the upper atmosphere, affects atmospheric hydrogen Balmer-alpha emissions. The hydrogen emissions may also be effected by large scale volcano aerosols. Hydrogen in the upper thermosphere and exosphere is a byproduct of lower atmospheric chemical reactions of H<sub>2</sub>O, CH<sub>4</sub>, H<sub>2</sub>, OH, and CH<sub>2</sub>O; volcanoes can emit H<sub>2</sub>O into the stratosphere, potentially affecting these hydrogen emissions. We used data taken by the Wisconsin H-alpha Mapper Fabry-Perot interferometer (WHAM) to measure atmospheric Balmer-alpha emission during the solar cycle. Using the Voigt-fit spectral fitting code and calibration, I plotted Balmer-alpha emission intensity versus shadow height for hydrogen emission data coinciding with major volcano events.

## **INTERACTIONS BETWEEN CATEGORIZATION AND INTUITIVE PHYSICS**

Anantha Rao, Joe Austerweil (Mentor)

Functioning in the world requires information about objects' properties. People often perceive object mass using perceptual cues about material. Here, we examine how people predict an object's motion when its material is unobservable, but predictable from cues learned via category learning. Given an ambiguous object, people tend to predict properties based on the property's propensity in the most likely category. However, recent work has found that given an ambiguous cue, people sometimes integrate over categories. We investigate how categorization uncertainty affects continuous judgments in the domain of intuitive physics. We incorporate natural materials (wood, iron, etc.) into a category learning framework and test people's judgments about the distance a payload travels before and after category learning. Our results may suggest that people integrate in these scenarios.

## **REFRESH 2.0: NURSE SHIFT NAPPING LOG ANALYSIS**

Megan Reinhardt, Linsey Steege (Mentor)

Work-related fatigue among nurses develops in response to excessive demands and stressors with insufficient recovery, and is recognized as a critical challenge to patient safety as well as nurse health and well-being and job satisfaction. 58 nap/rest logs were collected from 22 unique nurses and will be included in data analysis. Forty-four percent of the logs were classified by participants as a nap and the remaining fifty-six percent as a rest. Analysis of results will be completed pending data entry. Napping has been identified as a recommended intervention to address fatigue among hospital nurses. Understanding of nurses' participation in a napping program over time and subjective experiences may help to understand how to improve adoption and dissemination of such programs.

## **DIRECTIONAL RELATIONSHIPS AMONG CLUSTERED CANCER SYMPTOMS**

Margaret Reske, Dr. Kristine Kwekkeboom (Mentor)

People with cancer experience multiple symptoms that co-occur in clusters. To date, researchers have identified which symptoms tend to occur together, but they have not explored important characteristics of the symptom cluster experience, such as directional relationships among clustered symptoms. Understanding relationships within patients' symptom cluster experiences is important in helping identify which symptoms trigger or contribute to other symptoms. This presentation will describe directional relationships within symptom clusters reported by 38 adults with cancer. Analyses will emphasize common symptom pairs and patterns observed in directional relationships between individual symptoms. Findings will be used to develop and test interventions to effectively manage complex multi-symptom interactions.

## **BRAINY MOVEMENT STUDY FOR KIDS!**

Ali Riaz, Diego Cisneros, Sonali Naik, Brittany Travers (Mentor)

In the U.S., approximately 1 in 59 children are affected with the neurodevelopmental condition, Autism Spectrum Disorder (ASD). Various sensory and motor symptoms in ASD have been linked to abnormalities in the brainstem. However, there is very limited information as to how the brainstem affects development in children, especially those with ASD. Through use of behavioral tasks as well as an MRI scan, this study investigates the relationship between the brainstem and sensory and motor functioning in children with ASD. Previous studies suggest that abnormalities in brainstem development may affect cortical and cerebellar formation, which in turn leads to ASD symptoms. By gaining a more comprehensive understanding of ASD development, this study aims to enhance quality of life for individuals with and without developmental disorders.

## **SEARCHING FOR THE LOST CITY: USING DRONES TO INCREASE UNDERSTANDING OF THE ARBORETUM**

Josh Riebe, Tanya Buckingham (Mentor)

On the south shores of Lake Wingra, a development company in the 1920s began to develop the land to build a new neighborhood. A few structures were built, but due to bankruptcy and uncooperating soils, the project never finished, and as time passed, many of these structures cannot be found in the current landscape. This research project analyzed historical and modern data, collected by modern research and collection techniques, to reveal this development. Utilizing these methods, our findings will help the Arboretum staff and visitors to learn more of the history of this landscape within the context of the modern development. This digital humanities research combines cultural concepts, physical geography, and economics to understand more about this urban environment.

## **INDIVIDUAL DIFFERENCES AFFECTING YOUNG CHILDREN'S WORD LEARNING FROM SPACED AND MASSED SCHEDULES**

Jessica Riegert, Natalie Worman, Laura Wintheiser, Catherine Bredemann (Mentor)

Using challenging elements in children's learning, such as spacing learning across time, has been demonstrated to benefit some children's learning while being detrimental to others. While spaced learning has been studied across a variety of tasks, the current study addresses children's individual differences and the desirable level of difficulty in children's language learning. In this study, children are given a task which implements spaced and massed schedules while assessing visual attention and auditory, visual, and associative memory skills. The results of this study will elucidate which cognitive abilities co-contribute to children's language learning during such challenges. Data collection is concluding soon; however, we expect to see a strong correlation between stronger memory and visual attention abilities with children's benefiting from spaced learning schedules.

## **THE RELATIONSHIP BETWEEN CARDIORESPIRATORY FITNESS, EFFICIENCY, AND PAIN MODULATION IN HEALTHY WOMEN**

Gunnar Roberge, Dane Cook (Mentor)

Our study examined the relationship between cardiorespiratory fitness (CRF), oxygen efficiency uptake slope (OUES), and pain modulation in healthy women. Methods: Fifty women (Age = 30+/- 4.6) completed maximal aerobic exercise and psychophysical pain testing before and after submaximal isometric handgrip. High active (HA) and low active (LA) groups were formed based on physical activity levels. A doubly multivariate repeated measures design was used to compare groups. Results: Thirty-nine women were included (HA=25, LA=14). The HA group had higher CRF and OUES  $t(38) = 3.957-5.625, p < .05$ . Significant reductions in pain ratings were observed following handgrip  $f(1,5)=2.5-32.0, p < .05$ , however this relationship was not different between groups ( $p > .05$ ). Conclusion: These results suggest that neither aerobic fitness nor efficiency are related to pain modulation in healthy women.

## **PYWINDS**

William Roberts, David Santek (Mentor)

Pywinds is a python application that finds useful information about the wind from a user given area and a file containing pixel displacements between two images. The information provided includes wind velocity, the v and u component of the wind, lat/long of each pixel, and the original pixel displacement data. This information is then easily accessible from both netcdf and text file formats. Other utilities exist such as finding the velocity of wind between two lat/long points given a delta-time.

## **WITHER THE CONTENTED? TOCQUEVILLE AND THE FATE OF THE UNAMBITIOUS IN DEMOCRATIC TIMES**

Benjamin Rolsma, Richard Avramenko (Mentor)

What is the proper place of ambition in democracy? This work attempts to address that question by turning to Tocqueville's *Democracy in America*, as well as some of his lesser-known letters and essays. Ambition in democratic times undergoes a striking transformation, from ambition after honor to ambition after material things. Using Tocqueville as a guide, the character and dangers of this new democratic ambition are described, in its excessive, deficient, and appropriate forms. It is suspected that appropriate democratic ambition is subjected to somewhat misplaced scorn due to the use of an outmoded, aristocratic manner of evaluating ambition. Properly framed, understanding the nature of appropriate democratic ambition sheds light on how to maintain the health of democracy and the sources of some of democracy's maladies.

## **OPTIMIZATION OF CRISPR-CAS9 MEDIATED GENE EDITING IN NK92 CELLS FOR IMMUNOTHERAPY**

Brittany Russell, Krishanu Saha, PhD (Mentor)

Chimeric antigen receptor (CAR) T cell immunotherapies are a promising treatment for hematological malignancies, but their success has yet to be reproduced in patients with solid tumors. Another cell type of interest for CAR-modification are natural killer (NK) cells due to their innate ability to destroy tumor cells without requiring prior sensitization. Although viruses are most widely used to generate CAR NK cells, viral transduction methods lack specificity and pose oncogenic threats, creating a critical need for alternative gene delivery mechanisms. This research focused on optimizing an NK92 cell-specific electroporation protocol for delivering CRISPR-Cas9 gene editing components. Further, an optimal gRNA targeting an inhibitory receptor locus has been selected, laying the foundation for use of CAR donor constructs in combination with CRISPR-Cas9 homology directed repair.

## **CHARACTERIZATION OF PERFORMANCE OF AEC SYSTEMS FOR DIFFERENT SIZED PATIENTS**

Jack Ruyle, Timothy Szczykutowicz (Mentor)

Medical imagers use the ALARA principle (As Low as Reasonably Achievable), limiting potentially harmful x-ray doses, while maintaining diagnostic quality of x-ray images. Four major medical companies, GE, Phillips, Canon/Toshiba, Siemens, produce different Automated Exposure Control (AEC) systems for the purpose of producing high quality images using the lowest dose of X-rays. The purpose of this study is to characterize the performance of the companies' AEC systems for different sized patients. Our research seeks to measure the quality of images, using the Contrast to Noise Ratio (CNR), which quantifies the ability to identify lesions in an image. Our research also seeks to investigate the relationships between: image size and noise, and patient size and CT number.

## **RESTORING MHC: RESPONSES IN PROSTATE CANCER CELLS**

Benjamin Ryabov, Joshua Lang (Mentor)

The MHC protein complex is an essential element for immune surveillance and disease control. T-cells interact with target cells via surface MHC I that displays peptide motifs reflecting cell function, including malfunction like tumorigenesis. Tumor cells may avoid detection by immunity due to deficiencies that inhibit proper MHC function. Our research is focusing on epigenetic mechanisms that may result in such MHC dysregulation. We test, if EPZ-011989 or GSK-503, that inhibit histone methylation by blocking the EZH2 methyltransferase activity may have any effect on the MHC I expression of the MHC-deficient LNCaP prostate cancer cell line. Epigenetic modifying agents may provide a new potential treatment for cancer patients that may enhance function of their own immune system and re-enable to identify and neutralize cancer cells.

## **STUDENT CIVIC IMMERSION PROGRAM**

Albiona Sabani, Tamia Fowlkes, Prenicia E. Clifton (Mentor)

The Student Civic Immersion program aims to establish a strong understanding of civic responsibility and public service to high school students. The program provides professional and leadership development skills for students from under-represented backgrounds by requiring them to develop and plan a project that aims to better their community in relation to civic engagement, public policy, and issues such as environmental and social justice. By granting students opportunities to create their own projects that aid their community, the program intends to grant students the necessary skills to directly translate their service into action in their own academic institutions. By completing this program, students will be offered an opportunity to attend a closing leadership workshop and demonstrate organization, leadership, and innovation.

## **INVESTIGATING THE LINK BETWEEN GLAUCOMA AND ALZHEIMER'S DISEASE**

Austin Sabbar, Kara Vogel, Gillian McLellan (Mentor)

Glaucoma and Alzheimer's disease are neurodegenerative diseases that have high instances of comorbidity. The cause of this correlation is unknown, and is thus the main goal this project seeks to address. Using glaucomatous cats, we are testing the hypothesis that Alzheimer's biomarkers implicated in protein aggregation will be abnormal in the retinal ganglion cells and visual brain. This will be accomplished through the quantification of Tau and beta amyloid by fluorescent microscopy and Western blotting. We hope to further uncover the biological mechanisms that connect glaucoma and Alzheimer's disease, the discovery of which could potentially have significant implications in treating said conditions.

## **THE ROLE OF SIN3A IN DIAPHRAGM DEVELOPMENT**

Gracia Sandok, Dr. David McCulley (Mentor)

Congenital diaphragmatic hernia (CDH) is a congenital malformation characterized by herniation of abdominal organs into the chest cavity, hindering lung and diaphragm development. Whole genome sequencing in patients with CDH identified variants in the SIN3A gene. Our objective was to investigate the role of Sin3a in the developing diaphragm. Using a tissue-specific knockout approach in mice, we inactivated the expression of Sin3a in the developing diaphragm fibroblasts, skeletal muscle, and mesothelium. Using histology and immunofluorescent microscopy, we analyzed the mutant phenotypes. Our results showed that deletion of Sin3a in the diaphragm skeletal muscle and mesenchyme resulted in abnormal diaphragm formation and CDH. These results demonstrate that Sin3a is a CDH gene and help us understand the role of genetic variants in the mechanisms of disease.

## **ON THE CONVERGENCE TO EQUILIBRIUM OF DISCRETE QUANTUM BOLTZMANN EQUATIONS**

Sivakorn Sanguanmoo, Gheorghe Craciun (Mentor)

For several classes of physical interactions, the dynamics of the excitations can be described by quantum Boltzmann models. We analyze discrete versions of quantum Boltzmann models and show that solutions of associated dynamical systems converge to an equilibrium point. Moreover, this point is unique for all initial conditions that satisfy the same conservation laws. In the proof, we establish a formal connection between quantum Boltzmann models and chemical reaction networks and show that the question about the convergence to equilibrium of quantum kinetic equations is related to the global attractor conjecture. We especially focus on transitions that have multiple species on each side and for which the in-depth analysis of the associated reaction network and its conservation laws are more challenging than for one-to-many transitions.

## **KEMĀMACEQTAQ: WE'RE ALL MOVING**

Thea Sankari, Amy Hilgendorf (Mentor)

After centuries of oppression and marginalization, Native American communities have been found to have comparatively low health and wellness standards. Health complications can be caused by poor nutrition, low exercise, stress, and illness. This research supports the Menominee Nation community in northern Wisconsin. Community-based research, focus groups, on-site interviews, analysis of parks, and investigation of grocery stores illuminate the conditions under which the community residents currently live. Preliminary results display a general lack of availability of healthy and culturally relevant foods as well as challenges for being active outside. Advancement in community active transit system design, increased healthy food access, and establishing standards in key community settings are strategies to alleviate these health and wellness issues.

## **GIRLS VS. BOYS WITH AUTISM SPECTRUM DISORDER (ASD): DIFFERENCES IN SYMPTOM PRESENTATION AND PARENT-CHILD RELATIONSHIP QUALITY**

Theresa Schinkowitch, Jessie Greenlee, PhD (Mentor)

There is limited research examining differences in the parent-child relationships of girls vs. boys with Autism Spectrum Disorder (ASD). The objective of this study was to examine sex-based differences in the observed quality of parent-child interactions in a matched sample of boys and girls with ASD (n=22). Parents and children were videotaped engaging in a 7-minute task-directed activity that was then coded. Results indicated that fathers were less sensitive towards male compared to female children (p=.002). In addition, mothers tended to be intrusive in interactions with female children (p=.06) and male children displayed less attention in interactions with fathers (p=.06). Findings suggest that the parent-child relationship may differ for boys and girls with ASD, which will inform future research further about parent-child relationships in ASD.

## **CHARACTERIZING ZOOPLANKTON-ASSOCIATED MICROBIAL COMMUNITIES AND THEIR ROLES IN LAKE PROCESSES**

Anna Schmidt, Trina McMahon (Mentor)

Zooplankton support a resident intestinal bacterial community which represents an overlooked niche for bacteria in aquatic ecosystems. This community may mediate specific biogeochemical processes and contribute to nutrient cycling. For this study, zooplankton gut samples were isolated from three cladoceran species and one copepod species collected from a eutrophic lake. Bacterial communities were characterized using 16S rRNA gene amplicon sequencing and compared between species. Metagenomic sequencing was conducted on gut samples from a native zooplankton species (*Daphnia pulex*) and an invasive species (*Bythotrephes longimanus*) to further investigate the metabolic capabilities of associated microorganisms. Characterizing these communities yields insight into the identities and functions of zooplankton gut microbiota and their impact on biogeochemical cycles in lakes.

## **HOME BASED EXERCISE FOR UNDERSERVED INDIVIDUALS WITH PARKINSON DISEASE**

Jessica Schmidt, Kristen Pickett (Mentor)

Rural dwelling individuals with Parkinson disease (PD) face several barriers to accessing available healthcare interventions. Recently, physical activity paired with pharmacological intervention has shown promise for slowing disease progression and prolonging improvements in measures of gait, balance, motor symptoms, depression, and fall reduction. Group exercise has also been shown to increase adherence and overall positive outcomes as compared with solo exercise. However, providing these programs to underserved populations of people with PD has proven extremely difficult. Telehealth, in the form of In-home cycling, paired with social engagement via skype is one feasible method for addressing the aforementioned barriers to group physical activity faced by rural dwellers with PD.

## **THE ROLE OF VIMENTIN IN MAINTAINING PROTEOSTASIS IN FIBROBLASTS**

Jaret Schroeder, Chris Morrow (Mentor)

Accumulation of damaged and misfolded proteins over the life of an organism is toxic, and neural stem cells maintain proteostasis through vimentin-mediated aggresome formation. Whether fibroblasts use aggresomes to recover proteostasis, however, is unknown. In this study, we investigated the role of vimentin and the mechanism that allows fibroblasts to recover from disruptions in proteostasis. Here we show that fibroblasts are unable to launch the aggresome in response to disruptions in proteostasis. Surprisingly, in the absence of aggresome formation, vimentin still confers a resistance to disruptions in proteostasis. Together, these findings demonstrate that aggresomes are not a universal response to disruptions in proteostasis and that vimentin plays aggresome-independent roles in maintaining proteostasis.

## **CHARTING GALAXY-SCALE DUST GEYSERS**

Kolin Schuerman, Ralf Katula, Lauren Laufman, Susanne Aalto, Jay Gallagher (Mentor)

Dust and gas distributed throughout the stellar body of a galaxy obscure our vision of the system. Zw049.057 is a luminous infrared galaxy with features such as a highly dust-obscured nucleus and a massive outflow of dust and gas. To investigate the gas and dust evolution of Zw049.057, we calculate the relative intensity of the dust-obscured regions by adopting a simple slab model with constant volume emissions. These data are used to estimate the amount of dust absorption in multiple wavelengths in the Hubble Space Telescope Wide Field Camera 3 images and to derive masses of the extended interstellar matter that reveal the energetics of the outflows. Here we report the findings and methodology from Zw049.057.

## **DETERMINING IF KNOCKOUTS OF HMGR MUTANTS WITH TNT INSERTION IN HMGR1 AND HMGR2 AFFECTS NODULATION IN MEDICAGO TRUNCATULA**

Anna Schwenn, Zachary Keyer (Mentor)

*Sinorhizobium meliloti* and *Medicago truncatula* take part in a symbiotic relationship in which association leads to the formation of nodules, allowing for nitrogen fixation. Fertilizer production releases mass quantities of carbon and its uses expel excess nitrogen, which contributes to rising temperatures and the growth of algae blooms. We hope to decrease nitrogen fertilizer use, while increasing our understanding of the molecular components involved in forming legume-rhizobia symbiosis. We would like to use information to modify the interaction for other crops. Using reverse genetics, we're examining HMGR1-1 and HMGR2C genes in *Medicago*.

## **MAPPING RIPARIAN SHADE IN THE KICKAPOO WATERSHED**

Ben Sellers, Beckett Hills (Mentor)

Riparian trees block solar radiation, minimizing stream insulation and subsequent warming while potentially threatening bank stability. Dramatic floods common to the Kickapoo Valley have made management of bank stability more important than ever, while warming stream temperatures threaten native brook trout populations. Through the analysis of county LiDAR data using open source softwares, we have employed a remote sensing approach to shade modeling along Tainter Creek, an 'outstanding and exceptional stream within the Kickapoo Watershed. The product offers a 2010 shade inventory, able to identify sensitive areas where solar insolation is extreme. Future data collection will allow comparison between streams and track changes in shading to help mitigate stream temperature rise on a watershed scale.

## **GENDER DISPARITY IN PEDIATRIC MEDICINE**

Sanaa Semia, Sarah Webber (Mentor)

Gender disparities amongst physicians are of growing concern. In academic medicine, disparities can include rates of promotion, gender make up of leadership, publication of papers, and presentations at national conferences. Compared to other specialties, pediatrics is unique in that it is one of the very few medical specialties with majority women physicians. This project examines the proportion of female speakers at the 2019 Pediatric Academic Societies conference. Using the published list of speakers at this conference, we are categorizing speaker type by gender using genderize. Genderize is a program that uses social media data to determine the probability of whether a first name is male or female. We found that 46.7% of plenary speakers were female and 65.5% of platform speakers were female.

## **INDIAN MYTHOLOGY IN U.R. ANANTHAMURTHY'S NOVEL "SAMSKARA" : POLEMIC OR ALLEGORY?**

Ben Severt, Gudrun Buhnemann (Mentor)

This research paper probes the variety of interpretations of South Indian author U.R. Ananthamurthy's standout novel Samskara (1966), which ignited fierce opposition from some critics sympathetic to Brahmin orthodoxy. I contrast the dominant critical view, which sees the novel as a polemical attack on the traditional Brahmin way of life, with an alternative perspective that reads the novel in allegorical and psychological terms—as a rite of passage richly imbued with Indian mythology. Ultimately, the second position is better supported, both by textual analysis of the novel itself and by the author's comments in interviews.

## **COMMUNITY DEVELOPMENT FINANCIAL INSTITUTION PROGRAM EVALUATION**

Emmett Sexton, Tessa Conroy (Mentor)

For the last 20 years, Wisconsin's entrepreneurial climate has consistently ranked near the bottom of state rankings. Low business birth rates can be explained by changing population demographics, differing sector compositions, and in large part, business death rates. Business financing is also important in the dynamism equation. One under researched financing initiative that plays a role in funding business activity in Wisconsin is the Community Development Financial Institution program. This research assess the impact that this program has had on entrepreneurship in the state.

## **STUDYING SATURATED DOMS IN ICECUBE**

Adam Shandonay, Tianlu Yuan (Mentor)

The IceCube Neutrino Observatory, located at the south pole, provides scientists with an effective way of studying unknown astrophysical objects. IceCube uses photomultiplier tubes connected to digital optical modules (DOMs) in the ice to collect Cherenkov light. When an excessive amount of light is detected, the DOMs can become saturated, rendering them less useful for characterizing the neutrino event. Since IceCube collects millions of events, an efficient algorithm was developed to identify saturated DOMs and aggregate them accordingly for ease of analysis. Then the data was used to create a distribution of waveform peaks from saturated events to look for variation in each DOM. This collection of processed data and analysis elucidates the nature of IceCube's DOMs, allowing for more accurate reconstruction of neutrino events.

## **MULTIMEDIA CURRICULUM FOR ETHICS AND EDUCATION**

Kellen Sharp, Carrie Welsh (Mentor)

The Center for Ethics and Education's Multimedia Curriculum Project aims to address ethical concerns in education by providing study guides to professors and policymakers on philosophical issues of education. Over the course of the academic year we conducted several interviews with professors nationwide. I interviewed Dr. Quentin Wheeler-Bell from Indiana University Bloomington on his concept of "Education for Liberation". I produced this interview with Dr. Wheeler-Bell by developing key questions, setting up recording equipment, and using software to edit the audio and transcribe the interview. This audio was then embedded on a website for the Ethics and Education Multimedia Curriculum Project. This study guide is but one of many in an ongoing project.

## **EVALUATING BELGIUM COASTAL RESTORATION PRACTICES AND THEIR FEASIBILITY FOR APPLICATION IN THE GREAT LAKES**

Briana Shea, David Hart (Mentor)

In recent years, interest has risen for more natural solutions to coastal challenges in the Great Lakes region due to water level rise and a new understanding of the limitations of traditional coastal infrastructures like seawalls and revetments. The North Sea coast has similar coastal and climate challenges to the Great Lakes and has implemented many sustainable solutions that could be applied to the Great Lakes. This project examined practices from Belgium and the greater North Sea region that have the potential to benefit the Great Lakes community. Coastal resilience procedures on a "gray to green" spectrum as well as broader water resource management methods are discussed with an emphasis on their application to the Wisconsin coast.

## **PARTNER2LOSE RESEARCH STUDY**

Armaan Shetty, Corrine Voils (Mentor)

The number of people dying due to early onset diseases from obesity grows annually. The Partner2Lose study is specifically researching the link between partner assistance and effectiveness of weight loss programs. The study has a control group in which an individual with a partner participates in a weight loss program alone. In the experimental group an individual participates in the same weight loss program with their partner who also comes to the program to learn skills on how to support their partner during their journey. The study is currently in year 2 of 5. Analyses will be done to determine whether patients who participate in the weight loss program with their partner have a greater 2-year weight loss than those who participate alone.

## **THE RELATIONSHIP BETWEEN FASTING INSULIN AND BETA-AMYLOID IN CEREBROSPINAL FLUID**

Stephanie Shoaf, Gilda Ennis (Mentor)

Elevated plasma insulin, classified as hyperinsulinemia, becomes more problematic because insulin acts as a competitive inhibitor to insulin degrading enzymes, preventing deterioration of the main product of Alzheimer's disease, beta amyloid. Accumulation of beta amyloid proteins can build up between neurons, destroying synapses, in the brain's of Alzheimer's patients. Excess beta amyloid is not cleared from the brain to cerebrospinal fluid (CSF). The detection of decreased beta amyloid proteins in the CSF is considered to be an indicator of Alzheimer's pathologic change. This research will further investigate any correlation of fasting insulin to a decreased amount of beta amyloid in CSF. Brain imaging data from adults who have normal to mild impairment of dementia due to Alzheimer's will be examined for beta amyloid accumulation.

## **AFRICAN AMERICANS IN 20TH CENTURY DENMARK**

Jasmyne Short, Ethelene Whitmire (Mentor)

Ethelene Whitmire is writing a book, *Searching for Utopia: African Americans in 20th Century Denmark*, about African Americans who have visited, studied, performed, lived and died in Denmark. This project was to create different online outlets for her projects to reach a variety of audiences. African American educators, artists, singers, athletes, students, musicians, diplomats and draft dodgers were among the people studied in this Scandinavian country. The goal of the research is to help people understand the society and lives of the individuals who lived in this particular place and how this impacts our view of their history. It is important to explore history because it helps us understand change and why we live the way we do.

## **THE CONTRIBUTION OF LINGUISTIC AND EXTRALINGUISTIC CUES TO CHILDREN'S SHAPE BIAS**

Nathan Simon, Haley Vlach (Mentor)

"Shape Bias" describes the human tendency to generalize objects' information by their shape, rather than by color, material, or texture when learning novel nouns. This study examined whether children use shape bias as a linguistic strategy, learned through exposure to adult speech, or as a general cognitive ability, allowing them to recognize that count nouns refer to object categories. In an experiment, the linguistic and extralinguistic environments were manipulated. Children completed a shape bias task with either removal of linguistic articles in the experimenter's speech or with no linguistic manipulation. Moreover, children completed the task with either no extralinguistic manipulation or replacement of the novel object's name with a noise. Preliminary results suggest that linguistic context may not be necessary for shape bias to occur.

## **ROLE OF LAT ENHANCER AND CHROMATIN INSULATORS IN HSV-1**

Shailaja Singh, Donna Neumann (Mentor)

It is estimated that 67% of the global population is infected with Herpes Simplex Virus 1 (HSV-1), a lifelong virus that can cause keratitis and lead to corneal blindness. The Latency Associated Transcript (LAT) is a gene present in HSV-1, expressed when the virus is latent within the host cells. Encoded in the gene is an enhancer and chromatin insulator sites, two elements that promote or inhibit gene expression, respectively. We hypothesize that the LAT enhancer is an important regulator of chromatin insulators. To test our hypothesis, we generated a series of reporter constructs containing the LAT enhancer with and without chromatin insulators. Understanding the role of these critical viral elements can provide novel targets for future drug development or treatment of this eye disease.

## **A NEW METHOD FOR THE DESIGN OF FINITE BUILD STELLARATOR COILS**

Luquant Singh, Aaron Bader (Mentor)

The stellarator concept is a candidate for a future nuclear fusion power plant. Stellarators confine plasmas with temperatures hot enough to produce fusion reactions using complex external magnetic coils. At present, these magnetic coils are designed using computational codes that model coils as infinitely thin filaments. In reality, coils have a fully three-dimensional build, which can make the filament model a poor approximation, particularly when filaments lie close to the stellarator plasma. We present a new method for designing stellarator coils with finite build given a set of filament coils. Example coil sets generated with the new method are shown for the UW-Madison HSX stellarator.

## **EMPLOYING A ONE HEALTH APPROACH TO ADDRESS THE IMPLICATIONS OF MYCOTOXIN EXPOSURE IN RURAL GUATEMALA**

Haley Sisel, Claudia Calderon (Mentor)

Mycotoxins, (naturally occurring toxic compounds produced by fungi which typically reside in crops like maize,) are linked to a myriad of health concerns in human and livestock populations. This project aimed to identify the ramifications of excessive mycotoxin exposure on animal and human well-being in the Guatemalan western highlands and connect experts in each field through its signature One Health approach. I performed and analyzed lateral flow assays for the mycotoxins Aflatoxin and Fumonisin in maize; interviewed professionals from a wide variety of academic and occupational disciplines to discuss the impacts of mycotoxins; and created strong, culturally competent educational materials to disseminate to locals. These outcomes are crucial to ignite social, cultural, and eventually, governmental change as it relates to surveillance and regulation of mycotoxins.

## **EFFECT OF EFRTRANSGENE ON DROUGHT TOLERANCE OF TOMATOES INFECTED WITH OR WITHOUT R. SOLANACEARUM, CAUSAL AGENT OF BACTERIAL WILT DISEASE.**

Ritesh Sivakumar, Sanju Kunwar (Mentor)

R. solanacearum is a soil-borne plant pathogenic bacterium responsible for bacterial wilt in a wide range of hosts. It affects tomatoes, potatoes, bananas, ginger, and other crops that are of high economic importance. Transgenic tomatoes expressing the Elongation Factor Tu Receptor (EFR) have shown remarkable resistance to bacterial wilt in both greenhouses and in the field. The impact that natural and abiotic factors have on the growth of EFR tomatoes is not well documented. This experiment aims to focus on how EFR tomatoes react to drought stress in the lab as a preliminary model for studying drought stress in the field.

## **UNDERSTANDING THE EVOLUTION OF THE PRODUCTS OF GLOBAL PHARMACEUTICAL COMPANIES**

Evan Slonac, Josie Matyszewski, Zhi Cao (Mentor)

In the United States, the FDA annually publishes an Orange Book detailing every pharmaceutical firm's names, divisions, and drugs produced. However, we lack a resource that provides information on the evolution of these companies and pharmaceuticals due to factors like finances and medical discovery. Through this project, we aim to construct a collective body of knowledge on the development from the first edition in 1987 to the present. Having this arsenal of information at one's disposal would be immensely helpful for future scientists and professors alike. A long term goal is to develop a commercial website for this information to make it universally accessible. By tracking the evolution of the pharmaceutical industry, we can better understand why firms and drugs enter and leave the market.

## **PHYSICAL ACTIVITY AND CEREBRAL BLOOD FLOW IN ADULTS AT RISK OF ALZHEIMER'S DISEASE**

Bailey Smith, Ozioma Okonkwo (Mentor)

This study examined the relationship between physical activity (PA) and cerebral blood flow (CBF) in older adults with family history (FH) of Alzheimer's disease (AD). Previous studies have found that those with maternal FH of AD have increased risk of AD as well as diminished CBF in specific brain regions. Decreased CBF is associated with AD progression and can be used as an indicator of brain health. Participants for this study were taken from the Wisconsin Registry for Alzheimer's Prevention (WRAP), in which they completed PA questionnaires and underwent magnetic resonance imaging to measure CBF, among other procedures. Analyses are currently ongoing, but it is expected that PA will mediate the relationship between family history and CBF.

## **INVESTIGATING THE PRESENCE OF CO-FACILITATION BETWEEN INVASIVE EARTHWORMS AND HONEYSUCKLE IN A MESOCOSM EXPERIMENT**

Emily Snelson, Brad Herrick (Mentor)

Non-native earthworms have been shown to alter the ecology of northern temperate forests. The effects of European earthworms are well known, but much less is understood about the effects of Asian “jumping worms” (*Amnityhas* spp.), a recent arrival. Invasive species can interact such that they co-facilitate, intensifying the impacts of both species. Co-facilitation has been seen between European earthworms and honeysuckle, an invasive shrub, but no studies have been conducted with jumping worms or with both species together. This study investigated (1) if earthworm success is correlated with honeysuckle presence, and (2) if earthworm success differs based on the species present. Data analysis for this project is still underway, but the results will shed light on the implications of jumping worm invasions on Wisconsin ecosystems.

## **IDENTIFYING MOLECULAR MECHANISMS IN BRAIN PERICYTE DIFFERENTIATION FROM HUMAN STEM CELLS**

Margaret Snyder, Eric Shusta (Mentor)

Brain pericytes line capillaries and are required for development of the blood-brain barrier (BBB), which regulates transport of molecules into the brain. Current protocols for differentiating human brain pericytes from human pluripotent stem cells use media containing fetal bovine serum (FBS), and the molecular mechanisms underlying pericyte differentiation are not well understood in vitro or in vivo. To identify factors in FBS that may be involved in brain pericyte development, we used chromatographic fractionation of FBS, mass spectrometry, and medium-throughput screening to identify proteins that induce expression of the pericyte marker NG2. Further characterization of these cells using flow cytometry and immunostaining to measure expression of other pericyte markers is ongoing. Understanding the mechanism could help explain roles of pericytes in BBB development and disease.

## **IN SEARCH OF A PRIMATE MODEL OF HUMAN PEGIVIRUS: CHARACTERIZING THE TRANSMISSION OF SIMIAN PEGIVIRUS**

Elizabeth Somsen, Dave O’Connor (Mentor)

Pegiviruses are a widespread genus of viruses that remain understudied. Human pegivirus (HPgV) infection has recently been associated with several forms of lymphoma, which is worrisome due to its high prevalence in worldwide populations. An animal model would aid in understanding these disease processes. The common marmoset (*Callithrix jacchus*) is a natural host for simian pegivirus (SPgV), and due to similarities between nonhuman primates and humans, they would be an ideal animal model. However, SPgV transmission routes in natural hosts are poorly understood. To investigate, we will use metagenomic deep sequencing to generate full-genome SPgV sequences for 61 marmosets comprising of 30 family groups. We analyzed horizontal and vertical transmission via sequence homology and hypothesized that SPgV transmits in similar patterns as HPgV.

## **ISLAM, DEMOCRACY, AND TRADITION: A CRITICAL COMPARISON BETWEEN TWO CASES OF CHILDREN’S RIGHTS ABUSES IN SENEGAL**

Lauren Sorensen, Scott Straus (Mentor)

Modern political discourses champion the ideals of democracy and human rights while popular narratives of Islamic extremists and incompatibilities between religion and modernity captivate the public. Senegal has maintained relative democratic stability and support for human rights protection since independence in 1961. The established democratic regime and perceived commitment to human rights continue despite a culture profoundly influenced by a 95% Muslim population. Senegal presents itself as a secular democracy however the influence of Islam remains largely unquestioned as religious leaders endorse political candidates and laws lack enforcement. This thesis analyses the intersection of Islam and democracy in two cases of children’s rights abuses in Senegal: the taalibés who are exploited as part of religious education and girls who are sexually abused in secondary schools.

## **KINEMATIC ANALYSIS OF RODENT MODELS OF NEURODEGENERATIVE DISEASE**

Jinan Sous, Anjon Audhya (Mentor)

Hereditary spastic paraplegias (HSPs) are a group of neurodegenerative disorders that cause progressive loss of control of lower limbs through corticospinal axon degeneration. From other research, disease-causing mutations were identified within the coiled-coiled domain of TRK-fused gene (TFG). As a requirement for regulation of COPII-mediated protein transport, this causes early-onset HSP. Biochemical/cell culture work suggests that mutated TFG assembles into aberrant proteins that lead to inefficient cargo transport, including adhesion molecules necessary for axon bundling. Using CRISPR-mediated genome editing, Sprague Dawley rats with TFG p.R106C mutation were created. Through quantitative kinematic measurements of the progressive deterioration of normal gait, it will allow us to understand disease progression and serves as a baseline to judge the efficacy of potential treatments delivered to these animals in the future.

## **TOWARDS AN IN VITRO BIOCATALYST FOR THE PRODUCTION OF 5-AMINOLEVULINIC ACID**

Calvin Spolar, Andrew Buller (Mentor)

5-aminolevulinic acid (ALA) is the first committed precursor in the biosynthesis of tetrapyrroles, including heme. ALA Synthase (ALAS) catalyzes the formation of ALA in many species, but is regulated by heme and requires the costly succinyl-Coenzyme A (CoA) as a substrate. We synthesized several succinyl-thioesters as alternative substrates for a bacterial ALAS, which showed reactivity with the enzyme. Subsequently, the reaction's mechanism and scope was probed through UV-Vis spectroscopy and in vitro reactions with purified catalyst. These efforts laid the groundwork for protein engineering that is currently being explored in the hopes of identifying activating ALAS variants towards an effective in vitro biocatalyst for the production of ALA and related compounds.

## **SOLAR POWERED AIR FILTER**

Cara Stanker, Akshith Mandepally, Ryan McAdams (Mentor)

Pollution is the greatest environmental cause of disease and early death today. Most pollution-related deaths occurs in low-income countries with pollution-related diseases being prevalent among marginalized people. Household air pollution from combustible fuel places children at substantial health risks. An affordable, effective, and reliable device could decrease air pollution and health risks. Our objective is to create a solar powered air filter to reduce household air pollution. Our team created a proof-of-concept prototype. This device requires modifications to enhance efficiency, effectiveness, and reliability. Once our device is further developed, we hope to partner with the Hope2Others organization to implement our device in village households in Tanzania. If shown to reduce household air pollution, this device may provide a strategy to reduce air pollution-related diseases globally.

## **SICILY AND THE EAST: MATERIAL EVIDENCE FOR MODES OF CONTACT AND EXCHANGE BETWEEN SICILY AND THE AEGEAN IN THE MIDDLE TO LATE BRONZE AGE**

Nathan Steagall, William Aylward (Mentor)

This project investigates the nature of the relationships that existed between the native inhabitants of Sicily and civilizations in the Aegean world throughout the Late Bronze Age, with particular emphasis on the distribution of Mycenaean materials on the island. Drawing heavily on data from field reports and detailed chemical analyses of archaeological materials, I highlight connections between shipwrecks and coastal settlements across the Mediterranean to reconstruct possible trade routes and reconsider the contexts in which Mycenaean wares made their way to Sicily. Through this investigation, a strong case is made for a robust trade network of Cypriot or Near Eastern origin being responsible for introducing this material rather than the Mycenaean themselves.

## **HOW DOES RALSTONIA SOLANACEARUM CHANGE OVER TIME? USING BIOINFORMATICS TO ANALYZE MICROEVOLUTION**

Olivia Steidl, Alicia Truchon (Mentor)

Working with three strains of *Ralstonia solanacearum* from southeastern United States isolated up to 60 years apart, this project analyzes how phylotype II-sequevar 7 has changed over time. Using bioinformatics tools, the targets of interest are microevolutionary changes in SNPs and small indels, gene addition and deletion events, and genomic scale rearrangements.

## **INTEGRATING HEALTHY AND SUSTAINABLE PRACTICES INTO THE LIVES OF MADISON YOUTH**

Katherine Stenehjem, Brianna Denamur, Cathy Middlecamp (Mentor)

As climate change progressively impacts the global environment, the actions of current and future generations will have a resounding impact. The connections that children make often dictate their life choices later as adults. Therefore, with the Wisconsin Idea Fellowship, we saw an opportunity to inspire such connections related to both personal and environmental health by introducing health and sustainability topics to 3rd through 5th graders at the Goodman Community Center's after-school program. The goal of our project is not to convince students to take action against the effects of climate disruption, but to embolden students to question how their actions are connected to the natural world.

## **IMPROVING THE SUSTAINABILITY OF SORGHUM BIOMASS THROUGH BACTERIAL NITROGEN FIXATION ON AERIAL ROOTS**

Justin Stensloff, Jean-Michel Ane (Mentor)

Nitrogen is often a limiting factor of plant growth, with most grain plants relying on nitrogen-based fertilizers. Recently, the Sierra Mixe corn discovered in Mexico was capable of nitrogen fixation from the atmosphere instead of the soil due to a symbiotic relationship it possesses with bacteria inhabiting the mucus on its aerial roots. This process has also been observed in preliminary testing of sorghum plants. Transferring this attribute to other species of grains such as corn and rice would increase their sustainability. By utilizing nitrogen isotopes in the soil along with inoculating the aerial roots of sorghum crops with the bacteria *A. brasilense*, we determined the crop's ability to acquire nitrogen from fixation by analyzing their nitrogen content obtained from the soil and the atmosphere.

## **PREVENTING CLIMATE CHANGE: ASSESSING LAND CHANGE RISK IN DANE COUNTY, WI**

Gavin Greywolf Stingle, Seth Spawn (Mentor)

In coherence with the pressing issue of global climate change, residents of Dane County are not exempt from the negative externalities that result from societies growing green-house gas emissions. It is known that varying land types such as grasslands in comparison to agricultural land store significantly more CO<sub>2</sub>, a greenhouse gas, within the soil in proximity to the grasses extensive root system. By developing and applying mathematical functions created in Rstudio, a computer code software program, our research team is able to create physical graphs that reflect specified trends that are extracted from large data about land size, ownership, and cost/acre. By identifying correlation patterns, we can approximate the risk of land change within Dane County.

## **SOIL BACTERIAL COMMUNITIES ACROSS TROPICAL SECONDARY FORESTS AT DIFFERENT SOIL ORDERS AND AGES**

Milan Stolpman, Emily Diaz Vallejo (Mentor)

Bacterial communities play crucial roles within soil systems. As human activity continues to lead to large environmental degradation, changes in land cover—such as deforestation—have drastic effects on these fragile populations. However, as previously disturbed areas re-grow, it provides insight into the relationships between secondary forest succession, the process by which pastures become re-forested, and soil bacteria. The objective of this study is to understand how bacterial communities respond to tropical secondary forest succession, soil order—either Mollisol or Alfisol, which correlates the amount of organic matter in a given soil sample, and nitrogen levels. By analyzing these factors, we seek to understand how bacterial populations are impacted by the previously mentioned variables. I hypothesize that higher abundances of bacteria will be present in older forest ages in Mollisol soils.

## **SCD-1 DEFICIENT MICE EXPECTED TO CONVEY RESISTANCE FROM DIET-INDUCED NEUROPATHOLOGY**

Abbey Stoltenburg, Sarah Lewis (Mentor)

Understanding how poor diets contribute to diabetes-related dementias is crucial to improving dementia treatments. Prior to this experiment it was known that impaired glucose metabolism may influence dementia onset. Whole-body Stearoyl CoA Desaturase-1 (SCD1) deficient (GKO) mice fail to gain weight on a high-sucrose very low-fat diet (HSVLFD), suggesting SCD1 regulates obesity. We have previously shown that GKO mice display increased insulin sensitivity and literature suggests brain insulin insensitivity contributes to sporadic dementia. We hypothesize that GKO mice fed a HSVLFD will display increased brain insulin sensitivity and decreased neuroinflammation compared to wild type mice. We will test this hypothesis using pathological stains, qPCR, and immunohistochemistry. Investigating SCD1's impact on brain insulin signaling is important because this project may identify targets for novel diabetes-related dementia therapies.

## **ASSOCIATIONS BETWEEN SOCIAL MEDIA, BODY IMAGE AND PHYSICAL ACTIVITY IN YOUNG ADOLESCENTS**

Zoe Stratman, Reese Hyzer (Mentor)

Social media is an ever present phenomena in adolescent life. Little is known about how social media influences a younger audience. The purpose of this study is to determine how social media use in young adolescents affects their perception of body image as well as physical activity. A secondary analysis of data collected from a national sample of adolescents aged 12-14 will be analyzed using regression. Relevant measures include social media use frequency, Physical Activity scale, and the Body Image scale. Results will help identify how social media use impacts young adolescents' perceptions of themselves and if that in turn increases or decreases how physically active they are.

## **AUGMENTATION OF ANTI-MELANOMA RESPONSE BY COMBINING RADIATION-BASED IN SITU VACCINATION WITH GIFT4 B CELL THERAPY**

Elizabeth Sumiec, Zachary Morris (Mentor)

The combination of radiation (RT), immunocytokine (IC) and immune checkpoint inhibitor anti-CTLA (designated RT+IC+CTLA4) has durable success at curing large primary melanoma (MEL) tumors in C57BL/6 mice, but sometimes fails if there's a high metastatic burden. A recent report has shown that fusokine GIFT4 programs B-cells (GIFT4BC) to acquire a unique phenotype with augmented anti-MEL activity. C57BL/6 mice engrafted with 2x10<sup>6</sup> B78 MEL intradermally and injected with 3.5x10<sup>5</sup> B16 MEL intravenous to induce metastases were treated with RT+IC+CTLA4+GIFT4BC or a control therapy. Combination RT+IT-IC+anti-CTLA-4+GIFT4BC displays anti-MEL activity that reduces metastatic burden and prolongs survival in murine MEL models, thus, supporting published hypotheses which postulate that GIFT4BC-mediated mechanisms augment the T cell response through B cell antigen presentation and chemotactic cytokine production in vivo.

## **DISCOVERING MECHANISMS OF BLOOD CELL DEVELOPMENT: GATA1 REGULATION OF MITOCHONDRIAL SOLUTE CARRIER PROTEINS**

Jiameng Sun, Emery Bresnick (Mentor)

GATA1 is a transcription factor that regulates erythrocyte development. Although mechanisms for GATA1 function have been established, the downstream genetic networks are incompletely understood. Analysis of transcriptomes using RNA-seq revealed that GATA1 regulated 27 genes encoding mitochondrial solute carrier proteins (SLCs). We hypothesize that GATA1-mediated regulation of mitochondrial SLCs controls vital metabolic processes. After implementing a prioritization scheme, I decided to investigate the branched-chain amino acid transporter Slc25a44, which was upregulated by GATA1 in the erythroid precursor G1E-ER-GATA1 cell line. To ascertain Slc25a44 function during erythrocyte development, I designed shRNA-expressing retroviruses. I will use these retroviruses to dissect the consequences of Slc25a44 down-regulation during erythropoiesis. Elucidating these mechanisms will advance knowledge on GATA1-regulated genetic networks governing erythropoiesis and may reveal translational avenues in hematological pathologies.

## **ANALYSIS OF MMS SPACECRAFT DATA**

Bubakar Sy-Garcia, Jan Egedal (Mentor)

Earth's magnetic field has many impacts on life on its surface. Importantly, it shields Earth from the solar wind, but occasionally magnetic field lines get pinched by the solar wind, building up magnetic energy until it is explosively released in a process known as "magnetic reconnection". This process is intertwined with geomagnetic storms that can cause major damage to electrical grids. Currently, the Magnetic Multiscale (MMS) mission is making measurements of this process; however, the spacecraft only supply four points of information, making it hard to interpret. Reconstruction of the global geometry will properly give context and insight to future analysis. Once constructed, better understanding of this phenomenon can help in understanding and dealing with geomagnetic storms.

## **A STRATEGY TO PROFILE GENE EXPRESSION IN ADULT-BORN HIPPOCAMPAL NEURONS**

Moosa Syed, Xinyu Zhao (Mentor)

Neurogenesis in the adult hippocampus contributes to neural plasticity, brain homeostasis, and brain maintenance, which are processes integral to cognitive functions. Deciphering the mechanisms at play in adult neurogenesis may lead to novel therapies for neurodegenerative disorders. Therefore, it is critical to understand gene expression regulation in adult-born neurons. However, new adult-born hippocampal neurons represent a small cell population in the mammalian hippocampus. To profile gene expression specifically in these cells, we created the double transgenic mouse line Nestin-CreER::RiboTag by crossing Nestin-CreER, a mouse line with inducible Cre expression in adult-born neurons, and RiboTag, a mouse line with Cre-dependent HA-tagging of polyribosomes. The Nestin-CreER::RiboTag line enables isolation of translating mRNA selectively from new adult-born neurons, which can then be analyzed to profile gene expression.

## **DEEP LEARNING FOR PROTEIN ENGINEERING**

Liza Szymborski, Sanjan Gupta (Mentor)

Protein engineering is a field with wide ranging potential such as the creation of novel antibodies and industrially relevant enzymes. Thermostability is a key parameter for protein design and engineering as it indicates how stable/unstable a protein is at high temperatures. So, the goal of this project is to build a deep learning model that can accurately predict whether a protein sequence is thermophilic, mesophilic, or psychrophilic. In silico models like these have the potential to accelerate the protein engineering pipeline.

## **MGAT2 DEFICIENCY PROTECTS AGAINST HYPERGLYCEMIA AND PRESERVES ISLET MORPHOLOGY IN SEVERE MODELS OF DIABETES**

Lauren Tancer, Dr. Eric Yen (Mentor)

Diabetes occurs when the body is unable to produce or respond to insulin. Insulin, released from beta cells of pancreatic islets, stimulates glucose uptake into cells. Also present in the islets are alpha cells, which secrete glucagon to increase blood glucose or glucagon-like peptide-1 to increase insulin secretion. MGAT2, an enzyme encoded by the *Mogat2* gene that aides in intestinal fat absorption, is a target for treating diabetes. MGAT2 deficient mice are protected from diet-induced obesity and diabetes. To directly test the effects of MGAT2 deficiency on islets, we tested chemical and genetic models of mouse diabetes. We found that MGAT2 deficiency in both models of diabetes preserved normoglycemia. We hypothesized that MGAT2 deficiency preserves normoglycemia by maintaining islet cytoarchitecture and increasing GLP-1 secretion.

## **TRUST BETWEEN ORGANIZATIONS AND PERFORMANCE IMPLICATIONS**

Michael Tang, Zhi Cao (Mentor)

Business operations invoke the notion of a tangible flow of goods and services, however, there are other intangibles that moderate these flows. One of these moderators is trust. It is a component that cannot be easily measured, yet is integral to business operations. This project focuses on the role of trust on firm performance. We conduct a meta-analysis of the most recent academic literature covering the relationship between trust and firm performance. We are looking for general trends amongst the literature to provide insights on the impact of forming strong inter-firm relationships. We have found dozens of articles that support our hypothesis and are hoping to find broad patterns to report, providing results that are statistically significant and are helpful in the field of strategy.

## **BACKYARD POULTRY: MISCONCEPTIONS ABOUT HUMAN HEALTH RISK**

Alexis Terry, Wendy Bedale (Mentor)

Raising backyard chickens have become increasingly popular, with an estimated 10 million U.S households having backyard flocks. Pathogens (e.g., *Salmonella*, *E. coli* O157:H7, and *Campylobacter*) from direct and indirect contact with backyard poultry are making people sick. In 2019, more than 1100 people in the U.S. developed salmonellosis following a backyard poultry exposure. Unfortunately, 2019 was not unusual: In the past two decades, 76 *Salmonella* outbreaks have been associated with backyard poultry. We explored reasons why such outbreaks might be occurring by interviewing a veterinarian, an epidemiologist, an infectious disease biologist, and several backyard chicken keepers. We identified numerous misconceptions among those who raise backyard poultry that may contribute to human health risks. Communicating these health risks and clarifying misconceptions can potentially save lives.

## **CHARACTERIZATION OF THE CYTOKINE PROFILE OF DOGS WITH PRIMARY IMMUNE THROMBOCYTOPENIA**

Dahlia Tesfamichael, Jessica Pritchard (Mentor)

Immune thrombocytopenia is a disease of autoimmune platelet destruction and resultant bleeding with high rates of mortality and relapse in dogs. As the exact immune deficit is unknown, therapeutic decisions are based on surrogate markers of the immune system. Consequently, some dogs get treatments that are too long, increasing their risk for medication side effects, and some get treatments that are too short, resulting in relapse. Understanding the immune signaling molecules (cytokines) expressed during ITP will improve knowledge of pathogenesis and identify potential biomarkers for improved outcomes. We hypothesize cytokine profiles from ITP dogs will differ from healthy dogs and those with other causes of thrombocytopenia. To prove this hypothesis, blood cytokine concentration measured by ELISA and transcription measured by RT-qPCR are compared among the three groups.

## **SCOPING REVIEW: HEARING LOSS RESEARCH AMONG RACIAL/ETHNIC MINORITIES IN THE UNITED STATES**

Sara Thao, Maichou Lor (Mentor)

While hearing loss is prevalent in the U.S., little is known about its impact on racial/ethnic minorities. We conducted a scoping review on hearing loss research among minorities using PubMed, CINAHL, PsycINFO, and Scopus. We reviewed 1848 English peer-reviewed articles from 1950 to 2019. Twenty-seven studies were included. Of the 27 studies, majority used surveys (n=16). The studies focused on Hispanics (n=10), Blacks (n=6), both (n=9) or other ethnicities (n=2). Studies' findings focused on three themes: (1) hearing loss prevalence (n=18), (2) access to hearing care (n=5), and (3) beliefs and attitudes of hearing loss (n=4). Findings highlight the need for more hearing research in racial/ethnic minorities

## **PROJECT HAIS LUS: PERSPECTIVES ON LANGUAGE ACCESS, CULTURAL BARRIERS, AND MULTILINGUALISM IN WISCONSIN'S HMONG COMMUNITIES**

Ariana Thao, Dominic Ledesma (Mentor)

As U.S. society increasingly becomes a culturally and linguistically diverse, public-serving institutions are often challenged in how they adapt their programs and services to accommodate linguistic and cultural differences among diverse constituent groups. With the third-largest population of Hmong people living in the upper midwestern United States, public-serving institutions in Wisconsin struggle to mitigate barriers that serve Hmong community needs. This study explores the intersections of language and culture based on the perspectives from leaders within the state's Hmong communities. It examines these intersections within the context of their connections to broader institutional barriers in educational programs sponsored by the University of Wisconsin-Madison's Division of Extension.

## **SOCIAL SECURITY DISABILITY INSURANCE**

Ngun Tial, Gefei Liu, Lydia Ashton (Mentor)

Social Security Disability Insurance (SSDI) project researches how individuals communicate about SSDI on internet forums to help address the limitations as well as applicable improvements. Over the years, the number of applications has been increasing due to reasons such as increasing listing of disabilities by the government. It is crucial to ensure the suitability and accessibility of the program and the application process for the insurance recipients, so the funds for the program can be used equitably. The team collects online forums that provide insights regarding applicants' authentic experiences with SSDI. Using a software called R, statistical summaries of different forums are collected and further recommendations can be developed to more effectively expand access and use of SSDI information.

## **DOES VOCAB MATTER?: THE IMPACT OF VOCABULARY ON NOVEL WORD COMPREHENSION IN YOUNG CHILDREN**

Luke Tinsey, Sadona Thompson, Catherine McCormick, Heather Kirkorian (Mentor)

The purpose of this study is to determine whether children (3-5 yrs) with higher vocabulary are better able to recognize and comprehend novel words. Using a vocabulary assessment, children are scored based on the number words they were able to identify correctly. Following the assessment children read a short story with their parents containing novel words that are used as tools throughout the story. They are then asked to identify the image that corresponds with the novel tool recognition and identify how that tool was used in the story comprehension. We expect that children who have a higher vocabulary will be able to recognize and comprehend more novel words. The findings of this research may reveal strategies to increase word learning from books.

## **INVESTIGATING THE MRNA BINDING PROPERTIES OF THE TRANSLATION REPRESSOR BICAUDAL-C**

Tommaso Tonelli, Megan Dowdle, Michael Sheets (Mentor)

Bicaudal-C (Biccl) is an RNA binding protein that represses the translation of specific mRNAs. Its functions are important for several biological processes, such as organogenesis, embryonic development, and several human diseases. The Sheets laboratory has demonstrated that a specific region of Biccl, the KH2 domain, is responsible for its mRNA binding functions. To define the important features of the KH2 domain required for RNA binding, I created Biccl variants in which particular residues were mutated. I expressed and purified these variant Biccl proteins from bacteria and will analyze their activity with RNA binding experiments. The goal is to determine what aa residues of the KH2 domain influence Biccl's ability to identify and repress mRNAs to provide a deeper understanding how Biccl influences specific biological processes.

## **MANAGING LAND USE TO MITIGATE CLIMATE CHANGE**

Tim Tran, Seth Spawn (Mentor)

Atmospheric carbon dioxide is at an all-time high. At the current rate of emissions, the planet is on a crash course to degradation. Global temperatures are rising, the oceans are warming and acidifying, the ice sheets are shrinking, and the glaciers are disappearing. One often-overlooked solution to reducing the amount of atmospheric carbon dioxide lies in managing grasslands. This project uses satellite records of IR intensities from grassland research sites and data gathered on biomass from these research sites to plot a relationship between biomass and IR intensity. Once this relationship is discovered, biomass can be determined at any location and time period. Biomass is directly related to carbon emissions. Approximately 50% of the biomass of the grass is released as carbon dioxide once cut.

## **THE POLITICAL ECONOMY OF OCCUPATIONAL VALUE: NEGOTIATING SKILL AND RISK IN A GREEN ECONOMY**

Gretchen Trast, Kaylee Castleberry, Alexis Econie (Mentor)

US economic policy discourse has promoted green industry, characterizing green jobs as well-compensated, lower-skill, environmental work. This model has garnered political endorsement as the number of 'green' jobs in the US climbs a projected 40 million jobs by 2030. Simultaneously, recycling, a core industry of the green economy, is the fifth most-fatal industry in the US (BLS 2019). This contradiction, high-quality, 'lower-skill' jobs with notably high fatality rates, suggests that green jobs may not have crystallized as predicted. We take the US recycling industry as a case study to illustrate how skill is socially constructed under the political framework of the green economy. We question the pairing of 'lower-skilled' work in recycling with its disproportionately high occupational risk.

## **MODELING ZIKA VIRUS TISSUE TROPISM IN RHESUS MACAQUES TO DEFINE THE RISK OF DONOR DERIVED TRANSMISSION**

Taylor Treadway, Emma Mohr (Mentor)

Almost 115,000 people in the United States are currently on a transplant waitlist, which vastly exceeds the number of organ donors every year. This discrepancy emphasizes the need for retention of all possible donors. Those who have recently traveled to an area with an active outbreak of Zika virus (ZIKV) are often disqualified as a donor because immunosuppressed recipients would be at risk of a donor-derived ZIKV infection. Therefore, we define ZIKV tissue tropism and the risk of donor derived transmission.

## **INTRA-SUBUNIT INTERACTIONS IN THE GABAA RECEPTOR'S INTRACELLULAR DOMAIN MEDIATE GABAAR FUNCTION**

Anton Tung, Cynthia Czajkowski (Mentor)

Although current research reveals how the extracellular and transmembrane regions of the GABAAR structure help control GABA binding and channel opening and closing, relatively little is understood about how the GABAARs' intracellular region regulates GABAAR function. In this study, four putative and charged intracellular intra-subunit interactions between the GABAAR M4 transmembrane helix and MX helix were removed using site-directed mutagenesis. With two-electrode voltage clamping, GABA dose response curves were obtained and compared between each mutant and wild-type (WT). Three of the four mutations had a higher EC50 than WT, indicating worsened receptor function, and one mutation had a lower EC50 than WT, indicating improved function. Overall, these four mutations reveal the stabilizing role of the GABAAR's intracellular region and how it regulates receptor function.

## **A PHENOTYPIC AND POLYGENIC MODEL OF ADHD THAT EXPLAINS HOW SOCIAL DEFICITS IN THESE CHILDREN ARISE**

Sheyenne Tung, James J. Li (Mentor)

Attention-deficit/hyperactivity disorder (ADHD) is a psychiatric disorder characterized by abnormal patterns of inattention, hyperactivity, and impulsivity, which may impair social skills. However, the mechanisms in which social deficits occur remain unclear. This study investigates whether the prospective association between childhood ADHD (measured both phenotypically and polygenically) and social skills is mediated by child negative affect and negative parenting, assayed through self-reports. We recruited 210 children and their parents at time 1 (T1) and 114 have returned for follow up thus far (T2). We hypothesize that the effects of ADHD on children's social skills at T2 are explained by their temperament (i.e., negative affect) and negative parenting experience at T1. Clarifying mediators of social deficits in ADHD may improve our understanding of key targets for intervention.

## **WHAT IS THE RELATIONSHIP BETWEEN STANDING ELECTRIC SCOOTER INJURIES, SUBSTANCE USE, AND HELMET USE IN THE UNITED STATES FROM 2017 THROUGH 2018?**

Mariah Ulness, Traci Snedden (Mentor)

Though standing electric scooter vendors and municipalities generally recommend helmet use and avoidance of scooter operation under the influence of any substance, these recommendations are largely unmonitored. The purpose of this study was to describe the relationship between substance use, helmet use, and standing electric scooter-related injuries using data from a nationally representative dataset. In this study, of those who had documented substance use (n=22), 13.6% (n=3) were documented as wearing a helmet. A limitation of this dataset is that we were unable to clearly determine helmet use and substance use as not all clinical narratives included documentation of yes/no for these variables. This demonstrates the need to improve documentation to better understand the relationship between standing electric scooter injuries, helmet use, and substance use.

## **UNDERSTANDING ASSOCIATIONS BETWEEN PARENT STRESS, PARENT ALLIANCE, AND CHILD INTERNALIZING BEHAVIOR PROBLEMS IN AUTISM SPECTRUM DISORDER**

Emily Unmacht, Brianna Gambetti (Mentor)

Little is known about how stress associated with parenting a child with autism spectrum disorder (ASD) is related to parenting alliance or how parenting alliance is associated with child mental health. Therefore, we examined parenting stress and parenting alliance in parents of children with ASD and its association with child internalizing behaviors. Parents (n=377) reported on their parenting stress, parenting alliance, and the child's internalizing behaviors. Pearson correlations indicated significant associations between parenting stress and parenting alliance ( $r = -.356, p < .001$ ) as well between parenting stress and internalizing behaviors ( $r = .295, p < .001$ ). Parenting alliance was not significantly correlated with internalizing behaviors. Findings suggest parent stress may negatively influence both the parent relationship and the child.

## **IMPACT OF COAL POWER PLANTS ON SULFUR DIOXIDE AIR POLLUTION**

Vincentius Utama, Tracey Holloway (Mentor)

This study will quantify contributions from individual coal power plants to sulfur dioxide (SO<sub>2</sub>) air pollution in the United States. The U.S. electricity generation industry's reliance on coal as a source of energy has led coal power plants to be a primary contributor of SO<sub>2</sub> emission. My work examines how these emissions affect air pollution at ground-level, where it affects human health. A statistical analysis will be performed with measurements from over 400 active ground monitors across the United States from the Environmental Protection Agency's Air Quality System network. These measured values will be compared with SO<sub>2</sub> as simulated by a computer model, the Community Multiscale Air Quality (CMAQ) model, which takes account of emissions, chemistry, weather patterns, and atmospheric removal of SO<sub>2</sub>.

## **INFLAMMATION-INDUCED PROSTATIC OSTEOPONTIN AS A POTENTIAL DRIVER OF FIBROSIS IN A MOUSE MODEL OF LOWER URINARY TRACT DYSFUNCTION**

Francesca Van, Petra Popovics (Mentor)

Lower urinary tract symptoms (LUTS) in men are caused by benign pathological changes in the prostate including hyperplasia, inflammation and fibrosis. Recent findings have suggested that osteopontin, an inflammatory cytokine and pro-fibrotic molecule, is elevated in response to prostatic inflammation. Our findings have shown that osteopontin expression is increased in testosterone and estradiol (T+E2) treated mouse prostate tissues, which is a hormone induced model that displays lower urinary tract dysfunction (LUTD). CD45 positive cells (common leucocyte marker) also significantly increased in the anterior, ventral and dorsolateral lobes of the prostate in T+E2 treated mice. This suggests that osteopontin drives prostate inflammation and fibrosis in this model.

## **GLAUCOMATOUS CHANGES TO THE TRABECULAR MESHWORK AND THE OPTIC NERVE HEAD**

Kayla Van Asten, Colleen McDowell (Mentor)

Glaucoma is a leading cause of visual impairment and blindness in the world, affecting over 60 million individuals. Elevated intraocular pressure is one of the major risk factors for glaucoma and occurs due to damage to the trabecular meshwork (TM) which regulates aqueous humor outflow. The damage occurs due in part to an increase in the extracellular matrix (ECM) in the TM. We explore a novel molecular mechanism involved in the development of glaucomatous TM damage with TGF $\beta$ 2 and TLR4 signaling crosstalk in the regulation of the ECM. We utilize in-vitro, in-vivo, and ex-vivo models to investigate the mechanisms of TGF  $\beta$  2-induced glaucoma. Investigation into the signaling pathway could further explain the mechanisms involved in the development of glaucoma and lead to new, effective therapies.

## **COMPARING CASEIN TO SOY PROTEIN EFFECTS ON PHENOTYPES IN FRAGILE X DIETS**

Olivia Van Hammond, Cara Westmark (Mentor)

Fragile X is a genetic condition that causes intellectual disability and has varying phenotypes. There are treatments that may help with this condition, however, there is no cure, and this is the leading known cause of inherited intellectual disability. The purpose of this study is to investigate how the protein of a diet will affect Fragile X Syndrome phenotypes, specifically comparing casein to soy. Using perfectly matched diets, methods to test phenotypes include passive avoidance for learning and memory, growth charts for weight and length, and hyperactivity testing. This will provide insight into whether genetic screening should be done on newborns regarding Fragile X, as the protein source in baby formula could possibly exacerbate their phenotypes.

## **COMPETITION AMONG INVERTEBRATES AND SNAILS IN THE WILLAMETTE RIVER, OREGON**

Magic Vang, Landon Falke (Mentor)

Juga silicula are snails that make up nearly 90 percent of the invertebrate population in Pacific Northwest streams. Given the high abundance of these snails, an important question is: do snails compete with other stream invertebrates? I am currently processing samples collected from the North and South Santiam Rivers, which are sub-basins of the Willamette River in western Oregon. To analyze these samples, I will first remove invertebrates from dip-net samples collected by my mentor. I will then identify all the invertebrates to quantify diversity at each site. By combining this information with data on snail densities, we can determine if there is a potential competitive relationship between snails and other stream invertebrates.

## **PHONETIC CHARACTERIZATION OF PAIN INTENSITY EXPRESSIONS AMONG HMONG PATIENTS**

Lee Vang, Mai Nhia Vang, Maichou Lor (Mentor)

While pain intensity is critical for pain assessment, it is unclear whether Hmong patients have words to describe pain magnitudes. We characterized pain intensity expressions in 67 Hmong patients using phonetic analysis. Findings revealed that Hmong patients expressed magnitude of pain through pitch, vowel length, and use of Thai words. For no pain, Hmong patients expressed the word mob [hurt in Hmong] with a normal pitch and vowel length. For mild pain, Hmong patients used a Thai word, tas ma das. For severe pain, Hmong patients expressed the word mob [hurt in Hmong] with a high pitch and long vowel length. This study's findings can increase clinicians' understanding of pain communication among Hmong patients.

## **UNDERSTANDING HMONG-SPEAKING MEDICAL INTERPRETER'S CHALLENGES IN HEALTHCARE ENCOUNTER**

Mai Nhia Vang, Maichou Lor (Mentor)

Medical interpreters play an essential role in facilitating communication between providers and patients with limited English proficiency. While there has been increasing research on medical interpreters, no research has focus on Hmong-speaking interpreters' experiences and the challenges they encountered. This study's purpose was to assess 11 Hmong speaking interpreters' challenges during medical interpretation. Semi-structured Interviews were conducted, audio recorded, transcribed, and analyzed using conventional content analysis. Interpreters reported two themes related to medical interpretation challenges including linguistic and cultural differences between them and Hmong patients. Findings highlight the need for creating a standardized tool for medical interpretation for the Hmong language.

## **GOOD-ENERGY: HEALTH BELIEFS OF URBAN LOW-INCOME ADULTS COPING WITH DISABILITIES**

Chatay Vang, Cierra Mccoy, Claire Weissenfluh, Rick Volland, Linda Denise Oakley (Mentor)

Health beliefs influence how people respond to their personal health needs. We explored this observation in urban residents of community housing for adults with physical/mental disabilities receiving on-site health promotion services offered by nurses and nursing students. Volunteers (N=28, Male=9, Female=19) responded to our survey on general health beliefs and the unseen forces (luck, reward/ punishment, Karma, magic, energy, fate/destiny, faith, people, support, jinx) residents believe have harmed or improved their health. Most said they had experienced a big health change in their life (n=23). Most top ranked "bad luck" as an unseen force that harmed their health and "good energy" as an unseen force that improved their health. Positive mind-body health programs designed to build good energy are discussed.

## **CREATING BICAUDAL C PROTEIN MUTATIONS TO DEFINE RNA-BINDING DETERMINANTS**

Krystal Velasco, Michael D. Sheets (Mentor)

In specific cell types of most animals, the Bicaudal-C (Bic1) protein binds to specific target mRNAs and regulates their translation. The binding and translational repression by Bic1 impacts the production of specific proteins that influence the functions of individual cells. Therefore, an important issue is to define the amino acids necessary for Bic1 to bind to specific mRNAs. When Bic1 binding is compromised, it leads to abnormalities in organ development. For example, kidneys deficient in normal Bic1 activity develop polycystic kidney disease. For my experiments, I have focused on the Bic1 KH2 domain, a region of the protein responsible for Bic1 RNA binding. I am creating mutations in the KH2 domain and analyzing the mutant Bic1 proteins for defects in RNA binding and translation.

## **WHAT INFLUENCES HOW OFTEN A BILINGUAL CHILD CODE MIXES?**

Rocio Velasquez, Dave Curtis, Margarita Kaushan skaya(Mentor)

This project identifies what factors influence bilingual children's code-mixing tendencies. Code-mixing refers to the use of two languages within a single unit of discourse. Spanish-English bilingual children 4-5 years of age and their parents will engage in play-based interactions. We will analyze the frequency with which participants code mix. We hypothesize that children's language dominance and overall language ability will contribute to code-mixing behaviors. For example, if the dominant languages between the parent and child are the same, the child will code mix less than if the dominant languages differ. This research may help us identify factors that influence a bilingual child's code-mixing habits.

## **EMOJIS AND DEPRESSIVE WORD CHOICE ON TWITTER: A CONTENT ANALYSIS**

John Ventura, Dr. Megan A Moreno (Mentor)

Ten billion emojis were used on Twitter from 2013-2014. Few studies have examined the use of emojis in tweets about depression. This study investigated the relationship between the use of emojis and words associated with negative emotion on Twitter. Using the search term #Depression, 50 tweets with and 50 tweets without emojis were collected. A content analysis using the Linguistic Inquiry & Word Count (LIWC) program evaluated affective language use variables including negative emotion, anxiety, and sadness in the tweets' word choice. Tweets with emojis were evaluated based on the presence of positive, negative, and miscellaneous emojis. A t test compared the tweets with and without emojis regarding the LIWC variables. The results of this study could offer a new approach to identifying depression online.

## **IMPACTS OF LANDSCAPE FEATURES ON TURTLE ROAD MORTALITY ACROSS SCALES**

Rachel Verkhovyykh, Zach Peery (Mentor)

This study aims to understand how landscape features across Wisconsin affect turtle road mortality for Blanding's and Painted turtles across two scales: within counties and statewide. Statewide analysis showed that increased Blanding's mortality and overall road crossing occurrences were linked to areas with herbaceous wetland cover. For Painted turtles, mortality events were higher in areas with higher road density, open water, and herbaceous wetland cover. Overall road crossing occurrences were higher in areas with open water. Local analysis for Painted turtles shows higher mortality in areas with more deciduous forest cover and marginally higher along straighter roads. This suggest that factors that drive road crossings and mortality events vary across scales and species, and provide initial guidance for targeted efforts to reduce road crossing mortality.

## **EFFECTS OF GEOMORPHIC PROCESSES ON AEOLIAN LANDSCAPES IN THE CENTRAL GREAT PLAINS**

Tien Vo, Joseph Mason (Mentor)

This project investigates how soil development in loess landscapes and nearby dune fields is influenced by aeolian (wind-related) processes. Additionally, this project investigates how the soil that develops, in turn, affects the aeolian processes that shape the soil. The project will use a variety of analytical methods including Chittick analysis of carbonates and laser diffraction of particle size in order to analyze carbon content and soil aggregate stability, respectively, and other qualities of soil. Previous research demonstrates that soil structure can change over time. The results of the project will help to predict the landscape's response to more frequent, severe drought and/or intense precipitation caused by climate change. Additionally, the results of this project will be used to develop methods to better conserve these landscapes.

## **ART-BASED COGNITIVE TRAINING**

Masha Vodyanyk, C. Shawn Green (Mentor)

Art is a complex skill that involves higher and lower level cognition and perception. Through incorporating principles of computerized cognitive training with art exercises, I created a 16 session intervention that aims to train attention, memory and psychomotor functioning in elderly adults with and without cognitive impairment. The study was conducted at Capitol Lakes Assisted Living and the Madison Senior Center. By comparing scores in computerized tasks testing multiple cognitive domains before and after the intervention, we assessed if there is a possibility that art based exercises can improve cognition.

## **EFFECTS OF STEM CELL PASSAGE NUMBER ON THE EFFICIENCY OF GnRH NEUROGENERATION**

Sara Wagers, Ei Terasawa (Mentor)

Gonadotropin-Releasing Hormone (GnRH) neurons play a key role in human reproductive function. Absence of GnRH neurons in the hypothalamus results in Idiopathic Hypogonadotropic Hypogonadism (IHH) disease. To provide a research tool for studying human GnRH neurons, this lab found a method to generate GnRH neurons from human stem cells. During the course of the GnRH neurogeneration study, the lab noticed that various factors modify the efficiency of GnRH neurogeneration. The question of whether the passage number of stem cells influences the efficiency of GnRH neurogeneration is unknown. The proposed study will examine if there is any difference in the efficiency of GnRH neurogeneration when human embryonic stem cells at a low and a high passage number are treated with fibroblast growth factor (FGF) 8.

## **THE DEVELOPMENT OF AN OMENTUM-INSPIRED HYDROGEL SYSTEM FOR DETERMINING THE ROLE OF INCREASED MATRIX DEPOSITION AND STIFFNESS IN OVARIAN CANCER PROGRESSION**

Alyssa Walker, Dr. Pamela Kreeger (Mentor)

High-grade serous ovarian cancer is the deadliest gynecological malignancy, with a 5-year survival rate of less than 40 percent. The high mortality rate can largely be attributed to the late stage of diagnosis, in which there is widespread dissemination of malignant cells throughout the peritoneal cavity. During metastasis, the extracellular matrix (ECM) of the omentum undergoes extensive changes in structure and composition, which alters the mechanical properties of the tissue. To mimic the ECM composition and physical properties of healthy and diseased omentum, we created polyacrylamide hydrogels of varying stiffness that were functionalized with decellularized human omental tissue. This system will be used in future studies to explore how increased matrix deposition and stiffness impact cell proliferation and the expression of metastasis-associated genes.

## **MAPPING THE SWITCH OF CHLORIDE GRADIENT IN DEVELOPING RETINAL BIPOLAR NEURONS**

Julie Wallin, Mrinalini Hoon (Mentor)

During development, GABA switches from exerting excitation to inhibition. This is because the intracellular chloride equilibrium potential of developing neurons changes, with NKCC1 cotransporter being downregulated together with upregulation of KCC2 cotransporter. This switch is essential for proper synaptic development and has been well-characterized in many brain regions, but remains understudied in the retina. Using immunohistochemistry and gene expression assays, we show the expression of NKCC1 and KCC2 across development in ON and OFF retinal bipolar cells. Our findings reveal that the switch from NKCC1 to KCC2 in bipolar cell axon terminals occurs just before eye opening. Understanding when GABA switches from an excitatory to an inhibitory neurotransmitter in different types of developing retinal bipolar neurons is key towards understanding the mechanisms governing retinal synaptogenesis.

## **IS AMAZON WORTH IT? ANALYZING FULFILLMENT CENTER IMPACTS ON EMPLOYMENT AND WAGES**

Anna Walther, Laura Dresser (Mentor)

Are Amazon Fulfillment Center jobs worth communities' multi-million dollar investment? An analysis by the Economic Policy Institute found that Amazon Warehouse jobs create county-level warehousing/storage sector job growth that wouldn't have occurred otherwise. However, new Amazon jobs did not improve overall private-sector employment and average quarterly wages. This study replicates and builds off of EPI's findings by investigating heterogeneity in these effects: for example, does Amazon have a greater impact on non-metropolitan versus metropolitan communities? Do these results change once we isolate and control for other county-level indicators? This, combined with a review of literature exploring Amazon's effects on workers, surrounding communities, and the economy, intends to answer the question: is Amazon worth it?

## **THE EFFECTS OF FRAMES ON COMMUNICATING DECEPTION**

Brianna Wanek, Lyn Van Swol (Mentor)

Two studies examined how framing a situation as either a gain or loss and how a prevention or promotion regulatory focus interact to impact the amount of deception. It was found that in a gain frame, there were more lies with a promotion than prevention focus and the opposite was true for a loss frame. The results reveal how a prevention focus may worsen the pain of a loss and a promotion focus may increase the desirability of a gain, both of which may lead to increased deception.

## **SEX-SPECIFIC ALTERATIONS IN LPS-INDUCED PERIPHERAL INFLAMMATION IN ADULT OFFSPRING EXPOSED TO GESTATIONAL INTERMITTENT HYPOXIA: POTENTIAL REGULATION BY MIR-146**

Tao Wang, Jyoti Watters (Mentor)

The prevalence of sleep disordered breathing (SDB) and concomitant intermittent hypoxia (IH) during pregnancy is rising. IH caused maternal immune activation is detrimental to the offspring. Having rat dams exposed to gestational IH (GIH), we studied spleen inflammatory cytokine gene expression before and after a lipopolysaccharide (LPS) challenge in adult offspring. We found that LPS-induced inflammatory gene responses were impaired in females but not in males. Because small non-coding microRNAs (miRNAs) are important in regulating immune system function, I screened the expression of several immunoregulatory miRNAs. The immunosuppressive miR-146b was highly upregulated in female (not male) spleens, supporting that GIH may suppress peripheral inflammation by altering miR-146 levels. It would be important to explore the relationship between inflammation and miRNA regulation.

## **EVALUATING AND IMPROVING PATIENT/PARENTAL SATISFACTION**

Muen Wang, Emma Hock, Walid Farhat (Mentor)

Customer satisfaction is of utmost importance in healthcare. The objective of this project was to assess and improve parental satisfaction in pediatric urological surgical services at The American Family Children's Hospital. Parental satisfaction is important because it lowers the burden on the family when their children undergo surgery. Satisfaction also enhances the hospital's reputation not only to deliver care but also to secure better resources. In order to gauge parental satisfaction, surveys will be sent out after surgical intervention had been undertaken on a child. In order to avoid recall bias, the survey will be sent in a week after the treatment. The data gathered from the surveys will be analyzed to assess satisfaction and identify improvements in the system that need to be tackled.

## **CYTOCHROME P450 STRUCTURE AND ITS FUNCTIONAL OUTCOME**

Junting Wang, Garvesh Raskutti (Mentor)

Cytochrome P450 (CYPs) is a collection of enzymes responsible for various functions as monooxygenases. As a part of a broader project aiming for large-scale presence-only data for biological systems engineering, this study examines the influence of Cytochrome P450's structure on its binary functional outcome. Based on cleaned data, this project will (1) build and compare machine learning models for protein sequences function of CYPs, (2) examine interactions among amino acids in CYPs, and (3) investigate important roles of amino acids in the location of sequences. With these findings, scholars will have a deeper understanding of the structural factors that influence the function of CYPs, including impacts from mutation that occurred in active sites.

## **PREDICTING LONG-RANGE ENHANCER-PROMOTER INTERACTIONS IN HUMAN AORTIC ENDOTHELIAL CELLS**

Yuanhang Wang, Sushmita Roy (Mentor)

Regulatory sequence elements such as enhancers can regulate the expression level of a gene hundreds of kilobases away through chromosomal looping, which brings regulatory elements in three-dimensional proximity to target genes. Long-range regulatory interactions play a role in controlling the expression of inflammatory genes, which contributes to cardiovascular disease. However, technologies to detect long-range interactions have been limited to well-characterized model cell lines due to sequencing costs and the required number of cells for making reliable measurements at high resolution. Here, we applied a regression-based method, L-HiC-Reg, to generate in silico contact counts using one-dimensional regulatory signals to study long-range regulation in human aortic endothelial cells (HAoEC). We find that genes that are connected to HAoEC-specific enhancers are enriched in processes related to angiogenesis.

## **DESPITE UPSETTING EVENTS URBAN ADULTS LIVING WITH MENTAL ILLNESS CAN FEEL SAFE**

Claire Weissenfluh, Chatay Vang, Cierra Mccoy, Rick Volland, Dr. Linda Oakley (Mentor)

Low-income adults living with mental illness can feel overwhelmed by distressing life events. Those living in densely populated, urban communities also could feel uniquely disadvantaged. With these concerns in mind, we surveyed residents of an urban housing community who receive on-site health promotion services from nurses and nursing students. Volunteers (N=28) completed our survey designed to evaluate life events and safety perceptions. Nearly half (48.1%) said they recently went through a very emotionally upsetting experience. Over half (60.7%) told someone about their experience. Most (71.4%) said they did not feel their rights had been violated. Majority (82.6%) talked to relatives or friends. Nursing health promotion services designed to help residents feel safe should encourage building and maintaining friendships and family ties.

## **RACIAL DIFFERENCES IN CHILDHOOD ASTHMA INCIDENCE ATTRIBUTABLE TO NO<sub>2</sub> AIR POLLUTION IN THE CHICAGO METROPOLITAN AREA**

Maya Welch, Tracey Holloway (Mentor)

My research examines air pollution and health disparities in the Chicago metropolitan area. Using computer models and Census data, racial differences in exposure to the air pollutant, nitrogen dioxide (NO<sub>2</sub>), as well as the associated health outcomes are quantified. Specifically, the Community Multiscale Air Quality (CMAQ) model is used to view exposure patterns, ArcGIS and Census block data are used to plot racial distribution in the Chicago area, and the Environmental Benefits Mapping and Analysis Program (BenMAP) model is used to obtain health impacts. Exposure to NO<sub>2</sub> is associated with asthma development and exacerbation, especially in children living near roadways and power plants. Because these neighborhoods near emission sources commonly house minorities, the results show racial disparities in childhood asthma associated with NO<sub>2</sub> exposure.

## **QUALITATIVE INJURY EXPERIENCE OF UNDERGRADUATE STUDENTS WHO SUSTAIN A CONCUSSION VERSUS A MUSCULOSKELETAL INJURY WHILE ENROLLED AT A LARGE PUBLIC UNIVERSITY.**

Payton Wesley, Traci Snedden (Mentor)

Injuries such as concussion and musculoskeletal issues are known to occur among general/non-athlete undergraduate students. However, little is known about how these injuries affect their college experience, as they are significantly less studied than their athlete counterparts. Our study, a qualitative secondary analysis of data extracted from a cross-sectional survey at a large public university, examined the general/ non-athlete undergraduate student college experience after sustaining a concussion or musculoskeletal injury using student text responses. Thematic analysis is in process but has thus far identified transportation and access to class, healthcare services, academic concerns, and faculty support as major themes. These initial findings highlight the importance of awareness and provision of support for all undergraduate students post-injury.

## **INVESTIGATION OF THE TRANSCRIPTIONAL REGULATION OF THE REL<sub>A</sub> GENE IN ESCHERICHIA COLI**

Julie Wessel, Richard Gourse (Mentor)

Bacteria have evolved effective survival mechanisms when nutrient conditions become unfavorable. During starvation conditions in *Escherichia coli*, the enzyme RelA produces the alarmone ppGpp which binds to two sites on RNA polymerase, inducing a process known as the stringent response. The small molecule reprograms the cell's transcriptome by inhibiting transcription of hundreds of genes and activating hundreds of others, redirecting resources to genes required for survival. ppGpp plays a vital role in cell survival, virulence, and antibiotic tolerance. While there have been extensive studies on the regulation of RelA protein activity, there is little research on the transcriptional regulation of the relA gene in a physiological context. Therefore, I am investigating relA gene expression through the creation of promoter fusions and in vitro transcription.

## **MUTATION IN CHONDROITIN SULFATE SYNTHASE 1 AFFECTS RETINAL FUNCTION AND STRUCTURE**

Dan Western, Akihiro Ikeda (Mentor)

Glycosaminoglycans are multifunctional sulfated sugar chain moieties present in the retina but their function in the retina is largely unknown. One enzyme expressed in the retina is chondroitin sulfate synthase 1 (CHSY1) that generates the glycosaminoglycan chondroitin sulfate. Mice with the functional loss of CHSY1 develop a photoreceptor degeneration. In this study, I investigated what cell types in the mouse eye are affected by the loss of CHSY1. I found the loss of CHSY1 decreases chondroitin sulfate exclusively in the neural retina but not in the retinal pigmented epithelium (RPE). Remarkably, we did not observe any structural changes in the RPE; rather, we detected significant changes in the photoreceptors. Our results suggest a novel function for chondroitin sulfate in maintaining photoreceptor homeostasis.

## **FATHERS' REFLECTIONS: NAVIGATION OF PARENTHOOD WITHIN THE CRIMINAL JUSTICE SYSTEM**

Layne Wetherbee, Besa Asani, Pajarita Charles (Mentor)

In the U.S., over half of the current prison population consists of parents, predominantly fathers, the majority of whom will eventually be released. Consequently, the effects of parental criminal justice involvement can be detrimental to child outcomes and parent-child relationships, owing to stigma, trauma, and reduced financial and social support. To understand the parenting experiences of recently released fathers, our study analyzed focus groups of fathers in reentry (n=15) and connected mothers and relatives (n=8) in a Midwestern state. These focus groups offer insight into fathers' experience navigating both parenting from behind bars and, ultimately, parenting in reentry. By hearing reflections from individuals impacted by incarceration, this study highlights the importance of father involvement and parenting experiences within the criminal justice system.

## **CIVIC AND ETHNIC CITIZENSHIP LAWS AND INTERNATIONAL CONFLICT**

Joseph Wichleman-Berg, Nadav Shelef (Mentor)

In this research project, we are seeking to analyze the origin of conflicts, namely if different types of nationalism are linked with conflict. To answer that question, we coded citizenship laws with two criteria; birthright citizenship- obtaining citizenship upon birth in the said country- and ethnic-based citizenship- obtaining citizenship because an individual's parents meet certain ethnic requirements- into a database containing all countries from their independence until 2019. So far we are still gathering data and have yet to conduct analysis that could answer the question. Our hope is to eventually explore the relationship between different kinds of nationalism (divided along citizenship requirements) and conflict.

## **TYPE VI SECRETION SYSTEM EFFECTOR ANALYSIS REVEALS STRAIN-LEVEL DIFFERENCES IN XENORHABDUS NEMATOPHILA**

Catherine M. Wilkinson, Michael Thomas (Mentor)

The type VI secretion system (T6SS) is a bacterial nanomachine primarily used for bacterial competition. T6SSs have been mostly characterized in bacterial pathogens and their function in beneficial bacteria is not well understood. The mutualistic bacteria *Xenorhabdus nematophila* has two T6SS clusters. We performed bacterial competition assays and bioinformatic analysis. The bacterial competition assays indicated that both *X. nematophila* T6SS clusters are required for successful bacterial competition. The bioinformatic analysis on multiple *X. nematophila* strains revealed strain-level differences in the T6SS effectors encoded in the *X. nematophila* genomes. There were two main categories of effectors; Rhs and Non-Rhs toxins. Collectively, these results provide insight into T6SS functionality and discovery of strain-level differences in T6SS effectors in the beneficial bacteria, *X. nematophila*.

## **EFFECT OF MAJOR ON LONELINESS**

Georgia Williams, Phillip Vang, Cindy Kuhrasch (Mentor)

Loneliness is extremely commonplace - everyone faces it in their lifetime. Chronically, it can have serious detrimental effects to your health which range from heightened vulnerability to disease, depression, and premature death, according to existing studies. Some are genetically predisposed to encounter loneliness, and age and personality can vary the intensity. Thus, my partner and I were aiming to explore connections between students' ambitions or academic inclinations and feelings of loneliness (revised scale of loneliness developed by UCLA professor Daniel Russell (1996)), paying special attention to freshman. By surveying several introductory classes at UW, we can examine levels of existing loneliness, which students tend to experience more self-reported loneliness as it relates to intended major, and start a conversation on ways to help those most at risk.

## **ASSOCIATIONS BETWEEN COLLEGE STUDENTS' PSYCHOLOGICAL DISTRESS AND PRESCRIPTION DRUG MISUSE IN DAILY LIFE**

Hannah Witt, Lauren Papp (Mentor)

Although college students with elevated psychological distress may be at risk for prescription drug misuse, current knowledge is based on retrospective, global methods. Overcoming these limitations, we employed ecological momentary assessment to examine whether mental health is associated with the occurrence of prescription drug misuse in daily life. Descriptively, one-third of the sample reported depression symptoms of moderate or severe levels, and one-third of the sample (32.6%) indicated that prescription drug misuse had occurred in daily life. Following preregistration of study hypotheses at Open Science Framework, we will examine associations between psychological distress and prescription drug misuse in daily life. Understanding mental health risk factors for serious prescription medication behaviors during key developmental periods is imperative for informing future research and prevention and treatment efforts.

## **WI LOVE BROWN HEALTH**

Stephanie Woodson, Dr. Susan Andreae (Mentor)

Studies have shown students of color(SOC) attending predominantly white institutions(PWI) experience increased mental health burdens due to daily experiences of discrimination and racism. This study will develop (aim 1) and pretest (aim 2) a wellness program designed to improve physical activity and reduce stress in SOC at UW-Madison. Aim 1, collect data using a purposive and snowball sampling methodology used to recruit stakeholders. Data will be analyzed using thematic analysis. Aim 2, engage various campus organizations to recruit a sample of SOC to pretest the program. A pre-post 1-group study design will be used to assess change in perceived stress and physical activity. A wellness program designed to improve mental and physical health of SOC at PWIs will be pretested for feasibility and acceptability.

## **TRACKING THE UNPRIORITIZED STIMULUS REPRESENTATION IN WORKING MEMORY**

Zengbo Xie, Quan Wan, Brad Postle (Mentor)

Investigating executive function and cognitive control in the brain is one of the most important topics in modern cognitive neuroscience. The attentional prioritization of working memory is one essential component of executive function. For decades, the neural imagining evidence of the prioritized memory item has been traced many times, but there is little knowledge about the unprioritized memory item (UMI) and the neuroimaging evidence of the UMI is not sufficient. In order to uncover the active trace of the UMI, my proposed research will take advantage of the 2-back task as behavioral task for tracing evidence of the UMI. In addition, I will decode the data from electroencephalography (EEG) by using the inverted encoding modeling for more explicit neuroimaging evidence of UMI.

## **ESTABLISHMENT AND BIOLOGICAL CHARACTERIZATION OF A HES CELL LINE WITH CRISPR-INTRODUCED GRAB-NE SENSOR**

Ke Xu, Yunlong Tao, Su-Chun Zhang (Mentor)

Norepinephrine (NE), as a vital neurotransmitter existing in the central nervous system, plays an essential role in many cell regulation processes throughout the brain. Recent work has shown a valuable way to monitor NE transmission status through genetically modified fluorescent GPCR activation-based NE sensors(GRAB-NE) in vivo and in HEK293T cells. This poster works to assess the validity of the GRAB-NE sensor introduced HESC cell lines on detecting the spatial and temporal dynamics of NE signals.

## **INVESTIGATING THE ABUNDANCE OF KEY STEM CELL REGULATOR, SYGL-1, AND ITS IMPACT ON THE FATE SWITCH FROM SELF-RENEWAL TO DIFFERENTIATION**

Mingyu Xue, Judith Kimble (Mentor)

The proper balance between self-renewal of germline stem cells (GSCs) and gamete generation underlies survival of the species. In the nematode *Caenorhabditis elegans*, GSC self-renewal relies on a key stem cell regulator, SYGL-1, and lowering SYGL-1 protein abundance appears to trigger the fate switch from self-renewal to differentiation. Our goal here is to define the threshold of SYGL-1 abundance below which germ cells are triggered to differentiate. Our approach takes advantage of existing mutants with SYGL-1 abundance above or below that threshold. We propose to use genetic crosses to generate an intermediate level of SYGL-1 and thereby identify the minimum level of SYGL-1 required for GSC self-renewal. Identifying that threshold level will be crucial for a molecular understanding the in vivo stem cell network.

## **IMPROVING COMMUNITY FOOD SYSTEMS: HOW DATA CAN HELP**

Mingqi Yan, Alfonso Morales (Mentor)

Farmers market have become an important part of the community that assume important economic and social role. It brings incomes and employment to local farmers and improve diet quality of community members. This project, farm 2 facts, aim to empower farmers market by assisting market with aggregating, interpreting and reporting data that generated during market activities. After farmers market manger collect the needed data for the metrics they selected, farm 2 fact teams generate statistically reliable results that can be used to improve the decision making of the market. With these results, farmers market managers can run these markets in a more efficient way, make the decision that fit the market the most and thus bring greater social and economic benefit to the community.

## **PRESTON LAB**

Ann Yang, Landon Flake, Ann Yang , Daniel Preston (Mentor)

The River Continuum Concept (RCC) is a model for describing changes in abiotic and biotic factors that occur in stream networks. The Preston Lab uses the RCC to test how changes in factors such as land use, primary production, and water quality affect macroinvertebrate communities along a stream continuum. We are also specifically looking at how differences in land use and water temperature regimes between two sub-watersheds affect macroinvertebrate communities in the Willamette River system in Oregon. We process the dip-net samples by sorting all macroinvertebrates from abiotic materials to look at abundance and species richness. The findings of this project will show how changes related to the RCC affect stream macroinvertebrate communities.

## **DESIGNING AND EVALUATING A PAIN INFOGRAPHIC TOOL TO ENHANCE PAIN ASSESSMENT: EXPERT FEEDBACK**

Mai Joua Yang, Maichou Lor (Mentor)

There are no existing graphical pain quality assessment tools for patients with low health literacy. This study's purpose was to evaluate the design of a pain infographic tool. Fifteen experts evaluated 45 different infographics for 13 pain qualities (i.e., burning, throbbing, sharp, dull, numbness, pins and needles, tingling, aching, squeezing, pinching, shooting, cramping, and sore). Responses were analyzed using thematic analysis. Experts provided four common themes to improve the pain infographic designs: (1) making designs more universal, (2) revising designs to be gender-neutral, (3) using action specific designs (e.g., arrow, lines), and (4) deleting body specific designs. Findings highlight that universal designs may improve pain assessments for patients with low health literacy.

## **IDENTIFYING SAPOSIN A PICODISC SYSTEMS IN NEUTRAL PH FOR THE ELUCIDATION OF CRYSTAL STRUCTURES OF SINGLE-PASS TRANSMEMBRANE DOMAINS**

Xinyu Ye, Samuel H. Gellman (Mentor)

Many single-pass transmembrane domains (STMD) play important biological roles as cell surface receptors, which would transduce cellular signals after oligomerization and conformational change. However, there is very few crystal structures of STMDs in protein data bank (PDB) because of their hydrophobicity which is hard for crystallization and their small size which is hard for cryo-EM. Previous literature has demonstrated that the formation of stable Saposin A (SapA) picodiscs with detergent LDAO would mimic cell membrane environment to encapsulate STMDs, but the determination of the picodiscs' crystal structure in LDAO system requires acidic pH, which is not ideal for the encapsulation. This project aims to identify systems that would assist SapA picodisc crystallization in neutral pH to furtherly facilitate STMDs insertion for their structural elucidation.

## **QUANTITATION AND LOCALIZATION OF CRUSTACEANS HYPERGLYCEMIC NEUROPEPTIDES UNDER HYPOXIA CONDITIONS USING MASS SPECTROMETRY**

Simon Yen, Lingjun Li (Mentor)

Hypoxia (i.e., low oxygen levels) poses an environmental challenge for numerous aquatic species, including crustaceans. Ambient oxygen deficiency causes fatigue and decreased glucose metabolism, which may lead to neurological impairment. Within the nervous system, neuropeptides are the most diverse class of signaling molecules; however, their roles in regulating physiological response to hypoxia stress are poorly understood. The crustacean hyperglycemic hormone (CHH) neuropeptide superfamily consists of a group of neuropeptides that are involved in metabolic control and homeostasis. To understand neuropeptide dysregulation, we targeted hyperglycemic neuropeptides within a hypoxia model system. The development of mass spectrometry (MS)-based methods to probe CHH dynamic changes and localization patterns in response to hypoxia stress would provide insight into nervous system modulation of hypoxic stress and metabolism.

## **DESIGN RECOMMENDATIONS FOR CONSUMER HEALTH INFORMATION TECHNOLOGY FOR INFORMAL CAREGIVERS**

Laura Younan, Nicole Werner (Mentor)

6 million persons with dementia (PwD) in the U.S. receive a majority of their care from informal caregivers. Caregivers are often over-burdened and under-resourced which often leads to negative outcomes such as stress, burden, and burnout. While many interventions have aimed to reduce caregiving burden, few have been successfully adopted. The objective of this study was to use human factors engineering to extract design recommendations to inform the development of interventions for informal caregivers. We conducted a literature review and cognitive walkthroughs with 5 dementia care specialists using a prototype designed to support caregivers in the documentation, communication and coordination of care. A thematic analysis revealed that simple language, salient pathways, and rapid accessibility are necessary for caregivers' acceptance of interventions.

## **REAL OR UNREAL? CONTEXTUAL FACTORS THAT INFLUENCE PRESCHOOLERS' REALITY JUDGEMENT OF TV CHARACTERS.**

Yvonne Yu, Ivy Chen, Heather Kirkorian (Mentor)

Preschoolers watch about two-and-a-half hours of TV a day, and we were curious about how children perceive the TV characters. The purpose of this study was to examine the relationship between children's reality judgement of a TV character, and frequency of TV viewing and parent TV mediation. Parents reported how often their child watches TV at home and how often they mediate their child's TV viewing. Children's reality judgement of a novel TV character was measured by asking whether the character is real. We expect children's reality judgement of the character to be positively correlated with TV viewing and negatively correlated with parental mediation. This study will provide an insight into how contextual factors influence children's reality judgement of TV characters.

## **EXTERNAL BEAM RADIOTHERAPY ENHANCES EFFICACY OF CPG-OLIGODEOXYNUCLEOTIDE AND ANTI-OX40 IN AN IMMUNOLOGICALLY COLD TUMOR MODEL**

Luke Zangl, Ravi Patel (Mentor)

Intratumoral CpG, a TLR9 agonist, and anti-OX40 antibody, a T cell costimulatory molecule activator, elicit potent anti-tumor effects in an immunogenic murine lymphoma model, however not in a poorly immunogenic one. The addition of EBRT to an intratumoral CpG/OX40 regimen results in a noticeable improvement in tumor regression and significantly increases survival in a poorly immunogenic melanoma model. EBRT increases total tumor infiltrating (TIL) population and within this population is an increased proportion of Treg cells. CpG/OX40 reduces Treg populations to a similar degree when acting both with and without EBRT. EBRT upregulates OX40 expression on Treg cells leaving this population susceptible to anti-OX40 effects. CpG/OX40 invokes an increase in Thelper / Treg proportion.

## **REPRESENTATIONS OF PHYSICIAN PERCEPTIONS OF MINDFULNESS IN BLOGS**

Sarah Zarvan, Megan Moreno, Bradley Kerr (Mentor)

Burnout affects 44% of physicians, but its effects can be mitigated through mindfulness practice, resulting in improved job satisfaction and patient care. Physicians' perceptions of mindfulness remain understudied. Discussions from physician blogs, used by 25% of physicians, may help address this research gap. This study aimed to understand physician perceptions of mindfulness portrayed in blogs. A popular medical blog hub, KevinMD, was used to obtain relevant physician blogs under the search term "mindfulness." Investigators used the constant comparative method to identify themes in the data. Understanding physician perceptions of mindfulness may inform integration of this practice into modern, Western medicine.

## **THE RELATIONSHIP BETWEEN CARDIORESPIRATORY FITNESS AND CEREBRAL BLOOD FLOW**

Niklaus Zeller, Jill Barnes (Mentor)

Habitual exercise is recommended to prevent or delay cognitive decline. Furthermore, higher cerebral blood flow (CBF) is associated with a lower risk of Alzheimer's disease (AD). Acute exercise increases CBF. It is unclear if higher cardiorespiratory fitness, as a result of regular exercise, leads to chronically elevated CBF. The purpose of this study was to examine a possible linear relationship between cardiorespiratory fitness (VO<sub>2</sub> max) and global CBF. Two groups, young (18-35y) and older adults (55-75 y), underwent a maximal exercise test to determine VO<sub>2</sub> max and a 4D flow MRI scan to determine global CBF. We hypothesized that individuals with a higher VO<sub>2</sub> max will have a higher global CBF.

## **THE IMPACT OF DRAMA GAMES ON EXECUTIVE FUNCTION DEVELOPMENT FOR PRESCHOOL STUDENTS**

Maya Zent, Riley Knueppel, Olivia Haessly, Katherine Norman (Mentor)

This study asks how and if common childhood practices such as gameplay and make-believe have an effect on executive functioning. Executive Functioning is an umbrella term for a collection of foundational cognitive skills incorporating Working Memory, Inhibitory Control, and Cognitive Flexibility. Early childhood capacity in these domains is a reliable predictor not only of school readiness but of long-term academic achievement and positive life outcomes. Based on prior research, adult-guided make-believe is defined as drama and this study has partnered with seven early childhood centers. In the preschools we work with three to five-year-old classrooms, implementing sixteen drama sessions. Pilot data has yielded significant outcomes in the effects of our drama sessions and increased executive functioning skills compared to control groups.

## **VERTICAL MOTION PROFILES OVER LAND COMPARED TO OCEAN**

Warsa Zerome, Larissa Back (Mentor)

Convection and vertical motion in the atmosphere are important to understand weather and climate. The purpose of the research project is to study convection by examining vertical motion profiles over land in the Intertropical Convergence Zone (ITCZ). This is done using principal component analysis on reanalysis data from ERA-Interim to create vertical motion profiles displaying empirical orthogonal functions (EOFs). The ratio of EOFs with the two largest variances can be translated to a map showing vertical motion top-heaviness in the Tropics. Top-heaviness describes the location of where vertical motion peaks in the atmosphere. The second half of the project is to compare profiles and maps over land to the ocean to determine the land-ocean relationship of vertical motion and why this relationship exists.

## **EVOLUTIONARY GENETICS OF ALPINE INSECTS**

Carolina Zhagnay, Sean Schoville (Mentor)

Over the course of evolutionary time, organisms have descended from a common ancestor into diverse groups of species. An interesting example are the rare and poorly studied ice crawlers. These insects are often found in cold areas, in mountains, under rocks, in forests, and in caves. They feed on frozen insects found on the surface of snowfields. It is unclear how many species exist, how they diversified through time, and what areas harbor endemic species. To help understand how they evolved, I use genetic data to reconstruct the relationships of new specimens compared to known species. I show that there are likely several new species that are new to science. We can use this information to help conserve these insects and their environment.

## **EXPLORING THE EXTREME OUTLIER HYPOTHESIS OF GERRYMANDERING**

Seanna Zhang, Matthew Karrmann, Jordan McWilliams, Ian Gordon Mark, Lorenzo Najt (Mentor)

Gerrymandering is a tactic for favoring one political party by manipulating electoral districts' boundaries. Through this project, we hope to better understand how different drawings of district boundaries will affect voting outcomes in a state. A recent approach to determine gerrymandered plans is ensemble methods, which involve sampling a large number of possible districting plans and classifying the outlier as a gerrymandering plan in the resulting distribution. This project empirically tests the Extreme Outlier Hypothesis, which states that all sampling methods will classify the same districting plans as gerrymandered. By using software to incorporate voting data with an ensemble of maps, we analyze how the classification of a plan is dependent upon the choice of algorithms and parameters.

## **UNDERSTANDING ANTIBIOTIC RESISTANCE IN BACTERIA FROM WHOLE-GENOME SEQUENCES**

Zhaoyi Zhang, Aryan Adhlakha, Lareina Liu, Claudia Solís-Lemus (Mentor)

Traditional methods such as direct association have been used to predict antibiotic resistance. However, they are not ideal for predicting phenotype, due to the complex relationship between genotype and phenotype. The current project aims to predict bacterial antibiotic resistance based on whole-genome sequences of *Pseudomonas* and *Staphylococcus* utilizing statistical and machine learning models. Missing nucleotides are inferred by multiple imputation methods to offset sequencing errors. A phylogenetic tree is built from distance matrices for each bacteria as the reference for generating data to augment the small data sets. Then the sequences are used to train both simple and complex models to predict resistance. The model parameters can be used to identify resistance-related genetic loci for the purpose of designing effective antibiotics.

## **APPLICATION OF FOURIER ANALYSIS TO THE DESIGN OF BRANCH PREDICTORS**

Megan Zhang, Mikko Lipasti (Mentor)

As computer architects are continuously refining the design of modern high-performance processors, the goal of developing processors that are faster, smaller, and consume less power than previous generations remains unchanged. This research project aims to develop an algorithm that increases branch prediction accuracy; its effectiveness is evaluated in terms of improving performance and lowering costs. The enhancement is based on the state-of-the-art TAGE branch predictor, to which an additional algorithm that applies Fourier analysis is added. The prediction accuracy of TAGE is improved because the procedure for predicting results of branch instructions, that have a long history but with no easily discernable outcome patterns, is aided by Fourier analysis.

## **QUANTIFYING INTERACTIONS OF POLYETHYLENE GLYCOLS (PEG) WITH PROTEIN FUNCTIONAL GROUPS USING VAPOR PRESSURE OSMOMETRY**

Keer Zhao, Irina A. Shkel (Mentor)

Polyethylene glycols (PEG) are widely used to stabilize and crystalize proteins and to solubilize aromatic compounds including pharmaceuticals. From studies of interactions of PEG 200 with various model compounds displaying multiple functional groups, Record's lab developed a way to approach this. I propose to test this approach by determining the preferential interactions of PEG400 with the same model compounds studied previously by using Vapor Pressure Osmometry (VPO). Then I can obtain the free energy derivatives which quantifies the effect of model compound concentration on the PEG chemical potential. I will compare my results with predictions based on PEG200, and use this information to refine previously-determined interaction strengths. The result of this can be used to better predict chemical effects of PEG on various protein processes.

## **IMPROVING THE PRODUCTION OF TERPENES BY RECOMBINATION OF 1-DEOXY-D-XYLULOSE 5-PHOSPHATE SYNTHASES**

Haiyang Zheng, Philip Romero (Mentor)

1-Deoxy-D-Xylulose 5-Phosphate Synthase (DXS), a rate-limiting enzyme involved in methyl-D-erythritol 4-phosphate (MEP) pathway, plays a crucial role in the biosynthesis of terpenes. To remove this metabolic bottleneck for high production, it is necessary to improve activity of DXS. The covarying residues were inferred by machine learning and applied to algorithm to find the breakpoints for protein recombination. To construct the chimeric library, DXS from *Escherichia coli*, *Zymomonas mobilis*, *Bacillus subtilis*, and *Populus trichocarpa* were selected. By coupling the high-throughput assays with the third-generation sequencing, the sequence abundance of chimeras was used to train the statistical models for prediction of protein solubility and enzyme activity. A short list of chimeras predicted with high activity and solubility will be selected and characterized.

## **EXPANSION OF CAMPUS FOOD SHED**

Elaine Zheng, Grace Puc, Kavya Ayalasomayajula, Irwin Goldman (Mentor)

The U.S. Department of Agriculture estimates that about 30-40% of food in the United States is wasted. Additionally, studies report that up to 59% of college students may be food insecure. Although many food pantries are available, fewer programs provide nutritious, fresh produce. Our project aims to bridge this gap between food waste and food insecurity by creating a partnership with local grocery stores and university farms to donate leftover produce to college students, free of charge. Through the use of social media, student workshops, and educational networking, we were able to create community interest in our topic while reducing the stigma of food insecurity. We currently aim to spread our model to other universities in order to have an impact in communities across Wisconsin.

## **CULTURAL INFLUENCES ON EMOTION AND PERFORMANCE DURING A STRESSFUL TASK**

Hairu Zheng, Yuri Miyamoto (Mentor)

Previous studies have suggested that how stress influences us depends on how we perceive stress. Reappraising stress as a challenge and a coping strategy to solve the problem can weaken the affect-health link and even improve our cognitive functioning and performance. Recent research shows that the valuation of emotions varies culturally. Specifically, East Asians value negative emotions more positively than Americans do. However, few studies have studied whether negative emotions influence performance similarly across cultures. In the present study, I aim to investigate whether the emotions expressed under a laboratory stressor task influence performance differently in East Asians and European Americans. Facial Action Coding System is employed to code emotion expressions of participants. I plan to bring preliminary analysis to the Undergraduate Symposium.

## **EFFECTS OF L2 LANGUAGE EXPOSURE AND CURRENT LANGUAGE CONTEXT ON ADULTS' OBJECTS CATEGORIZATION AMONG MANDARIN-ENGLISH BILINGUALS**

Wenqi Zhou, Yi Tong, Melina Knabe, Alexis Hosch, Haley Vlach (Mentor)

Previous research demonstrates that Mandarin-speakers make more shape-based categorizations than English speakers. Moreover, reliance on shape decreases with more English (L2) exposure. Researchers have not examined how testing language influences this relation. Thus, the current study examines the effects of L2 language exposure and current language context on adults' object categorization. English monolinguals and Mandarin-English bilinguals will view sixteen sets of common objects. Each set contains a target object and two objects that match the target in shape or function. Participants will select the object that is most similar to the target object. We hypothesize that bilingual participants will make more shape-based choices than monolinguals. Among bilinguals, we expect that lower L2 proficiency and being tested in Mandarin will lead to more shape-based choices.

## **USING A PEPTIDE INHIBITOR OF FIBRONECTIN MATRIX ASSEMBLY AND LUNG FIBROSIS**

Terry Zhu, Ksenija Bernau Phd, Jonathan Leet, Nathan Sandbo (Mentor)

Idiopathic Pulmonary Fibrosis (IPF) leads to the death of more than 40,000 individuals in the US annually. Given that the cause of IPF is unknown, the search for a treatment is urgent. Extracellular matrix (ECM) is a combination of collagen, enzymes, and proteins, and an excess amount of ECM leads to scarring of lung tissue, and therefore, fibrosis. We treated mice with saline or bleomycin to induce fibrosis. Three days after we induced the mice, we started a daily treatment with PEG-FUD or PEG-mFUD. We monitored the mice for 14 days then collected the lung tissue and analyzed the collagen content. We concluded that there was a reduction in collagen in the bleomycin and PEG-FUD treated mice compared to the PEG-mFUD treated mice.

## **DEVELOPMENT OF SMARTPHONE SOFTWARE PLATFORM AND ELECTRONIC SURVEY TO STUDY CHRONIC HEADACHES IN HYDROCEPHALIC PATIENTS TREATED WITH VENTRICULO-PERITONEAL SHUNTS**

Kyle Zielinski, Bermans J Iskandar (Mentor)

Hydrocephalus is a neurological condition characterized by excessive production of cerebrospinal fluid (CSF) in the ventricles of the brain which may lead to short and long-term complications such as mechanical failure, infections, and chronic headaches. The ventriculo-peritoneal (VP) shunt is the most common treatment for hydrocephalus, yet it has a failure rate of 40-50% within 2 years of placement. Many adolescents and adults who grow up with a VP shunt develop severe, debilitating, intractable headaches. Therefore, we propose to design and implement a smartphone application that will survey the symptoms of patients' headaches across multiple populations in real-time to establish the true prevalence and characteristics of headaches in shunted individuals for the purpose of improving clinical care and developing novel treatment paradigms.