



Undergraduate
SYMPOSIUM

FRIDAY, APRIL 12



ABSTRACTS 2019

We are very pleased you are joining us for the 21st Annual Undergraduate Symposium at the University of Wisconsin–Madison. Our university proudly honors its multifaceted mission of leading edge knowledge discovery and quality undergraduate education. The two meet in the Undergraduate Symposium. Our 21st year is an extraordinary milestone demonstrating our steadfast commitment to providing a Wisconsin Experience to our undergraduate students and the continual initiative they bring to their pursuit of new knowledge.

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

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A special thanks goes to Stephanie Diaz de Leon of The Wisconsin Union; Jay Ray and Crague Cook at College Library; Mandy Morrow at DesignLab; Jeff Crucius and Steve Devoti of the Division of Information Technology; and College Library Computer & Media Center.

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HEALTH HABITS AMONG PARENT-CHILD DYADS IN A PEDIATRIC FITNESS CLINIC

Alex Abts, Cassandra Vanderwall (Mentor)

Caregiver-child dynamics can have a strong influence on a child's health given the caregiver's role. A multiracial sample of patients (9–18y) and their caregivers engaged at the Pediatric Fitness Clinic [PFC] were distributed a Healthy Habits Questionnaire at the initial visit. The HHQ encompasses questions related to nutrition, activity, readiness and awareness. Survey responses were compared by respondent (caregiver vs. patient) to examine the differences in self-reported health information within families. The Wilcoxon Signed Rank test was used to analyze the responses; significance was based on a p-value < 0.05. Preliminary findings include that self-report within families for health-related habits are not significantly different. These findings will contribute to understandings related to how family dynamics influence weight-related habits in childhood.

EFFECTS OF KETOGENIC DIETS ON BLOOD SODIUM LEVELS IN PATIENTS WITH EPILEPSY

Tanushree Adya, Elizabeth Felton (Mentor)

Hyponatremia (low blood sodium levels) has been noted to occur in patients on oxcarbazepine (OXC) and carbamazepine (CBZ). The purpose of this study is to determine whether patients with epilepsy (PWE) on these medications are more likely to experience hyponatremia when starting a ketogenic diet (KD). A retrospective chart review was conducted of PWE on a KD. Within 6 months of starting KD therapy, results showed a significant decline ($p=0.001$) in patient's blood sodium levels. We conclude that the KD therapy could make patients more susceptible hyponatremia, as this diet requires increased fluid intake. It is recommended that sodium levels may need to be monitored frequently for PWE when they start KD.

CHARACTERIZATION OF THE EFFECTS OF ORF73 IN VITRO ON THE BACTERIOPHAGE LAMBDA'S PROMOTERS

Madeline Akbari, Richard Gourse (Mentor)

Escherichia coli generally contain an F-plasmid that is involved in conjugation. The transfer region on the plasmid contains genes involved in producing the structural components of the DNA transport system. TraR is a unique protein encoded in this region, which, when expressed, binds to RNA polymerase and negatively regulates ribosome biosynthesis and may also upregulate membrane damage repair pathways. The transfer region has four promoters that regulate the transcription of these transfer genes and we discovered that TraR increases transcription at these promoters. We then tested the effects of the TraR homolog, Orf73, from bacteriophage Lambda on Lambda's own promoters to determine if similar small proteins from other organisms have the same effects on transcription.

EXPANSION OF CANINE NATURAL KILLER CELLS FOR IMMUNOTHERAPY OF SOLID TUMORS

Adeela Ali, Matthew Forsberg (Mentor)

Children with metastatic solid tumors do not have effective treatments and have a poor prognosis. One way to improve current therapies is to use animal models that mirror the natural progression of these cancers. Pet dogs present with high rates of spontaneous osteosarcoma (OSA) that mirror disease in humans. In this study, we aim to improve treatment of canine OSA by adoptively transferring activated natural killer (NK) cells. We will stimulate and expand healthy canine NK cells ex vivo using interleukin (IL)-2, IL-21 and feeder cells expressing CD137 ligand. We will then characterize the NK cells by flow cytometry and then perform a cytotoxicity assay against a series of canine OSA cell lines. Our results will inform future developments of immunotherapy for pediatric solid tumors.

END OF LIFE ISSUES IN THE LGBTQ COMMUNITY: A REVIEW OF THE LITERATURE

Elizabeth Alleman, Kristen Pecanac (Mentor)

The purpose of this study was to review current literature on end-of-life care for the LGBTQ community and identify best practices and areas for further research. There are 2.4 million LGBT individuals in the US over age 65, who will have increasing healthcare needs, particularly at the end of life. We conducted a literature search of major databases and included 35 articles in our review. Most studies revealed a lack of familiarity among the healthcare workforce for LGBTQ end-of-life needs, especially for transgender patients. Current best practices indicate the need for healthcare facilities and health sciences curricula to ensure training of the healthcare workforce to implement inclusive, intersectional practices, yet more research is needed to effectively identify and address end-of-life needs of LGBTQ patients.

SURVEY OF RACIAL DISPARITIES IN MADISON

Darion Allen, Bianca Baldrige (Mentor)

Madison, Wisconsin, is ranked among the top cities in the nation in educating white youth while it is second to last for black youth. That being said, this study explores how conversations about racial disparities manifests in contexts where progressive ideas are openly expressed despite racial and structural inequities challenging such ideas. The importance of this research lies in its focus on the systematic racial and economic structures rather than the intrapersonal interracial interactions. The process of the study includes the historical mapping of racial discourse, interviews with community-members, and focus groups consisting of the black youth of the communities. There is hope that this survey will examine the processes community-based educational spaces develop to assist black youth in understanding racial disparities and educational opportunity.

THE INFLUENCE OF HIDDEN CURRICULUM ON ACADEMIC SUCCESS

Rachel Alsbury, Oona-Ife Olaiya, Janean Dilworth-Bart (Mentor)

"Hidden curriculum" refers to the unwritten and unintended lessons and values students learn in school (Alsubaie, 2015). These expectations and social processes, often perpetuated by teachers, reinforce social inequities, which influences how students perform within the classroom. The purpose of this research is to understand how a teacher's expectations toward male African American students impacts one's ability to succeed. Through secondary analysis of STAR data, I aim to bring awareness to an issue that influences the life trajectory of these students. Through awareness and acknowledgment, teachers can be purposeful in changing the expectations they have for their male African American students, resulting in higher school achievement. Furthermore, this heightened awareness will promote the development of policies and curriculum that supports a more equitable learning space.

COOPERATIVE VISUALIZATIONS: THE INTERSECTION OF SPATIAL SKILLS AND NONVERBAL COLLABORATION ON DEVELOPING CHEMISTRY INTUITION

Briana Alvarez, Martina Rau, Lydia Nyachieo, Briana Alvarez, Miranda Zahn (Mentor)

Extant research has shown that high spatial skills promote learning in STEM domains that represent concepts visio-spatially. The present study explores the interaction of spatial skills and chemistry learning methods. Following a spatial skills assessment, students used ChemTutor, an online program that presents chemistry problems using multiple visual representations. Students worked collaboratively on initial problems and were then randomly assigned to work independently or collaboratively (via gestures) on fluency problems that aim to increase students' chemistry intuitions using nonverbal cognitive processes. Student learning gains between pre- and post-tests were used to assess the effectiveness of conditions. Preliminary analyses reveal that students with low spatial skills demonstrated more learning gains when collaboratively solving fluency problems. Implications for supporting students based on needs will be discussed.

SEED PREDATION IN TALLGRASS PRAIRIES CHANGES THROUGHOUT THE YEAR AND IS AFFECTED BY LITTER COVER

Genevieve Anderegg, Ellen Damschen, Jonathan Henn (Mentor)

Tallgrass prairie is one of the most threatened habitats in the Midwest, with less than 1 percent of original native prairie remaining. Small mammal seed predators are important aspects of these communities, as they influence plant recruitment and structure by consuming seeds and plant matter. We seek to measure the impact of management decisions like burn timing and mowing on rodent seed predation in restored tallgrass prairies. Seed predation was quantified in monthly trials with a giving up density model in plots that were subjected to either a spring burn, fall burn, fall mow, or unmanipulated control to alter plant litter levels. Burning and mowing resulted in significant reductions ($p < 0.001$) of seed predation during times when seed predation was otherwise very high in the control plots.

INVESTIGATION OF THE ENZYMES REQUIRED FOR L-SERINE BIOSYNTHESIS IN MYCOBACTERIUM TUBERCULOSIS

Thomas Anderson, Thomas Anderson, Hazel Holden (Mentor)

Tuberculosis, one of the world's deadliest diseases, is caused by the bacterium *Mycobacterium tuberculosis*. The World Health Organization reported that 1.7 million people died from tuberculosis in 2016. As the amount of multidrug-resistant strains of this organism increases, the need for new ways to combat this disease has increased as well. A common technique in countering diseases is to attack key biosynthetic enzymes within the disease-causing bacteria. The enzymes of interest in my research are Rv2996c, Rv0884c, and Rv3042c. These enzymes are utilized by *M. tuberculosis* for the biosynthesis of *L-serine*. The goal of my research is to learn more about these enzymes through X-ray crystallographic analyses. The knowledge gained from the structure of these enzymes could be used for drug design.

THE EFFECT OF PH AND ANTIMICROBIALS ON THE GROWTH AND SURVIVAL OF LISTERIA MONOCYTOGENES IN A HIGH MOISTURE MODEL CHEESE.

Kory Anderson, Kathleen Glass (Mentor)

High-moisture, low acid cheeses have been known to support the growth of *Listeria monocytogenes* during refrigerated storage due to post-process contamination. Recognized as clean label ingredients, bacterial fermentates present the opportunity to inhibit the growth of *L. monocytogenes* in ready-to-eat foods. The purpose of this study was to determine the effectiveness of a commercial bacterial fermentate to prevent the growth of *L. monocytogenes* in soft model cheeses at different acidities. Addition of fermentate showed to have inhibitory properties of *Listeria* in low acid cheeses (pH 6.0-5.25) compared to controls. This data suggest clean-label fermentates may have anti-listeral properties in the formulation of soft cheeses, thus having the potential to be an effective hurdle in preventing growth of *Listeria monocytogenes*, enhancing safety for the consumer.

CONNECTED AND AUTONOMOUS HIGHWAY SYSTEMS

Siddharth Aneja, Yang Cheng, Bin Ran (Mentor)

In 2017, there were around 40,000 deaths related to traffic accidents in the United States alone. An autonomous roadway system where every aspect is in communication with each other is the backbone of this project. We are working to achieve this grand scheme of things by working on a virtual simulation in VISSIM to consider variables that affect the working of such an automated system. The next stage of the project is to build a small real-life connected highway in Racine, Wisconsin, to test the extents to which our simulations are accurate in predicting the behavior of vehicles and the environment. A connected and autonomous highway may reduce deaths due to accidents and negligence, promote a sustainable future and make commute efficient in the future.

ANALYZING MIDDLE SCHOOL STUDENTS' LEARNING IN SCIENCE

Emerson Ankenbauer, Sadhana Puntambekar (Mentor)

This investigation focuses on evaluating a series of final written reports from local middle school students in a "Growing Healthy Plants" unit. Students are presented with the dilemma of our world's food crisis and asked to design a method of growing healthy plants as efficiently as possible. We developed a coding scheme of the most important science ideas that students needed to learn and coded the final reports. The scores were then categorized by each individual teacher, class, and student. This data is currently being analyzed for the purpose of identifying patterns in students' comprehension in certain topics and environments. These results may provide insight into improving effectiveness of middle school science classrooms and future learning experiences.

UNION RIDES: HARNESSING THE SHARED VALUE OF COMMUTE TRAVEL

Agalia Ardyasa, Carey McAndrews (Mentor)

Founded in 1979, Union Cab operates the largest taxi fleet in Madison. However, Union Cab faces new forms of competition since transportation network companies (i.e., Uber and Lyft) entered the Madison market. Through this research, we are seeking to enter a new market: non-drivers and zero-car household in rural places in Dane County, who are struggling to find jobs due to low accessibility and limited transit options. By negotiation-based collaboration planning between Union Cab and anchor institutions, we are piloting a new ride-share service that connects underserved workers with jobs in an affordable, flexible and demand-responsive manner. As this project serves the best interest of different stakeholders: Union Cab, underserved workers, and anchor institutions, surely increasing the welfare of Dane County as a whole.

EXPLORING RELATIONSHIPS BETWEEN ENVIRONMENTAL POLLUTANTS AND CHILD DEVELOPMENT

Joana Arengo, Janean Dilworth-Bart (Mentor)

The purpose of this review is to examine associations between environmental pollutants and health disparities. Previous research shows that children who live in low-income areas are at a higher risk of exposure to environmental pollutants. Furthermore, extended exposure to environmental pollutants is associated with central nervous system diseases. It is essential to address environmental health disparities to decrease the detrimental effects of environmental pollutants, especially in children during their critical period of development. Through extensive literature reviews, we seek to identify inconsistencies within existing research and to find areas where additional research is needed. This review will help increase the understanding of the relationships between air pollution, health disparities, and child development.

AN EXPERIMENTAL STUDY OF GLACIAL SLIDING

Laura Arneson, Lucas Zoet (Mentor)

The discharge of glacier ice into the ocean is a primary component of sea level rise. Providing accurate models of glacial slip has been shown to be increasingly important for predicting this contribution. How glaciers slip over and deform sediments at the base (till), however, is not well understood. We examined till deformation in the framework of rate and state dependent friction using an experimental apparatus. Tills with a range of grain size distributions were sheared in velocity-stepping and slide-hold-slide tests to gather friction behavior. Friction values were then analyzed to determine velocity weakening or strengthening properties and frictional healing capabilities. Preliminary experiments indicate velocity strengthening. These results describe material properties of till across many compositions and provide insight into the stability of sub-glacial sliding.

BUILDING HEALTHY COMMUNITIES THROUGH COMMUNITY-BASED PARTICIPATORY RESEARCH

Harleen Arora, Amy Hilgendorf (Mentor)

Transform Wisconsin was a project funded by the CDC in 2012 to build healthy communities in 25 different counties throughout the state. Unfortunately, the funding for the project ended abruptly in 2014. We're emailing a survey to former healthy community connectors to learn about whether their efforts continued after funding ended, and to ask them if they'd like to participate in a focus group to gain further understanding of the project's impacts. We hope to find out which coalitions are still successful and how they are continuing to improve the health of their communities. We're particularly interested in healthy eating and active living efforts and plan to use knowledge gained from the focus group to help improve the sustainability of future coalitions doing this work.

LENGTH OF PARENT-CHILD SEPARATION DUE TO PARENTAL INCARCERATION IN RELATION TO CHILD BEHAVIORAL PROBLEMS IN SCHOOL

Andie Asher, Julie Poehlmann-Tynan (Mentor)

Upwards of 5 million children have an incarcerated parent in the U.S., more than any other country in the world (Murphy & Cooper, 2015). Little research has been done regarding how this separation is associated with children's behavior in school. As part of a larger study focusing on young children of jailed parents, this analysis will focus on the length of time a child has been separated from a parent due to incarceration and the behavior problems that children exhibit in school. I will examine teacher/care provider report data on 44 children, aged 2 to 6 years. I hypothesize that the longer a child has been separated from their incarcerated parent, the more internalizing and externalizing behaviors they will demonstrate in school.

MODIFICATION OF THE PARENT-CHILD EARLY RELATIONAL ASSESSMENT TO REPRESENT FAMILIES OF CHILDREN WITH AUTISM SPECTRUM DISORDER.

Madeline Attewell, Karla Ausderau (Mentor)

Core characteristics of an individual with autism can interfere with the parent-child interaction in a family context. One tool being used to code the quality of affect and behavior in parent-child interactions is the Parent-Child Early Relational Assessment (ERA). This tool was developed for families in high-risk settings for determination of early relational disturbances among parents and children. However, interactions between parents and children may function differently with characteristics presented in children with autism. Item analysis of variables in the ERA was completed to review item performance in children with autism. This was done to determine what specific coding variables within the ERA may be beneficial to be reverse coded to better describe the characteristics present in parent-child relationship in families of children with autism.

ROLE OF CITY PLANNING IN EARLY STATE-LEVEL SOCIETIES

Emma Axelrod, Nam Kim (Mentor)

In this research paper, I plan to focus on the architecture of Harappa (in modern day Pakistan) and Shimao (in China). Specifically, I will analyze how city planning was utilized to assert power in ancient civilizations. I will seek to answer this question: what role did city layout have in controlling and stabilizing a population? In order to answer this question, I will look at works presented by Professor Kenoyer and his colleagues that have worked in Harappa, and chronicles of Shimao in journals put forth by Li Jaang, Zhouyong Sun, and their collaborators. To make my research clear, I have organized the paper by type of power: political, physical, ideological, and economic. City planning played a unique role in each of these subcategories.

MARMOSSET TOY PREFERENCE

Kavya Ayalasomayajula, Atulya Reddy, Peter Pierre (Mentor)

Marmosets (*Callithrix jacchus*) express manipulative behaviors during foraging, exploring the environment, and during social interactions. Previous literature suggests psychological well-being of the animals in a captive environment is promoted by simulating aspects of the natural environment, such as by providing toys that allow the animals to engage their curious and interactive capacities. In this study we aimed to determine if marmosets prefer to interact with stable environmental elements as previously reported. We placed two identical wooden-block toys (stable or movable) in the enclosure. Next, we developed a coding scheme to measure toy preference. Our results will inform future choices for environmental enrichment strategies and allow us to maximize options that invite and sustain behavior.

ENHANCING TREATMENT OPTIONS FOR PATIENTS WITH NEUROENDOCRINE TUMORS

Christopher Babiarz, Dustin Deming (Mentor)

Neuroendocrine tumors (NETs) are among the most understudied human cancer types. Research into the genetics of NETs have shown that mutations in the mTOR/PI3K pathway are present (15%). Everolimus is an mTOR inhibitor that is a current standard of care drug to treat NETs. The objective of this study is to determine the response of NET spheroids when treated with everolimus in combination with the pro-apoptotic agent ABT263. Spheroids derived from human patient biopsies will be developed and treated with everolimus, ABT263, and the combination in order to determine efficacy by measuring the median spheroid diameter changes and change in metabolic imaging parameters. In addition, we will assess changes in the immune microenvironment in NETS by measuring the rate of proteolysis of versican (VCAN).

MAP1B OVEREXPRESSION LEADS TO DENDRITIC COMPLEXITY DEFICITS IN PRIMARY HIPPOCAMPAL NEURONS

Samantha Baker, Michael Stockton (Mentor)

The Map1b gene encodes for microtubule associated protein 1B (MAP1B) that is expressed in neurons. MAP1B plays a major role in microtubule assembly, neuron growth, and synapse development. Map1b has been implicated with neurological disorders and Map1b-KO neurons show structural presynaptic deficiencies. However, little is known about the effects of Map1b overexpression in neurons. To answer this question, we designed a CRISPR-Cas9 system to overexpress Map1b in primary neurons isolated from mouse hippocampus. We found that overexpression of Map1b led to dendritic complexity deficits in mouse primary hippocampal neurons. Therefore elevated levels of Map1b may impair neuronal development.

HOW DIFFERENT ETHNICITIES LEARN

Jaskaran Bakshi, John McGinty (Mentor)

We introduce three different ways of teaching Euler's Theorem to examine which method is the most successful for learning the concept. The purpose of this study is to understand the way objects, symbols, and icons influence the learning of Euler's Theorem for students at the University of Wisconsin-Madison. At this stage in the research, teaching Euler's Theorem through objects, symbols, and icons will be generally defined by the combination used during instruction. My research question is: What is the effect that ethnicity has on learning when using different instructional methods that include objects, symbols, and icons? My hypothesis is that someone from an Asian ethnical background will have higher learning outcomes when using symbols to grasp a concept because of their cultural background.

PEOPLE OVER POLITICS: ARTICULATING RESISTANCE WITHIN CLIMATE JUSTICE MOVEMENTS

Vic Barrett, Heather Owens, Marina Kelly (Mentor)

Grassroots movements throughout time have been built on being able to articulate their struggles and motivations for resistance. Political processes cannot do this as readily due to the rigid structures of institutionalism and bureaucracy, but are charged with the challenge of creating the framework for peoples livelihoods. Social movement art (including banner drops, puppetry, the production of protest signs) has filled the gap of articulating lived experience where words and policy simply cannot. In this project I will be exploring different mediums of art in political movements and the implications of artistic involvement in pushing social change.

SHOULD YOU TURN THE LIGHTS OFF IN THE BATHROOM?

Jacob Bartelt, Cathy Middlecamp (Mentor)

This project explores the difference in return on investment (ROI) and energy savings between two lighting options for Slichter Residence Hall bathrooms. I will gather data on current lighting (i.e., wattage amount, lifetime of bulbs, usage hours), then assess the costs as well as the ROI of each option (i.e., labor and material costs, wattage and lifetime of new bulbs). By comparing the benefits and drawbacks of installing motion sensor lights versus installing new, high-efficiency lighting, I will make an informed decision on which option is more cost-effective for University Housing.

THE EFFECT OF VARYING CONCEPT REPRESENTATIONS ON LEARNING

Michael Bartley, John McGinty (Mentor)

The purpose of this qualitative study will be to discover the effects of various representations of geometric concepts for college students at the University of Wisconsin–Madison. At this stage in the research, the concept representations will be generally defined as symbol, icon, and/or object activities while attempting to understand Euler’s geometric theorem. The experimenters will answer the following question: How do college age students use symbols, icons, and objects to initiate learning? Based on scientific literature and the data we will collect, we predict the students who receive a higher variety of concept representations will learn most effectively.

RELATIONSHIP STATUS AND DRINKING BEHAVIORS AMONG FIRST-YEAR COLLEGE STUDENTS

Megan Bartuch, Megan Moreno (Mentor)

Those who reference alcohol on social media are more likely to engage in drinking offline. Although college students in committed relationships are known to engage in less problematic alcohol use, we do not know if this is reflected in their online drinking displays. The purpose of this study is to determine whether the positive association between relationship status and alcohol consumption is reflected in online behavior. Secondary analysis of first-year college student Facebook profiles will be conducted, we will use a t-test to determine whether the mean number of drinking displays is significantly different between those who are single versus in a relationship. Results could be used to better address and plan specific online alcohol interventions for this group.

SWIMMER’S ITCH IN WISCONSIN

Chloe Baumbach, Daniel Preston (Mentor)

Using previous research papers and survey findings, we are assessing the distribution and possible factors behind the occurrence of water-borne Schistosomes, also known as Swimmer’s Itch, in areas of Wisconsin. Swimmer’s Itch is an incredibly uncomfortable cercarial dermatitis, or short-term allergic reaction that leads to rashes and constant itching. Previous research studies have hinted that Swimmer’s Itch patterns can be attributed to glacial distribution from the Ice Age. We are hoping to determine if the non-glaciated areas of Wisconsin support less swimmer’s itch, which may inform future efforts to control outbreaks.

WHY DO DEMOCRACIES ROLLBACK? THE CASE OF TURKEY

Jacqueline Beaulieu, Eunsook Jung (Mentor)

My research examines how democracies rollback. In the last decade, we witnessed the degrading qualities of democracies in many parts of the world. In this paper, I selected Turkey as a representative case as Turkey had strong institutions and half-century long history of competitive elections. However, Turkey’s democracy has rolled back instead of being consolidated. By examining the Turkish case in depth, I unpack the processes under which the Turkish democracy has been undermined. I argue that horizontal accountability has been compromised under the reign of Erdogan. The paper consists of an overview of democratic rollback theories, the state of democracy of Turkey before the rollback, and how democracy has rolled back under his reign.

CRISPR-CAS 9 MEDIATED GENETIC MODIFICATION TO IMPROVE SURVIVAL AND GROWTH RATE OF ZEBRAFISH LARVAE

Henry Benchimol, Dhanansayan Shanmuganayagam, Dominic Schomberg (Mentor)

Danio rerio, commonly known as Zebrafish, are an important species for human disease research as they are genetically similar to humans and are often used as model organisms to understand how genes, health, and disease interact. Improving the efficiency of rearing zebrafish larvae would increase the pace and yield of these research projects. The zebrafish genome is entirely sequenced which is useful in designing CRISPR mediated gene targets to increase growth rates. We used this understanding to knock out several targets in gene associated with growth suppression. Once mutants are established we will verify the effects of this modification via bone staining to objectively examine the growth and development of the zebrafish.

FIBROTIC MATRIX COMPOSITION AND MECHANICAL CUE INTERACTION

Brandilyn Bennett, Suzanne Ponik (Mentor)

Mechanical cues within the extracellular matrix (ECM) are important for developmental processes, but also numerous pathologies including cancer and pulmonary fibrosis. These pathologies cause ECM restructuring, thereby altering ECM stiffness and fiber organization. We investigated these processes by examining spatial protein distributions and overall protein abundance via immunohistochemistry (IHC) and Western Blotting respectively. Through a mouse model mimicking high tissue stiffness, we analyzed fibrotic responses in normal versus diseased (acute and chronic fibrosis) tissue samples. We find that the matrix protein, fibronectin, and the cellular protein, non-muscle myosin 2a, are increased in the high stiffness and diseased mouse conditions. These results are consistent with recent proteomic studies, providing valuable insight into how fibrotic matrix composition impacts mechanical signaling and guiding potential future therapeutic interventions.

DUAL SEQUENCING APPROACHES FOR RAPID HAPLOTYPING AND NOVEL MAJOR HISTOCOMPATIBILITY COMPLEX CLASS I ALLELE IDENTIFICATION IN DOMESTIC DOGS

Sarah Bennett, Matt Reynolds (Mentor)

Domestic dogs (*Canis lupus familiaris*) are increasingly being used as models for biomedical research, including cancer and autoimmune diseases. CD8 T-cells play an important role in these diseases; characterizing canine MHC may facilitate model development. However, little is known about canine MHC, which is encoded by the dog leukocyte antigen (DLA) gene. To address this, we established methods for rapidly identifying canine MHC Class I DLA-88 genes. In a cohort of 15 animals, we sequenced polymorphic regions of exons 2 and 3 with Illumina MiSeq and full length DLA-88 with Pacific Biosciences technologies. We identified 6 novel and 20 extensions of DLA-88 allele sequences. These technologies can be used to rapidly type canine MHC and aid in characterizing peptide-MHC interactions.

THE POTENTIAL CORRELATION BETWEEN HEALTH LITERACY AND ADHERENCE TO TYPE TWO DIABETES MEDICATION

Anya Beric, Yen-Ming Huang (Mentor)

Type 2 Diabetes Mellitus (T2DM) can become an extremely unpleasant experience if patients do not adhere to their medications. Therefore, our team seeks to further understand potential barriers and facilitators of medication adherence amongst patients diagnosed with T2DM across different levels of health literacy. Our cross-sectional study employs a mixed-method design, hoping the findings may lead to improved diabetes care. Currently, we are surveying 400 patients diagnosed with T2DM. The surveys gauge patients' medical adherences and literacies. Afterwards, we will have a 60-minute face-to-face interview with 20 patients to assess details of their experiences with diabetes medications. Based on our preliminary analysis of 101 patients, we predict that adherent participants will have high self-efficacy, regardless of their health literacy levels.

GREEK IDENTITY AND OTHERNESS IN THE COLONIAL SETTING OF ARCHAIC AND CLASSICAL SICILY

Megan Bernards, William Aylward (Mentor)

The Greeks have long used mythical people and monsters as stand-ins for non-Greek societies. Battles between the ancient Greeks and their many rivals including: Amazons, Centaurs, and Giants, decorate countless amphoras and temples throughout the Greek mainland. These motifs also travelled with the Greek colonists to new lands across the Mediterranean and helped to maintain a common identity between the colonies and their distant homeland.

BUMBLEBEES (*BOMBUS IMPATIENS*) FORAGING BEHAVIOR ON ALFALFA (*MEDICAGO SATIVA*)

Maya Bernstein, Fabiana Frago (Mentor)

My research aimed to investigate how bumblebee (*Bombus impatiens*) behavior affects the gene flow in alfalfa. Agriculture depends on pollinators, but there is an issue of unwanted gene flow between fields of conventional and genetically modified crops. We collected and counted pollen grains on several bumblebees after allowing bees to forage on alfalfa for different time intervals. In addition, tripping rates of alfalfa flowers by *B. impatiens* were observed when bees were foraging for nectar and pollen. Duration of foraging and number of pollen grains collected were positively correlated. There was a statistically significant difference between the number of flowers tripped when the bees were foraging for pollen, nectar and both resources.

VERTICAL DISTRIBUTION OF CMAQ NO₂ OVER LOS ANGELES

Matilyn Bindl, Tracey Holloway (Mentor)

Nitrogen oxides (NO_x = NO + NO₂) react in the atmosphere to form smog, acid rain, ground-level ozone, and particulate matter. In cities, cars and trucks are a prominent source of NO_x emissions, which vary with traffic patterns, local meteorology, and surrounding chemical environments. This study utilizes output from the Community Multiscale Air Quality (CMAQ) model to analyze the vertical distribution of NO₂ over Los Angeles for a summer day in 2011. Results indicate higher morning concentrations of NO₂ over downtown LA, lower afternoon concentrations at all surface locations, and increasing surface concentrations throughout the evening, trapped by the nocturnal boundary layer. This study will be extended to examine the relationship between the diurnal cycle of NO₂ and meteorological, chemical, and boundary layer processes.

FACTORS THAT INFLUENCE PARTICIPATION IN LUMBAR PUNCTURES

Madeleine Blazel, Cynthia Carlsson (Mentor)

Lumbar punctures (LP) are a crucial component of Alzheimer's Disease (AD) prevention clinical trials, as changes in cerebrospinal fluid biomarker levels can indicate early stages of AD. Using a cohort of individuals from the Wisconsin AD Research Center Clinical Core, I investigated whether demographic factors influenced a participant's likelihood to participate in a baseline LP (LP1), and whether experiences from LP1 influenced their likelihood to participate in a follow-up procedure (LP2). Chi-square analyses and independent t-tests were employed for individual variables, followed by logistic regression for significant predictors. Race was the only significant predictor of a participant's decision to undergo LP1, with white participants being significantly more likely than non-white participants. Additionally, participants who successfully completed LP1 were significantly more likely to opt into LP2.

EFFECTS OF OVEREXPRESSING LEGUME CYTOKININ RECEPTOR IN THE NON-LEGUME POPULUS SP.

Joshua Boadu, Lucas Gontijo Silva Maia (Mentor)

Root nodule symbiosis occurs in association between legumes and diazotrophs bacteria. The root nodule symbiosis in legumes develop a plant organ capable to host nitrogen-fixing bacteria. Cytokinin presents a key plant hormone involved in this process and capable trigger nodule organogenesis in legumes, on absent of diazotrophs. *Lotus japonicus* Histidine Kinase-1 (LjHK-1) is necessary for root nodule symbiosis and cause spontaneous nodule formation (Ljsnf-2) in legumes, when autoactive. Here we explore root phenotype of *Populus sp.*, a non-legume plant, when we overexpress these legumes receptors. In the cytokinin treatment, Ljsnf-2 presented high density of the of lateral roots per centimeter of transgenic root in comparison with the empty vector control and LjHK1 presented “pseudonodule”. Other treatments do not differentiate from the control.

POLICY DETERMINANTS OF MENTAL HEALTH AND RISKY BEHAVIORS

Brianna Boecker, Anita Mukherjee (Mentor)

The goal of our research is twofold: (1) to examine state-by-state school testing requirements and (2) to potentially examine whether there is a correlation between such requirements and student mental health. A major contribution of our project is to develop a database of the various tests administered by state and level (high school, middle school, or earlier), separated by which tests are more "high stakes" than others; i.e., students must pass in order to move to the next grade level or graduate. The sources for this data are primarily the individual state's websites regarding their testing requirements. Our next goal is to correlate these requirements with mental health indicators, with the goal of helping state administrators improve and holistically evaluate student learning standards.

EFFECTS OF INCOME ON FAMILY DYNAMIC IN ASD FAMILIES

Jordan Bondeson, Sigan Hartley (Mentor)

Autism spectrum disorder is a neurodevelopmental condition involving impairments in social communication, as well as restricted and repetitive behaviors. Previous research has shown that, on average, mothers of children with autism are engaged in less paid employment compared to mothers of children without disabilities. Autism services can also require out of pocket costs to families. Little is known about the impact of household income on family functioning. The current study examined the association between household income and child emotional and behavioral problems, parent marital satisfaction, and parenting styles in 185 families with a child with autism (aged 5 to 12 years). Findings have implications for future interventions.

AN IMAGE ANALYSIS PIPELINE FOR QUANTIFICATION OF CAROTENOID PIGMENTS IN CARROT ROOTS

Nathan Bosch, Philipp Simon, Kevin Coe (Mentor)

Carrots are one of the richest sources of β -carotene for humans. Efficient phenotyping techniques for carotenoid content can provide data that is more cost-effective while also helping to identify differences in tissue specific carotenoid levels within carrot roots. The objective of this project is to determine the accuracy of red, green, and blue (RGB) color values as a measure of carotenoid content in carrot roots. To do this, carotenoid content levels determined by RGB values will be compared to those measured using high-performance liquid chromatography (HPLC). Images of carrots were color corrected in ImageJ and RGB values were quantified for periderm, xylem, and phloem in each root sample. Future steps involve comparing RGB values to HPLC values and utilizing RGB values in an association analysis.

CONCURRENT VALIDITY BETWEEN CKTA PERFORMANCE-BASED TASKS AND BRIEF

Taylor Bradley, Elizabeth (Mentor)

Competence in executive functioning (EF) skills support children's academic success and behavioral adjustment (Jacobsen et al, 2014). Children's Kitchen Task Assessment is a performance-based EF assessment where children complete recipes. This project further develops the CKTA by examining concurrent validity between two newly-developed CKTA tasks and the parent-report Behavior Rating Inventory of Executive Function. Performance-based assessments can foster knowledge on how children plan, organize materials, and self-regulate during everyday tasks, providing targets for intervention. Ten elementary-aged children completed all three CKTA recipes (original and 2 new recipes), and were rated on the need for assistance. This analysis will examine the relationship between scores on CKTA tasks and the parent-report BRIEF. This will allow us to ascertain the extent each task demonstrates concurrent-validity with the BRIEF.

INFORMAL SCIENCE EDUCATION: OUT-OF-SCHOOL LEARNING FOR TEENS IN JUVENILE DETENTION

Lauryn Branham, Kevin Niemi, Lauryn Branham, Anna Bishop Courtier (Mentor)

The Wisconsin Institute for Science Education and Community Engagement (WISCIENCE) at UW–Madison offers training for undergraduates to work in informal out-of-school settings through Integrated Science 240: Service with Youth in STEM. In addition to informal science educational approaches, the course discusses many aspects of community building, mutually-beneficial partnerships, and understanding who you serve. The majority of UW–Madison students in the course are matched with community partners to run elementary school after-school science clubs. However, this training applies to informal education in other out-of-school settings as well. Particularly, I will present my work at the Juvenile Detention Center and demonstrate how continuing science education while incarcerated is crucial to students' learning, development, and retention of an interest in science.

GROWTH-DEFENSE TRADEOFFS AND THEIR INFLUENCE ON GENETIC VARIATION

Joel Bravo, Oliva Cope (Mentor)

The North American quaking aspen tree experiences a lot of environmental pressures. However, due to its high genetic variability, quaking aspen has been able to form defenses against those pressures. This study focuses on the relationship between defense mechanisms and growth and in which context they are more viable than growth. This allows us to find how the relationship leads to natural selection for or against different genotypes. To find that relationship we run various assays to determine the concentrations of condensed tannins in quaking aspens and take physical measurements of quaking aspen trees. Finding out how to induce the most effective genetic variability can help manage forests and help quaking aspen be better suited to face the overwhelming environmental pressures and damages that exist.

THE IMPACT OF TELEVISION ON CHILDREN'S ATTENTION, PHYSIOLOGICAL RESPONSES, AND MEMORY

Tiffany Bricco, Heather Kirkorian (Mentor)

The purpose of our ongoing study was to examine the relationship between children's attention to television, physiological responses, and consequently, their memory of the television program. Children (36–60 months) freely play in a room with a television. Their visual attention to 8 minutes of three conditions (child television program, adult television program, and no television) is recorded throughout the session, as well as their physiological responses using Empatica wristbands. The preliminary results show that children pay more attention to child-directed programs. Their comprehension task results are higher when they pay more visual attention to television content. This research will help us conclude information about the influence of television on children's memory of program content while they are playing.

ABILITY OF MOLECULAR TARGETED RADIONUCLEOTIDE THERAPY AND ANTI-CTLA-4 TO PREVENT SPONTANEOUS METASTASES IN A PRECLINICAL LEWIS LUNG CARCINOMA MODEL

Ryan Brown, Ravi Patel (Mentor)

Local control rates for early non-small cell lung cancer (NSCLC) are greater than 90% with stereotactic body radiation therapy. However, distant metastatic sites remain a clinical challenge. To address this challenge, we propose to combine localized external beam radiation therapy (EBRT) with systemic anti-CTLA-4 (C4) immune checkpoint blockade (ICB) and a novel molecular targeted radionuclide therapy (MTRT), 90Y-NM600, that delivers radiation to microscopic sites of disease through tumor specific uptake and retention. We hypothesized that our MTRT agent combined with ICB and EBRT to a primary tumor could prevent metastatic dissemination in a spontaneously metastatic syngeneic Lewis Lung Carcinoma (LLC) model.

EXPLORING CHILD'S ABILITY TO UNDERSTAND VOCABULARY IN RELATION TO PARENT WORD COUNT: RESULTS FROM THE CREATE STUDY

Chantel Browne, Nikki Thomas, Janean Dilworth-Bart (Mentor)

Existing studies have shown conversation is critical for early brain development, and that the number of words spoken to children each day is a strong predictor of children's vocabulary. The purpose of this study is to better understand how adults quantity of child directed speech relates to children's vocabulary development. We will use data from the Cumulative Risk, Early Development, and Emerging Academic Trajectories (CREATE) study to compare adult word count and child vocabulary. Researchers collected word count data using the wearable Language Environment Analysis (LENA) technology, the industry standard for measuring talk with children birth to three. The Peabody Picture Vocabulary Test (PPVT) was used to estimate children's receptive vocabulary ability. We predict a positive correlation between adult word count and children's PPVT scores.

INFORMAL SETTLEMENTS AND SUSTAINABLE URBAN DEVELOPMENT: THE ROLE OF NGOS IN RIO DE JANEIRO FAVELAS

Laura Bunn, Kathryn Sanchez (Mentor)

This project aims to explore how community-based organizations address issues in favelas in Rio de Janeiro, Brazil. By comparing and contrasting negative stereotypes of the favelas with the alternative perspectives from NGOs and local community organizers, it will examine historical prejudices of the current physical and social environment of the favelas. The research project will investigate the roles of NGOs and other organizations in community development and as a voice for bettering marginalized communities. The project will also investigate potential community-driven solutions for favelas based on interviews with community organizers and residents. It will ultimately seek to analyze the potential of NGOs and community-based organizations for improving both sustainable development and the quality of life in favelas.

PSYCHOLOGICAL RESILIENCE AND GROWTH FOLLOWING HEMATOPOIETIC STEM CELL TRANSPLANTATION

Alanna Burkart, Erin Costanzo (Mentor)

We investigated psychological resilience among cancer patients undergoing hematopoietic stem cell transplantation (HSCT). Participants completed the Psychological Well Being (PWB) scale and Post-Traumatic Growth Inventory (PTGI) pre-transplant and 1 and 3 years post-transplant to evaluate changes in well-being and growth. All PWB dimensions (Environmental Mastery, Personal Growth, Self-Acceptance, Purpose) remained stable across time (p values $<.10$). Four of five PTGI dimensions increased from pre-transplant to 1 year post-transplant and remained high at 3 years (New Possibilities: $F(2,185)=8.38$, $p<.001$; Personal Strength: $F(2,184)=16.32$, $p<.001$; Spiritual Change: $F(2,185)=5.58$, $p<.01$; Appreciation of Life: $F(2,185)=3.39$, $p=.04$). There were no significant differences in scores for those receiving more complicated allogeneic transplants as compared to those receiving autologous transplants (p values $<.10$). Results suggest psychological growth and resilient psychological well-being after HSCT.

THE ROLE OF VISUAL COMPARISON IN UNDERSTANDING FRACTION MAGNITUDES

Valerie Buroker, Percival Matthews (Mentor)

Research has shown that comparison enhances conceptual learning. This study investigated whether these findings extend to comparing non-symbolic fractions to improve the understanding of symbolic fractions. Irrelevant elements such as shape and color were altered to ensure they had no impact. Participants were presented two non-symbolic fractions of identical magnitudes that varied in shape and color depending on the condition. These were matched to one of four non-symbolic fractions with varying magnitudes, shapes, and colors. Preliminary results indicate that participants performed significantly above chance, which provides evidence that they are focusing on the magnitude. Future research plans to compare these findings to a study that uses only one non-symbolic fraction as a target to further explore the effects of comparison versus simpler modes of presentation.

LOCAL AND NATIONAL NEWS COVERAGE OF MASS PUBLIC SHOOTINGS: A TEXTUAL ANALYSIS

Maggie Bushman, Megan Moreno (Mentor)

The media's coverage of mass public shootings (MPS) has the potential to impact public fear by conveying a greater risk of an MPS incident. The purpose of this study is to examine print, broadcast and internet news media coverage of MPS. The database NexisUni was used to collect news coverage of MPS in 2017. LIWC, a textual analysis software was used to examine the linguistic differences between local and national coverage of these incidents. Linguistic differences will be assessed using variables such as tone, authenticity, and emotionality. It is vital to understand local and national coverage of MPS, as differences in coverage may lead to diverse perceptions of public safety.

ATTENTION BIAS MODIFICATION IN UNDERGRADUATE STUDENTS: A NOVEL TRAINING PARADIGM

Maureen Butler, Seth Pollak, Maureen Butler, Rista Plate and Brian T Leitzke (Mentor)

Individuals who over interpret ambiguous facial emotions as angry ("attention bias") often experience social difficulties. We conducted a randomized controlled trial of a novel training program designed to alter attention bias. 64 undergraduate students completed an experimental task in which they rated emotional content in facial configurations morphed continuously from angry to happy. Participants who completed the training received feedback on their ratings and subsequently reduced their attention bias more than participants who completed a control condition who did not receive feedback, $\beta = -1.04$, $F(3, 5158) = 45.55$, $p < .001$, $R^2 = .03$. This result helps validate the effects of this novel training program and has implications for the creation of future interventions to correct maladaptive attention biases.

THE EFFECTIVENESS OF DIFFERENT PROBLEM-SOLVING METHODS IN AN ENGINEERING CLASS

Kyle Byrnes, Sally Wu (Mentor)

The overarching goal of this analysis is to determine if different problem-solving strategies are correlated with enhanced learning outcomes. Problem-solving strategies such as drawing out diagrams, writing out steps to a problem, or asking fellow peers for help have often been recommended for challenging problems in engineering courses. This study compares effectiveness of different problem-solving strategies in one introductory level UW electrical engineering course. By comparing strategies to the class average, analysis determines if any strategies significantly affect one's grade in problem sets or exams. Findings of this study may identify which problem-solving strategies students should use for the most effective learning outcomes within an engineering course.

A GOODNESS-OF-FIT TEST TO STUDY THE HISTORY OF A GROUP OF SPECIES BASED ON GENOME SEQUENCES

Ruoyi Cai, Cecile Ane (Mentor)

When inferring species relationships from genome sequences, a variety of trees or networks can be obtained. How to choose the optimal genealogical structure from candidate trees and networks remains unresolved. To answer this question, this study investigates how to identify the genealogical structure that provides a good fit to the evolutionary relationships reflected in the genome sequences of many species. We developed a goodness-of-fit test to quantify the fit between data observed from genome sequences and data expected under a candidate genealogical structure. This test not only can be applied to infer the number of past hybridizations in a group of species but also can detect outlier species for which better models or more complex networks should be used to sufficiently describe their evolutionary history.

ELUCIDATING GENOTYPE-PHENOTYPE RELATIONSHIP IN *SACCHAROMYCES CEREVISIAE* VIA THE EFFECT OF STRAIN BACKGROUND AND GENE EXPRESSION ON STRESS SENSITIVITY

Ruoyi Cai, Audrey Gasch (Mentor)

How phenotypes of organisms vary due to ecological niches, genetic backgrounds, and gene expression patterns is unclear. With diverse lineages and abundant phenotypic variations, the budding yeast *Saccharomyces cerevisiae* is an excellent model to study phenotypes in relation to strain background and gene expression level. This project uses *S. cerevisiae* as the model organism to investigate genotype-phenotype relationship by studying how strain background and gene expression level contribute to salt sensitivity of yeast strains. The results of this project not only will help elucidate genotype-phenotype relationship in *S. cerevisiae* but also will have important implications for agriculture, human diseases and many other fields due to the similarities between the basic cellular processes of *S. cerevisiae* and those of higher eukaryotes.

ANALYSES OF ENZYMES REQUIRED FOR GDP-FUCOSE BIOSYNTHESIS IN MYCOBACTERIUM TUBERCULOSIS

Cory James Call, Hazel Holden (Mentor)

Mycobacterium tuberculosis is the causative agent of tuberculosis, a devastating and debilitating disease that primarily affects the lungs. Treatment requires use of various antibiotics for extended periods of time. Recently, both multidrug-resistant and extensively drug-resistant strains of *M. tuberculosis* have been isolated. There is clearly a pressing need for the development of new therapeutics. The biology of *M. tuberculosis* is still not fully understood and in particular with respect to its latent phase. The goal of my proposed research is to address the structure and function of two proteins, Rv1511 and Rv1512, whose genes are upregulated during prolonged anaerobic conditions. Although my research is basic in nature, the end results could provide insightful information on drug inhibitors that cure tuberculosis.

FACEBOOK DIAGNOSES UNDERGRADUATE ALCOHOL USE DISORDER

Diane Camarda, Maggie Mataczynski, Sarah Sant'Ana, John Curtin, John Curtin (Mentor)

Alcohol use disorder (AUD) is a persistent, prominent problem among college students. Most afflicted students are unaware that their drinking is problematic, and current undergraduate screening initiatives are infrequent, likely biased, and miss a large proportion of students with AUD. Social media offers one avenue for passive, large-scale screening that may alert users to seek treatment before alcohol related problems become too severe. We applied machine learning techniques to Facebook data to diagnose undergraduate AUD. Four-hundred undergraduate students provided the entirety of their Facebook data and were assessed in-session for AUD. The optimum combination of feature sets, tuning parameters, and classification algorithm for AUD classification was selected using repeated nested k-fold cross validation. Results demonstrated predictive utility within social media data for classifying collegiate AUD.

LIGHT MICROSCOPY IN CELL BIOLOGY

Jocelyn Cao, Aussie Suzuki (Mentor)

Light microscopy (LM) is used in a variety of research fields, but it's a necessary tool in cell biology research. However, researchers don't appreciate limitations of LM. At Suzuki Labs, we use various LM to study molecular mechanisms in faithful chromosome segregation. Currently, I'm focusing on calibrating the microscopes because every microscope has different characteristics; like PSF (point spread function) and bleed through rate. It's critical to determine these characteristics in order to obtain accurate measurements. In the spinning confocal disk of the imaging core, I'm measuring 3D chromatic aberration by using 3D fluorescent co-localization methods and bleed through rates. Not only will this data will be useful for my future research in Suzuki Labs, but also in improving confocal optics in imaging cores.

DEVELOPING A HUMAN ERYTHROID DIFFERENTIATION SYSTEM TO ENABLE MECHANISTIC ANALYSES

Miao Cao, Emery Bresnick (Mentor)

HUDEP (Human Umbilical Cord Blood-Derived Erythroid Progenitor)-2 cells can differentiate into erythrocytes, but are highly heterogeneous, and differentiation is inefficient. My objective was to develop a method with improved differentiation efficiency and to conduct initial mechanistic studies. Modifying the differentiation method from Masuda et al (Science, 2016) by manipulating stem cell factor and/or doxycycline and/or dexamethasone was insufficient to increase differentiation efficiency and improve cell survival. However, I utilized Vinjamur & Bauer's method (Methods Mol. Biol., 2018), which yielded increased survival and induced the switch from GATA2 to GATA1 expression during differentiation. My studies suggest that the HUDEP system may enable mechanistic analyses of the onset of differentiation, for example when GATA1 represses GATA2 transcription to trigger the initial steps in differentiation.

DISCOVERING CAUSAL HETEROGENEITY IN MEDICAID UTILIZATION WITH A TREE-BASED MACHINE LEARNING METHOD

Jiongyi Cao, Hyunseung Kang (Mentor)

In this paper, we analyze the heterogeneous causal effect of Medicaid enrollment, a type of federal insurance program, on various outcomes among different subgroups of the Medicaid eligible population. Our data comes from the Oregon Health Insurance Experiment (OHIE), a randomized experiment conducted by the State of Oregon in 2008 on Medicaid utilization. To detect the causal effect, we employ a recent machine learning method proposed by Athey, et al. (2018), called generalized random forest (GRF). We compare the results from GRF to those done originally by the authors of the OHIE study, which involved a priori understanding of health insurance markets and manual selection of important factors that drive heterogeneity. We further apply clustering analysis to make the result of GRF interpretable.

SINGLE-MOLECULE FRET STUDIES ON NASCENT PROTEIN FOLDING BY A CUSTOM-ASSEMBLED CONFOCAL MICROSCOPY APPARATUS

Tess Carlson, Silvia Cavagnero (Mentor)

An optimized procedure for the site-specific labelling of ribosome-bound nascent chains (RNCs) with two fluorophores will be developed. Fluorescently-labelled amino acids will be efficiently incorporated into the protein chain in a cell-free translation system at rates similar to natural translation. A custom-assembled confocal microscope designed for single-molecule Förster Resonance Energy Transfer (FRET) experiments will be used to examine the conformations of these RNCs. Data regarding photon arrival time, FRET efficiency and anisotropy of these RNCs will be simultaneously collected. Specific conformational subpopulations can be distinguished and analyzed separately. These experiments will provide new insights into conformational states and intramolecular interactions of RNCs that have been previously undetectable due to ensemble averaging in bulk experiments.

EFFECTS OF CDC42-INTERACTING PROTEIN 4 (CIP4) ON CORTICAL NEURONAL MIGRATION IN VIVO

Justin Carrington, Kendra Taylor, Erik Dent, Russell Taylor (Mentor)

The sequence of events that occurs during mammalian brain development is essential for its proper maturation and function. Cortical neurons in the brain are born adjacent to the ventricular zone and migrate radially outward to generate the six cortical layers. Neurites, initial protrusions from neural cell bodies, aid in this migration. Cdc42-interacting protein 4 (CIP4) has been shown to inhibit neurite initiation in vitro and its knockdown promotes earlier neurite formation. We found that CIP4 knock down via in utero electroporation mouse surgery results in further migration of neurons, potentially due to earlier neurite outgrowth. Quantification of migration was aided by software I developed, called TRON (Tracking Overlapping Neurons). Our findings support the robustness of CIP4 as an organizing protein in mammalian brain development.

THE INHIBITORY HETEROTRIMERIC G PROTEIN, G_z, REGULATES ALPHA-CELL ACTIVE GLUCAGON-LIKE PEPTIDE 1 (GLP-1) LEVELS

Brooke Carroll, Kathryn Carbajal (Mentor)

Biologically-active glucagon-like peptide 1 (GLP-1) amplifies glucose stimulated insulin secretion and promotes beta-cell survival by cAMP stimulation. Neighboring alpha cells produce active GLP-1 to influence beta-cell function. Although alpha-cell GLP-1 production and secretion is poorly understood, cyclic AMP levels are amplified by stimulatory G proteins (G_s) and blocked by inhibitory G proteins (G_i). Mice lacking the alpha subunit of G_z (G_z^{-/-}), are protected from hyperglycemia in several diabetes model systems due to increased beta-cell function and replication. To determine if beta-cell G_z regulates alpha-cell active GLP-1 levels, we imaged pancreas sections from beta-cell specific G_z-null mice. Our results identify G_z as a potential new therapeutic target to promote beta-cell function and replication and underscore the role of intra-islet cell-cell communication in beta-cell biology.

ANXIETY-RELATED DIFFERENCES IN STRUCTURAL CONNECTIVITY OF THE UNCINATE FASCICULUS IN ADOLESCENT GIRLS

Alison Casey, Lisa Williams, Ned Kalin (Mentor)

Anxiety disorders are the most prevalent class of mental disorders, and females have a heightened risk of being diagnosed. This study seeks to understand differences in the integrity of the uncinata fasciculus (UF) between preadolescent girls (age 9–11) who are at risk to develop anxiety disorders due to current subclinical anxiety symptoms and non-anxious comparison girls. The UF is the major white matter tract connecting the amygdala and the prefrontal cortex and is implicated in emotion regulation. I will assess the strength of the UF, with lower values possibly indicating weaker emotion regulation. I hypothesize that preadolescent girls at risk for anxiety will have lower UF integrity than non-anxious girls, and that girls whose anxiety severity increases over time will show decreases in UF integrity.

COLLEGE READINESS FOR STUDENTS OF COLOR THROUGH DIVERSE PROGRAMMING

Abigail Catania, Thomas Browne (Mentor)

This project works to connect minority students at Vincent High School in Milwaukee with career prep, college readiness, and mentoring through a Junior Minorities in Agriculture, Natural Resources, and Related Sciences (Jr. MANRRS) Chapter. Traditionally these students have not had access or knowledge regarding opportunities relating to agriculture and natural resources related majors and careers. Due to lack of consistency, representation, and funding at Vincent High School students have been limited in their experiences and the resources provided for them. Currently the agricultural program at Vincent has only one teacher of color at a school comprised of 97 percent students of color. The Jr. MANRRS Chapter has engaged in college programs and hands on activities in Science, Technology, Engineering, Agricultural, and Mathematics (STEAM) at UW–Madison.

SOCIAL ISOLATION AS A PREDICTOR OF POST-EMERGENCY DEPARTMENT (ED) VISIT FOLLOW-UP BY OLDER ADULTS

Nia Cayenne, Manish Shah (Mentor)

Outpatient follow-up after an ED visit is critical to high-quality care transitions. Older adults have high rates of post-visit complications and low follow-up rates. Social isolation may explain poor follow-up. We determine whether social isolation is associated with older adults' post-discharge follow-up. Participants answered a standardized social isolation questionnaire. Chart abstraction identified contacts and the follow-up method 30 days post-discharge. Of 611 individuals, 81% had in-person visits and 77% had non-face-to-face contact within 30 days. 52% were highly socially isolated and were 6.9 and 7.7 percentage points less likely to follow-up in-person and use non-face-to-face contact. Socially isolated patients were less likely to follow-up in-person or using alternative modes post-discharge. Future research should consider how to ensure follow-up in this population to optimize care transitions.

IKE CECH: A CAPSULE COLLECTION

Ike Cech, Mary Hark (Mentor)

Historic tailoring, fine craft, natural materials, and classic silhouettes are the foundation for each of my original designs. Through my creative research I explore questions of sustainability and what small batch or bespoke production could look like in an industry dominated by fast fashion. In this senior thesis collection, my design aesthetic draws from classic American work wear filtered through a minimalist lens. I am considering what modern menswear could look like.

DEFINING MOTOR DEFICITS IN THE RODENT MODEL OF HEREDITARY SPASTIC PARAPLEGIA

Maya Charan, Molly Lettman, Anjon Audhya (Mentor)

Hereditary spastic paraplegias (HSP) are a group of neurodegenerative diseases primarily impacting movement of the lower limbs. Many HSPs result from a defect in organelle function within cells of the nervous system. TRK-fused gene (TFG) is a protein that is necessary for organelle homeostasis, regulating COPII-mediated protein transport from the endoplasmic reticulum (ER). Previous studies have implicated a recessive mutation in TFG in an early onset form of HSP, but little is known about the mechanism by which this mutation leads to disease. I propose to define the effects of this mutation on gait, leg swing, and arm swing using a kinematic imaging system using Sprague Dawley rats harboring the TFG p.R106C mutation.

USING CAENORHABDITIS ELEGANS TO STUDY G PROTEIN-COUPLED RECEPTORS FROM PARASITIC NEMATODES

Eric Chen, Tran To, Nic Wheeler (Mentor)

The parasitic nematode *Brugia malayi* contributes to lymphatic filariasis (LF), a neglected tropical disease that infects over 120 million people and causes substantial morbidity in developing countries. Growing reports of resistance to the small number of anthelmintics used to treat LF threatens the sustainability of disease control. Neuronal receptors in parasitic nematodes are considered good drug targets due to their involvement in functions required for parasite transmission and development. Parasite receptor genes *ser-2* and *dop-1* have been transgenically expressed using the powerful model nematode *Caenorhabditis elegans* as a heterologous expression platform. We hypothesize that ligands for parasite receptors can be identified using plate-based assays, electropharyngeograms (EPG), and motion tracking software, and these can also be used to test for chemicals that dysregulate parasite receptor function.

RESILIENCY SKILLS CURRICULUM ON MEDICAL STUDENTS

Judy Chen, Jessica Babal (Mentor)

About 45–55% of medical students report burnout in Medical school. This study aims to determine ways that can decrease burnout. Participants in a resiliency course completed the Brief Resilience Scale (BRS), Interactivity Index, Perspective Taking (IRI-PT), Empathetic Concern (IRI-EC), Neff Self Compassion Scale (NSC), and Oldenburg Burnout Inventory (OB-E) survey tools before and one week after the course. There was significant improvement on the IRI-PT, (0.2 ± 0.3 , $p=0.0375$), NSC (0.4 ± 0.5 , $p=0.0342$), and OB-E (0.4 ± 0.3 , $p=0.0103$). No changes were seen in the IRI-EC and BRS. Resiliency courses can be helpful to reduce burnout for Medical students.

UNRELIABLE AUDITORY FEEDBACK LEADS TO DECREASED SENSITIVITY TO AUDITORY ERRORS

Taijing Chen, Ben Parrell (Mentor)

When we speak, we use our prior expectations and sensory feedback to speak more accurately. To determine how the reliability of auditory feedback affects speech, we ran a two-session experiment with two phases in each. In the first phase of both sessions, participants were exposed to either unperturbed auditory feedback or to small, unpredictable (noisy) perturbations. Compensatory responses to large perturbations were measured in the second phase. We could thus reduce the feedback reliability and test whether this reduction leads to changes in sensitivity to auditory errors. Results indicate that exposure to noisy feedback leads to a decreased compensatory response, indicative of reduced auditory feedback reliance. These results help clarify the role of feedback in speech motor control and, potentially, mechanisms behind certain speech disorders.

“WAIT, YOU SAY WHAT?” BRAND NAMES AND LEXICAL SEMANTIC CHANGE

Madeline Cheyne, Joe Salmons (Mentor)

New words are constantly developing with clear regional and social patterns; for example, the brand name Kleenex, introduced in 1924, is now used for any generic tissue. Brand names have unique etymologies because we know the exact timeline of these words' origins. I present results of a survey investigating how different age groups, regions, and genders use brand names as generics. Although one might expect this competition to resolve over time, with either the brand name or generic term dying out, no clear pattern emerges regarding which variant wins. According to initial analyses, there is regional and age variation in substitution of brand names for generics. These results reveal that variation in use of brand names follows classic patterns of lexicosemantic variation and change.

LIGHT AVAILABILITY AND BIOMASS PRODUCTION IN SWEDISH BOREAL LAKES

Matthew Chotlos, Jake Vander Zanden, Holly Embke (Mentor)

Water clarity can affect the productive capacity of fish populations by limiting light availability. One factor contributing to available light in lakes is dissolved organic carbon (DOC), which plays a major role in chemical, physical, and biological processes. Concentrations of DOC in northern lakes are increasing and the effects of these trends on fish communities are only beginning to be studied. Our research focused on sixteen boreal lakes in Sweden with varying concentrations of DOC. We calculated biomass production of European perch in each lake and related it to the light availability. Increases in DOC, and the resulting shifts in light availability, may drive a decline in fish biomass production with implications for wider trends in global fisheries.

STRAIN MEDIATED SWITCHING OF BLOCH SKYRMIONS IN A FEGE NANODISK

Sam Christianson, Jiamian Hu (Mentor)

Magnetic skyrmions are swirling spin structures in magnetic materials, and typically stabilized by the Dzyaloshinskii-Moriya interaction (DMI) arising either due to proximity to an adjacent heavy metal or intrinsically in the bulk lattice of cubic helimagnets such as FeGe. Magnetic skyrmions can potentially be used to revolutionize existing spintronic devices including memories, logic gates, etc. Here, we computationally investigate the thermal stability of one single magnetic skyrmion in FeGe nanodisks. Influences of the DMI strength and the disk diameter on the skyrmion stability are discussed. We also predict that the skyrmion can be created and deleted purely by mechanical strain, which could be used to design skyrmion-based spintronics with negligible heat dissipation.

ISOLATION OF MONOCLONAL ANTIBODIES FROM SINGLE-CELL SORTED ANTIGEN SPECIFIC β CELLS BINDING RHESUS MACAQUE MHC CLASS I MOLECULES

Tighe Christopher, Matthew Reynolds (Mentor)

Anti-major histocompatibility complex (MHC) monoclonal antibodies (mAbs) are used for tracking donor-recipient chimerism after hematopoietic stem cell transplants. Traditional methods of isolating mAbs such as hybridoma or phage display technology are labor intensive or difficult to perform with non-human primate (NHP) samples. Therefore, we aim to develop alternative methods to isolate mAbs from single cells by sorting MHC-specific β cells from alloimmunized macaques, amplifying antibody variable regions, and cloning them into mammalian expression vectors. However, the low starting RNA concentrations and polymorphic nature of these variable regions makes their amplification problematic. I am resolving current bottlenecks by refining primer pools and optimizing PCR and cloning conditions. Once developed, this system will aid in rapidly isolating mAbs against antigens of interest from NHPs.

DEVELOPING CELL-INTRINSIC CONTROL OF CARDIOMYOCYTE DIFFERENTIATION UTILIZING GENOME EDITING

Ethan Church, Gyuhyung Jin (Mentor)

Human pluripotent stem cells (hPSCs) can be programmed into any of the cell types in our body. Numerous protocols allow for differentiation into cardiomyocytes, the cardiac muscle cell. The adult cardiomyocytes in our body have very limited regeneration ability. The hPSC-derived cardiomyocytes can be applied to cell therapy, drug screening, disease modeling, and developmental biology. Current differentiation is achieved through cell-extrinsic factors by treating hPSCs with proteins and small molecules. However, this methodology has many limitations. Our goal is to enhance this process by utilizing cell-intrinsic control through CRISPR-Cas9 genome editing. With this we hope to eliminate the need for IWP2, a cell-extrinsic factor. Excluding cell-extrinsic factors could contribute to achieving cost-effective biomanufacturing as well as reduced heterogeneous response of the cells to extrinsic factors.

DOES REAL-WORLD OBJECT SIZE UNCONSCIOUSLY INFLUENCE MEMORY FOR OBJECTS?

Cole Cimoch, Emily (Mentor)

What we know about everyday objects influences how we see and remember them. Knowing that a paperclip is small will lead people to remember an image of a paperclip as smaller than it actually was. But do we need to be aware of an object for its properties, like size, to influence memory? We are testing this question by showing participants brief images of objects that were made invisible using a technique called masking. Participants then judged the size of the image. If the real-world size of objects influence memory, their responses will be smaller for small objects and bigger for big objects, even though they aren't aware of what object they saw. This study can show that we automatically and unconsciously perceive object properties.

UWELLNESS STUDY

Paula Bianca Yvette Clemente, Paula Clemente, Lauren Papp (Mentor)

College students face unique challenges and stressful experiences that can lead to unhealthy behaviors that impair their ability to succeed in several important areas, including academics, physical health, social connections, and wellbeing. Our research draws from the UWellness Study, which is designed to learn more about college students' behaviors in day-to-day life and health and well-being over time. Drawing from lab visits conducted during the baseline assessment of a longitudinal study, we will examine participants' open-ended reports of their daily lives over the past month to identify common themes related to students' academic, work, social, and wellness events and activities. Findings will provide a foundation for understanding sources of positive and challenging experiences with direct implications for supporting healthy development in college.

MEDICAL IMAGING: BLEEDS

Zoha Cochinwala, Dane Morgan (Mentor)

This project focuses on extending machine learning by training an algorithm in order to automate the detection of arterial bleeding in angiograms. The current process of detection is lengthy and challenging, due to the fact that the sites can only be identified visually by radiologists, and there are artifacts in the angiograms that mimic the desired bleeding sites. To improve the accuracy and efficiency of this process, we have been working towards modifying an algorithm that will identify if the input data, medical images from the UW Hospital, contains arterial bleeding in it, and if it does, where the bleeding site is. We are currently applying various functions to our existing algorithm in order to continue to improve the percent accuracy of it.

LEVITATING STEEL SPHERE FOR ATTITUDE CONTROL

John Compas, Eric Severson (Mentor)

Gyroscopes have been an invaluable tool in aerospace as an efficient way to control the rotation of spacecraft. Problems and failures with these motors and associated moving parts have plagued missions for years. Utilizing magnetic bearings has the potential to improve the longevity and reliability of these devices. To help realize a prototype attitude control device, hardware developed in-house was tested and utilized to levitate a steel sphere magnetically.

CULTURE INFLUENCES PERCEPTIONS OF HIGH-CONFLICT DATING RELATIONSHIPS

Ellen Converse, Yuri Miyamoto (Mentor)

East Asians generally have dialectical beliefs about emotions while European Americans have linear and hedonic beliefs about emotions. It is unknown if these beliefs apply to relationship contexts. This study aims to examine Easterners' and Westerners' perception of romantic relationships when varying levels of conflict exist. Participants read three hypothetical scenarios about dating partners and rated the likelihood of breaking-up or staying together. Although both Asians and European Americans were equally likely to predict that the low-conflict couple would stay together, Asians were more likely than European Americans to predict that the high-conflict couple would stay together. This study provides insight into how individuals perceive and evaluate relationships cross-culturally and has implications for why one might stay in a harmful relationship.

INCREASED SURVIVABILITY OF TREE SEEDLINGS THROUGH RECRUITMENT OF MICROBIAL COMMUNITIES

Kevin Cortes, Richard Lankau (Mentor)

As the environment changes, trees must adapt to their newer situations. Our research is focused on interactions between trees and microbial communities within the soil. We aimed to identify whether trees can increase their survival under drought by recruiting different communities. We collected tree seeds and inoculated them with various microbe communities collected from locations over Wisconsin and Illinois, then grew them in a control group and stress group where seedlings experienced drought conditions. We used PCR and sequenced to distinguish microorganisms and their richness in each sample. Our data showed an increased tree survivability in drought conditions with certain microbial communities. We hope to determine the exact microbe communities that benefit the seedlings in drought conditions.

EVALUATING AXONAL PROJECTIONS OF REGIONALIZED HUMAN MOTOR NEURONS IN THE DEVELOPING CHICK EMBRYO

Stephanie Cuskey, Kurt Weiss, Jan Huisken, Randolph Ashton, Randolph Ashton (Mentor)

Damage to the spinal cord disrupts an organism's limb-innervating motor neurons (MNs); this instigates paralysis at and below the point of damage. In the current work, we establish the efficacy of transplanting cryopreserved human embryonic stem cell-derived MNs for regenerative studies and improve methods to visualize axonal projections in an embryonic chick model. To visualize peripheral projections from the spinal cord, we optimized previously published whole mount tissue clearing methods with the goal of eventually tracking the extension patterns of our transplanted neurons relative to the growth of the chick's endogenous motor neurons. Additionally, our transition to using a custom light sheet microscope provided us higher quality, 3-dimensional renderings of our samples over ~10mm of tissue, proving more efficient for imaging large embryos.

FLUORESCENTLY-LABELED MONOCLONAL ANTIBODIES FOR THE STUDY OF EBV-DRIVEN LYMPHOMAGENESIS

Matthew Dandan, Dana Baiu (Mentor)

Epstein-Barr Virus (EBV) is an oncogenic human herpesvirus that will infect most humans during their lifespan. EBV targets human B-leukocytes and oropharynx epithelial cells, and is associated with Burkitt's Lymphoma, Hodgkin's lymphoma, Nasopharyngeal Carcinoma and many other lymphoproliferative disorders. EBV-infected tumor cells upregulate the expression of several receptor molecules, including CD23. A sufficient method of characterizing and quantifying these tumor cells has yet to be developed. We hypothesized that a fluorescently labeled monoclonal antibody for CD23 would be an effective instrument for differentiating EBV-infected cells from uninfected cells. Utilizing flow cytometry, we demonstrated the compelling potential of monoclonal antibodies as tools for quantifying and discerning EBV-infected tumor cells.

CHEMICAL ECOSYSTEM SELECTION AND THE ORIGIN OF LIFE

Brandon Dawning, Lena Vincent, Jennifer Heinritz, David Baum (Mentor)

How did life first arise on Earth, and what conditions were necessary for it to emerge? The origin of life is still one of the biggest mysteries scientists everywhere are trying to solve. In our lab, we are trying to experimentally recreate the first stages in which life emerged from non-living starting components by mimicking the environments we hypothesize were necessary for living systems to appear. If we are successful, we will gain a better understanding of how life emerged here on Earth, but also perhaps elsewhere in the universe.

SMART SUSTAINABLE MANUFACTURING

Patrick Day, Sangkee Min (Mentor)

Our research is focused on analyzing collected data from machines in order to monitor machine health and predict machine anomalies in response to major events. Data will be collected in real-time through Internet of Things to be processed and analyzed. The ability to predict when a significant event is likely to occur, such as machine failure, will enable the manufacturer to run machines as efficiently as possible and increase product output. This research is a part of Smart Sustainable Manufacturing, which plays a role in the bigger picture of Cloud Manufacturing and Industry 4.0, terms used to describe the next big leap in improving manufacturing.

PREGNANCY ASSOCIATED PLASMA PROTEIN-AA PROMOTES NEURON SURVIVAL BY REGULATING MITOCHONDRIAL FUNCTION

Emily Daykin, Marc Wolman (Mentor)

Sensorineural hearing loss affects 5% of the world's population and is primarily caused by damage to inner ear hair cells. In mammals, development of a successful therapeutic strategy hinges on understanding the molecular-genetic factors that regulate hair cell survival. We identified a novel role for the gene pregnancy associated plasma protein-aa (pappaa) in promoting hair cell survival. pappaa stimulates local insulin-like growth factor-1 (IGF1) signaling which we have previously shown promotes hair cell survival. Using markers of reactive oxygen species (ROS), we show that pappaa mutant hair cells possess dysfunctional mitochondria that produce higher levels of ROS and exhibit hypersensitivity to known mitochondrial toxins. Taken together, our results suggest that pappaa promotes hair cell survival by attenuating mitochondrial ROS production through the IGF1 signaling pathway.

INVESTIGATING THE POSSIBLE BENEFITS OF CONCRETENESS FADING IN THE CONTEXT OF GROUNDED AND EMBODIED COGNITION

Aylin Dedeoglu, John McGinty (Mentor)

In this experiment, I will be examining the potential benefit in grounding an interpretant using concrete objects, then gradually increasing its abstractness, when teaching and learning mathematics. My research question investigates: Is condition one, implementing a complete concreteness fading sequence, or condition four, implementing just abstract symbols, better for learning Euler's theorem? I hypothesize that condition one, going through the sequence of object-icon-symbol, will be the most effective in truly understanding Euler's theorem. Personally, I have seen, through teaching dance, the benefits of children physically learning choreography when it comes to understanding and remembering the movements. This study's finding will go beyond just teaching and learning math, but cognition in general by exploring the mechanisms of grounded and embodied cognition.

THE IMPACT OF CONFLICTING EMOTIONAL CUES ON FACIAL EXPRESSION INTENSITY RATINGS ACROSS DEVELOPMENT

Gwyneth Delap, Seth Pollak (Mentor)

The ability to read emotional expressions is socially adaptive. Historically, emotion researchers have focused on isolated facial expressions. Contemporary research is revealing that the situational context is essential for accurately reading emotional reactions. Moreover, research in this area has focused on how people categorize emotion—that is, are facial expressions read as angry, sad, happy, etc. Little is understood about how people discern the intensity of expressions—for example: is someone annoyed or furious? We examined these questions across three developmental periods: childhood, adolescence and young adulthood. Participants rated the intensity of images of individuals expressing emotions of various intensities in response to contextual information that matched or was inconsistent with the facial expression. They also provided free response labels to a subset of the images.

MANAGING FOR THE EFFECTS OF FERAL AND FREE-RANGING DOGS ON PEOPLE AND WILDLIFE

Brenna Denamur, Nadia Swanson, Cybill Biehlmann, Jim Berkelman (Mentor)

Feral and free-ranging dogs threaten both people and wildlife throughout the world. Here, we identify depredation, disease transmission, interbreeding, competition, and disturbance as problems associated with feral and free-ranging dogs in both developing and developed countries, and synthesize a management plan for feral and free-ranging dogs in Mexico. Proposed solutions include vaccination, sterilization, and euthanasia, however, lack of funding and public support have created barriers to enforcing these management plans. Therefore, we suggest that Mexico invest in education programs to encourage responsible dog ownership, improve cultural attitudes towards sterilization and euthanasia, and reduce access to food waste to manage feral and free-ranging dogs.

ANALYSIS OF FILAMENTARY MOLECULAR CLOUD CANDIDATES IN SOUTHERN GALACTIC STAR-FORMING CLOUD

Nathan Derenne, Audra Hernandez (Mentor)

We aim to aid in the understanding of the formation of proto-stellar cores in filamentary, galactic molecular clouds. The radio survey used is the $^{13}\text{CO} (1, \text{Ü}i0)$ is of the southern galactic plane ranging from $l = 300^\circ$ – 360° and $b = -1^\circ$. Using collected radio spectroscopic data we ran a data structure analysis algorithm to determine the geometric axis of the filamentary candidates. Looking at the filamentary structures and their relation to the formation of proto-stellar cores, we used spectroscopic data to utilize the velocity data associated with the survey to verify that the molecular cloud is cohesive in velocity space. I will be presenting the initial finding on a small sample within this region, employing this method we hope to find more.

BLACK PROTEST IN U.S NEWSWIRE STORIES FROM 1994–2010

Karinton Deville, Nzinga Acosta, Laura Moore, Abril Perznegron, Pamela Oliver (Mentor)

Our project collects data about Black movement protests between 1994–2010 from electronic archives of news sources. This fills a historical gap, as there is no systematic information about Black protests in this period. An earlier phase of this project collected information from mainstream news wire archives; however, now we are using Black newspapers. In addition, the project used the MPEDS automated system to select articles based on Black protests. The information gathered will be used to compile a list of events and people involved that will show what issues were important to Black people in the 25-year period, how Black protests relate to patterns of incarceration and policing, and how the pasts connect with the rise of Black Lives Matter protests after 2014.

PLACENTA GEOMETRY IN 2ND TRIMESTER ASSESSED WITH VOLUMETRIC MRI

Archana Dhyani, Dinesh Shah, Philip Corrado, Oliver Wieben (Mentor)

Quantitative measures of placenta volume, growth, and geometry are desirable as they (1) might be indicative of birth weights and pregnancy outcomes and (2) are valuable to normalize functional parameters such as total uterine blood flow, perfusion, and oxygenation. Ultrasound exams are frequently performed in clinical care, but do not allow for volumetric measures past 16 weeks because of a limited imaging volume. MRI is well suited to provides such measures throughout pregnancy. In this prospective study, we report on the implementation of workflows and algorithms to assess placenta volumes and surface areas in 40 human subjects at two time points in the second trimester (14–16 weeks and 20–22 weeks). This includes manual segmentation with dedicated software tools and subsequent shape analysis.

MACHINE LEARNING SOFTWARE FOR MATERIALS SCIENCE (MAST-ML PACKAGE)

Alexander Do, Dane Morgan (Mentor)

The objective of this project is to develop machine learning applications for materials as part of the Materials Simulation Toolkit. These tools are designed to aid in machine learning materials research within Informatics Skunkworks. It is intended to provide more uniform, accurate and tailored models to analyze materials data. Based as a Python application, I write scripts and incorporate open-source libraries and APIs into the application. These tools are open source and can easily be downloaded and run from the command line. Users can then input a data set for MAST-ML to run and receive a folder of output data. This tool removes the need for researchers to rely on searching for the right online machine learning tools to fit their needs.

SOCIAL CLASS CONCEALMENT: A DAILY DIARY STUDY OF LOW-INCOME COLLEGE STUDENTS

Mayra Dominguez, Mun Yuk Chin (Mentor)

Because classism is prevalent in college, one stressor for students who identify as low-income is the management of their social class identity as a concealable stigma. This study examines low-income undergraduate students' daily experiences of social class concealment and their relationship with psychological mood. Using a daily diary design, participants were asked to complete two daily surveys (i.e., in the morning and evening) for 14 days; surveys included questions related to mood and social class concealment events that occurred. From our qualitative and quantitative analyses, we aim to describe how students concealed and test our hypothesis that concealment during the day is associated with worse negative mood in the evening. Implications for practice and research will be highlighted.

APPLYING MACHINE LEARNING ALGORITHMS TO MEDICAL IMAGING

Katy Dong, Dane Morgan (Mentor)

Endoscopy and gastric lavage are two common medical diagnostic techniques that are used by doctors to find the source of bleeding. Although these tools are safe and convenient, they often have unsatisfactory performance when examining the low intestinal bleeding regions. The purpose of this research is applying machine-learning methods to implement accurate predictive models for helping doctors detect bleeding regions. In this project, we train a variety of models with human-labeled data set of patients' radiology results. The precision of each model has been analyzed through the loss of k-map. Since the models have various limitations, our future goal is to identify certain characteristics that may result in inefficiency of our models and strengthen them for detecting bleeding regions.

A STUDY OF THE PROTEIN-PROTEIN INTERACTIONS BETWEEN PILM AND PILB USING THE PHOTOCROSSLINKING AMINO ACID PBPA

Megan Doty, Katiria Gonzalez Rivera (Mentor)

Type IV pili are fibrous extensions in bacterial cells. To facilitate movement of pili, bacterial cells contain a pilus assembly system. This system includes proteins of interest, PilM and PilB. PilB is known to localize only when PilM is present; however, specifics of their interactions are unknown. We will be crosslinking specific amino acids of PilB to PilM. A library of 22 plasmids will be used to incorporate pBpa, a synthetic amino acid, at 22 specific locations in the PilB protein. To detect crosslinked products, we will utilize western blot. The interactions between PilM and PilB will be mapped based on the PilB-pBpa variants that promote crosslinked products. This information can give more insight into the molecular mechanisms utilized by bacteria to promote pilus assembly.

AIZOME: AN EXPLORATION OF JAPANESE STITCH RESIST AND INDIGO DYEING

Sophia Downs, Mary Hark (Mentor)

My creative research began with hands-on, in-depth studio exploration focused on the techniques and cultural significance of indigo dye traditions in Japan. Through the physical reproduction of these techniques I gained the skill necessary to experiment with traditional processes: exploring how they can be re-imagined and used in a new body of contemporary textiles that will make up my senior thesis. I am engaged in producing an original portfolio of wearable items and decorative, thoughtfully designed textile yardage that reference traditional Japanese indigo dyeing and draw heavily on my own design voice. This senior thesis calls attention to the importance of the process and the value of historical research while working with one's hands. The link between tradition and discovery drives my emerging design practice.

RELATIONSHIP SATISFACTION TRAJECTORIES OF COUPLES THAT HAVE A CHILD WITH ASD

Kim Drastal, Sigal Hartley (Mentor)

In the United States 1 in 59 children meet criteria for Autism Spectrum Disorder (ASD), a pervasive neurodevelopmental disorder characterized by impairments in communication, social interaction, and repetitive or restrictive interests or behaviors (NIMH, 2018; Baio et al., 2018). Couples who have a child with ASD have reported higher levels of parenting stress and marital dissolution, as compared to those with typically developing children and children with other disabilities (Saini et al., 2015). The current study examined trajectories of couple relationship satisfaction in mothers and fathers across 4 years. This research will help inform clinicians' practice of couples therapy, design of marital interventions, as well as family support services.

GABAERGIC CRF NEURONS ACT WITHIN THE PFC TO MODULATE WORKING MEMORY IN RATS

Kort Driessen, Craig Berridge (Mentor)

Corticotropin-releasing factor (CRF), a peptide neurotransmitter, acts within the prefrontal cortex (PFC) to impair higher cognitive function. Recent observations demonstrate that CRF-synthesizing neurons within the PFC are the endogenous source for cognition-modulating receptors. Moreover, neuropeptides such as CRF are typically found 'colocalized' with either the principal excitatory amino acid neurotransmitter, glutamate, or the principal inhibitory amino acid neurotransmitter, GABA. However, the cognitive actions of GABAergic vs glutamatergic CRF neurons are unknown. As a first step to understanding this relationship, we developed and validated a chemogenetic method to selectively target and activate GABAergic CRF neurons within the PFC. Using this method, we observe that when GABAergic CRF neurons within the dmPFC are activated chemogenetically, they act to impair working memory in rats.

DEVELOPING A TOLEROGENTIC MODEL USING THE T-CELL IMMUNOSUPPRESSIVE EFFECTS OF PD-L1 AND IDO

Travis Drow, Pradyut K Paul (Mentor)

Host immune system-mediated transplant rejection remains a primary obstacle in the success of organ and stem cell transplant therapies. Whether the host's immune system is rejecting the graft (transplant rejection) or the graft is rejecting the host as in Graft v. Host Disease (GvHD), allogeneic transplants must overcome mismatch in histocompatibility before they can be fully considered an accessible, reliable, and safe therapeutic. Demand has already outgrown an autologous model and will eventually necessitate allogeneic and xenogeneic transplants. The lack of therapeutic interventions for localized immunotherapy stands as a direct barrier to the success of transplants. In this work, I discuss the T-cell immunosuppressive effects of Programmed death-ligand 1 (PD-L1) and Indoleamine 2,3-dioxygenase (IDO) and demonstrate their success in mediating tolerogenic changes in the microenvironment.

SCHNEIDER NEONATAL ASSESSMENT FOR PRIMATE PRENATALLY EXPOSED TO ZIKA

Natalie Dulaney, Karla Ausderau (Mentor)

The Zika virus (ZIKV) has contributed to a range of neonatal complications when mothers are exposed during pregnancy. This research examines infant Rhesus macaque behavior to better understand the neurodevelopmental implications of ZIKV prenatal exposure. Infant macaques were either mother/surrogate (n=7) or nursery reared (n=1) and part of a ZIKV exposed or control group. Infants were assessed using the Schneider Neonatal Assessment for Primates to capture the neurodevelopmental progress during their first month of life. Trials were administered at the same time of day within the following days postpartum: 6-8, 13-15, 20-22, 27-29. The ~20-minute assessment examined orientation, motor maturity, state control, activity and sensory. Ratings were based on a 5-point Likert scale. Preliminary findings suggest differences in neurodevelopment for infants prenatally exposed to ZIKV.

SCIENTIST COLLABORATION

Saketram Durbha, Reece Washington, Thomas Ngo (Mentor)

Learning-by-hiring literature has suggested that hiring is beneficial to organizations. Hiring enables acquisition of important expertise that is not internally available and maintains expertise diversity within organizations, which is important for innovation processes. These potential benefits are, however, conditional on whether new hires' knowledge is integrated and transformed into organizational knowledge. We, here, study a particular type of the integration and transformation process, collaborations between a new hire and incumbents at the hiring organization. Specifically, we investigate how social ties and knowledge relatedness affect collaborations after researchers join American affiliations. We test our hypotheses using a conference dataset of over 50,000 researchers in the field of Management, which requires us to identify and track unique individuals and their affiliations over 14 years (2001–14).

DEVELOPMENT OF CHEMICAL TOOLS TO PROBE QUORUM SENSING IN ESCHERICHIA COLI

Stephen Early, Matthew Styles, Helen Blackwell (Mentor)

Quorum sensing (QS) systems control virulence in a variety of bacterial pathogens through chemical-mediated, cell-cell communication circuits. In the most common QS system in Gram-negative bacteria, a LuxI-LuxR-type synthase-receptor pair senses N-acyl-L-homoserine lactone (AHL) signals to coordinate group behavior. In this presentation, we outline our recent investigations into the activities of a library of 151 non-native AHLs using a cell-based gene reporter of SdiA activity. These studies revealed a collection of potent agonists and antagonists of QS in *E. coli*, and our lead compounds were capable of blocking QS phenotypes as measured by an acid resistance assay. These compounds represent some of the first chemical tools to study SdiA in *E. coli* and provide a pathway to new biophysical experiments to illuminate AHL:LuxR-receptor interactions.

RECOGNITION AND RETRIEVAL MEMORY: WHICH BETTER FACILITATES CHILDREN'S WORD LEARNING?

Karissa Ebert, Kylie Lowen, Haley Vlach (Mentor)

Children's storybooks facilitate word learning, but it is unknown how the composition of stories affects learning processes. This series of experiments investigated the effects of retrieval practice during storybook reading on children's memory for ten novel words and objects. Experiment 1 examined language comprehension through recognition practice of novel objects among other objects and revealed high performance regardless of engaging in retrieval practices. Experiment 2 focused on language production with retrieval memory tasks involving the production of the names of novel objects with insignificant results. Experiment 3 consisted of mapping and retrieval practices with mapping children remembering few target words and retrieval-practice children at floor performance. These findings suggest that children's storybooks may be beneficial for comprehension, but not production, of new words.

THE RETURN-TO-LEARN EXPERIENCE OF UNDERGRADUATE COLLEGE STUDENTS WHO SUSTAIN A CONCUSSION VERSUS A MUSCULOSKELETAL INJURY WHILE ENROLLED AT A UNIVERSITY

Leeah Eisch, Traci Snedden (Mentor)

A college education prepares students for a successful transition into the role and responsibilities of adulthood. However, a concussion can impair the cognitive abilities of a student, posing risks that may hinder this transition. Approximately 50% of college students with concussions return to the classroom prematurely resulting in worsened symptoms and prolonged recovery. But, little is known about the return-to-learn experience and related processes among college campuses. The purpose of this study was to describe the return-to-learn experience of college students who sustained a concussion compared to those who sustained a musculoskeletal (MSK) injury while enrolled. Preliminary results show that students with concussions missed more school days and were more concerned with their ability to learn in the classroom compared to students with MSK injuries.

ALTERING AMINO ACID RECOGNITION BY NRPS TO DEVELOP DESIGNER DRUGS

Sophie Eldred, Michael Thomas (Mentor)

Nonribosomal peptide synthetases (NRPSs) are enzymes that assemble many clinically significant drugs. NRPSs contain regions called Adenylation (A) domains that each recognize a specific amino acid that is incorporated into the final product. Learning how to alter the amino acid recognized by an A domain will enable us to make designer drugs. As a first step towards accomplishing this goal, I have constructed an *Escherichia coli* strain that expresses an artificial NRPS pathway that enables a directed evolution approach to reprogramming A domains. Here I will present my work using this system to understand how a glycine specific A domain can be altered to recognize serine. The success of understanding how to rationally reprogram A domains is a key first step in developing designer drugs.

QUEER EPISTEMOLOGY AS PEDAGOGY: CHALLENGING EPISTEMIC INJUSTICE IN THE CLASSROOM

Melady Elifritz, Hadley Cooney (Mentor)

Queer theory has worked to challenge theoretical assumptions about both sexuality and epistemology. Queer epistemology is an alternative to binary constructions of both gender and knowledge systems. Queering epistemology is a way to connect subjects to their knowledge theories in ethically representative ways. Lack of representation in the classroom creates disparities in certain students' abilities to assert themselves as credible knowers. Disproportionate access to credibility creates what Miranda Fricker refers to as epistemic injustice in classrooms. Challenging this injustice means searching for plurality, cultivating ethical social friction and encouraging resistant imaginations. These concepts come directly from José Medina's expansion of Fricker's work. Queer epistemology and other spectral or nonbinary truth structures are necessary inclusions on a theory of knowledge syllabus that values justice and diversity.

RESPONSIVE DESIGN AND THE LOCAL ENVIRONMENTAL MODELING APP

Jon Erbe, Brendan Eagan (Mentor)

Responsive design makes pages show well on a variety of devices and screen sizes. In a world of ever-varying devices, the ability to use the same apps across these devices is a high priority. Our mobile app is poised to be cleaner and more intuitive than its website counterparts. The Localized Environmental Modeler (LEM) allows classes to practice urban planning in their local environment: LEM automatically generates a playable simulation for any space with appropriately-sized parcels. Using press releases and feedback from stakeholders, students change their environment to satisfy competing interests. Classes are custom-made to fit any teacher's needs while keeping a naturally intuitive design for students. LEM is a responsive app that showcases our efforts in making software that works anywhere, on any device.

WORD CHOICE BETWEEN NEAR SYNONYMS

Jacqueline Erens, Joseph Austerweil (Mentor)

Previous research suggests that when planning speech, people choose words proportional to the amount of information they expect the word to convey, favoring words that are maximally informative over more general words. This has been shown in both nouns and pronouns, however less research exists across word classes. We presented participants with sentences from the BYU-TV Corpus, with one word removed. Participants chose between two synonyms that could both fit semantically within the sentence, picking the one they thought fit best. Some participants made this choice under demands on either visual or verbal working memory, while others faced no demands. At the current time, participants have not shown a preference for more informative words over less informative words, although more data is still being collected.

SPECIAL EDUCATION SERVICES FOR CHILDREN WITH ASD

Gabrielle Eull, Sigan Hartley (Mentor)

Based on national data, approximately 9% of children receiving special education services (Individualized Education Programs) met criteria for an autism spectrum disorder (ASD) during the 2015–16 school year. However, little is known about the distribution of services for children with ASD and the influence of ASD-specific behaviors on the number of services. The purpose of this study is to investigate the educational services provided to eleven children with ASD (aged 5–12 years) and their association with ASD symptom severity. Educational records indicated the majority of children received Occupational Therapy (72.7%), followed by Speech (54.5%) and Behavior Supports (36.4%). Analyses examined the association between ASD symptom severity and the number of services children received. Results highlight the educational supports provided to children with ASD.

EXAMINING THE RELATIONSHIP BETWEEN SLEEP AND LEARNING OUTCOMES WITHIN A CONCRETENESS FADING INSTRUCTIONAL DESIGN

Alicia Evans, John McGinty (Mentor)

The purpose of this study is to examine the relationship between sleep and participants' learning outcomes given specific teaching methods. This project asks how does the amount of sleep reported correlate to success learning math using an instructional method with only symbols, compared to an instructional method using objects, icons and symbols? The experiment measures the difference between subjects' pre and post-test scores for each instructional method, and analyzes that in relation to the amount of sleep reported. I hypothesize that because lack of sleep is shown to affect concentration, subjects who are sleep-deprived will be least successful at learning with symbols and more successful learning with objects, icons, and symbols. Subjects who are not sleep-deprived will perform better in both instructional conditions.

CHARACTERIZING TRANSIENT INTERMEDIATES IN PRODUCTIVE RNAP TRANSCRIPTION INITIATION

Claire Evensen, Thomas Record (Mentor)

Transcription initiation plays a key role in regulating gene expression, and a quantitative characterization of the process is needed. To determine the mechanism of promoter escape by *E. coli* RNA polymerase (RNAP), we determine forward rate constants for each step in DNA-RNA hybrid extension up to the escape point. These rate constants are strikingly smaller than elongation rate constants and differ greatly for different steps. Rate constants for the synthesis of 3-mer, 6-mer, and 10-mer are much larger than subsequent steps, resulting in transient accumulation of these three RNAs. We propose reductions in rate constants are due to a build-up of translocation stress during hybrid extension and indicate stepwise breaking of in-cleft, -10, and -35 DNA-promoter contacts to relieve stress and allow promoter escape.

CITRULLINES NEXT TO CERTAIN AMINO ACIDS ARE MORE COMMONLY FOUND IN ANTIGENS AND MORE COMMONLY TARGETED BY AUTOANTIBODIES IN RHEUMATOID ARTHRITIS

Lauren Fahmy, Miriam Shelef (Mentor)

Rheumatoid arthritis is an autoimmune disease with anti-citrullinated protein antibodies (ACPAs) that target citrulline, a post-translationally modified arginine. It is not known if certain amino acids next to citrulline are correlated with autoantibody binding or citrullination of arginines. We quantified the percent of peptides with each amino acid next to citrulline in peptides bound by autoantibodies in rheumatoid arthritis or citrullinated in the rheumatoid joint. We found that peptides bound by ACPAs frequently had citrulline next to specific amino acids with similar results for peptides citrullinated in the rheumatoid joint. Thus, ACPAs may target citrulline next to certain amino acids because citrulline is commonly found next to those amino acids in antigens.

KERNZA: A NEW PERENNIAL GRAIN AND FORAGE CROP FOR ENVIRONMENTAL STEWARDSHIP

Selma Fairach, Valentin Picasso Risso (Mentor)

Today, sustainable farming has become a goal of researchers worldwide. The current annual till-plant-harvest method that is adapted by many is unsustainable due to the extensive bare periods during winter and beginning of spring, causing soil erosion that leads to water pollution and a decrease in the already critical amount of consumable water for mankind. Kernza is a perennial grain that requires one time tilling and can be harvested multiple times over the next 1 or 2 decades. Right now, it is still being developed for large-scale agriculture. Thus, our current research focuses on forage quality: how companion crops and planting dates would affect yield and quality, as well as the stability of yield over the years.

ROLE OF MIR146A-5P IN PREECLAMPSIA-DYSREGULATED FETAL ENDOTHELIAL FUNCTION

Sana Fathima, Chi Zhou (Mentor)

Preeclampsia is a hypertensive disorder characterized by pregnancy initiated maternal hypertension and proteinuria, and is one of the leading causes of maternal/fetal morbidity and mortality. Children born to preeclampsia have higher risks of CVDs, which could be associated with endothelial dysfunction. MiR146a-5p is a small functional RNA that associates with CVDs, and is downregulated in fetal endothelial cells from preeclampsia. Cell migration is associated with wound healing capabilities. Scratch-healing and trans-well assays were used to measure cell migration in fetal endothelial cells with miR146a-5p downregulation. We observed that miR146a-5p downregulation causes decreased cell migration in fetal endothelial cells. This data advanced our understanding of miR146a-5p's role in fetal endothelial function, which could help future diagnosis markers identification for CVDs in children born to preeclampsia.

DETERMINING THE ACTIVITY OF TRYPTOPHAN-FREE D_{NAK} TO UTILIZE IN FRET ANALYSIS

Natalie Feider, Silvia Cavagnero (Mentor)

In vivo protein folding and cellular function are highly regulated by molecular chaperones. Therefore, understanding how chaperones affect protein folding benefits academia, biotechnology, and medicine. Hsp70, also known as DnaK in *E. coli*, is an essential chaperone whose biochemistry has been extensively studied to date. However, relatively few investigations focus on the conformation of the client protein as it interacts with the Hsp70 chaperone cycle. Förster resonance energy transfer (FRET) and fluorescence anisotropy will be used on a doubly-labeled protein, SH3, to observe these interactions. Wild-type Hsp70 has one tryptophan that interferes with fluorescent experiments. My project focuses on the expression and purification of Hsp70 variants and developing a luciferase activity assay to compare the activity of the variants to that of the wild-type chaperone.

FOMO: BEHIND THE POSTS

Isabel Fernandez, Amanda Zhang, Rocio Velasquez, Bradford Brown (Mentor)

Fear of missing out (FOMO) – worrying about not knowing or participating in key peer activities is a common concern among adolescents that can drive them to near-constant use of cell phones and, in some cases, lead to problematic levels of anxiety and depression. In intensive, qualitative interviews with a diverse sample of 29 high school freshmen, 24% expressed FOMO. Feelings of stress and disconnection often accompanied FOMO. Without their phone, participants felt bored and empty, like a piece of them was missing. FOMO seemed more common early in freshman year, before friendship networks were fully formed. High involvement in social media can increase the odds of feeling left out.

EVALUATING RIGHT EAR ADVANTAGE USING DICHOTIC VOWEL-EVOKED ENVELOPE FOLLOWING RESPONSES

Regan Flaherty, Viji Easwar (Mentor)

Auditory information from the right ear is processed preferentially by the brain in dichotic listening conditions. Electrophysiological evidence indicate the presence of REA at the cortical level. However, compelling evidence for the presence of REA at the brainstem level is lacking. This quandary may be in part be due to the use of monaural stimulation in prior brainstem electrophysiological studies. We hypothesize that a REA will be present at the brainstem under dichotic conditions. To evaluate REA in dichotic conditions, we used envelope following responses (EFR) elicited by a naturally spoken vowel /u/. Dichotic conditions were created by the lowering the fundamental frequency (f_0) of the vowel presented to one ear (92 Hz) while the original f_0 vowel (100 Hz) was presented to the other.

PULSATILE SECRETION OF GNRH PEPTIDE FROM GNRH NEURONS DERIVED FROM HUMAN PLURIPOTENT STEM CELLS

Benjamin Fordyce, Ei Terasawa (Mentor)

The pulsatile release of the molecule gonadotropin-releasing hormone (GnRH) is critical for mammalian reproductive function. However, the cellular mechanism of GnRH neurosecretion in the hypothalamus remains unclear. Recently, GnRH neurons have been derived from human pluripotent stem cells (hPSC) giving us the opportunity to study the mechanism of pulsatile GnRH secretion. Using perfusion, subsequent radioimmunoassay, and immunocytochemistry, I have found that 1) GnRH neurons derived from hPSC released the GnRH peptide in a pulsatile manner, similar to in vivo, and 2) they released the peptide in response to depolarization signals, such as high K^+ , kisspeptin, and estradiol. In general, these neurons behave very similarly to primary neurons.

ROLE OF MICRORNA-192 IN PREECLAMPSIA-DYSREGULATED FETAL ENDOTHELIAL FUNCTION

Colman Freel, Chi Zhou (Mentor)

Preeclampsia is a hypertensive disorder that complicates 3–8% of human pregnancies. Children born to preeclampsia have higher risk of adult-onset cardiovascular diseases. Endothelial dysfunction is the hallmark of cardiovascular diseases. Fetal endothelial cells from preeclampsia exhibit impaired cell function. MicroRNA-192 is associated with cardiovascular diseases (e.g., atrial fibrillation and heart failure). It regulates endothelial function and is downregulated in fetal endothelial cells from preeclampsia compared to normotensive pregnancies. RT-qPCR is the gold-standard gene expression quantification method. In this study, we evaluated the miR192 expression in female and male fetal endothelial cells from normotensive and preeclampsia using RT-qPCR. We observed that preeclampsia differentially dysregulated miR192 in female and male fetal endothelial cells. These data may advance our understanding of the mechanisms underlying preeclampsia-dysregulated fetal endothelial function.

GOVERNMENT INSPECTORS IN THE ROMAN EMPIRE AND HAN CHINA

Max Fuller, Marc Kleijwegt (Mentor)

The Roman and Han Empires were the largest and most developed empires of the ancient era in their respective regions. The two shared many similarities but also had numerous differences. This project researched two similar offices, the Roman *Correctores* and Han *Cishi*, which could be described as inspectors for the central government. These two offices were meant to address similar problems of but did so in very different ways. These differences were in many ways representative of larger political and cultural differences between the two Empires. This project therefore uses *Correctores* and *Cishi* as a lens through which to analyze the Roman and Han Empires.

MANDATED CONCUSSION EDUCATION FOR WISCONSIN HIGH SCHOOL ATHLETES AND THEIR PARENTS: SELF-REPORTED COMPLETION AND FACTORS THAT AFFECT IT

Anneliese Gall, Traci Snedden (Mentor)

Concussions in high school student athletes have become a significant public health concern. Recently, all 50 states and the District of Columbia have enacted legislation mandating a number of safety and prevention related components. Most states, including Wisconsin, require concussion education for all high school student athletes and their parents/legal guardians. This education is assumed to lead to higher levels of concussion self-reporting through increased awareness, knowledge, and improved recognition of symptoms. However, it's unknown if and how this requirement is met among high school student-athletes and their parents in Wisconsin. A secondary analysis of an existing cross-sectional dataset that includes student athlete and parent responses will provide the required variables to answer this important question. Factors that influence this education will also be examined.

MAPPING ERTAN PROJECT

Yixian Gan, Rania Huntington (Mentor)

The main purpose of this research is to find the spatial distribution of all the strange tales recorded in *Ertan*, a collection of ancient Chinese strange tales published in the late 16th century. The whole process of this project includes reading the original version of *Ertan*, finding the name of locations mentioned in the tales, and mapping these locations on a base map. Later analyze on these geographical data, including but not limited to counting instances within a provincial boundary will be performed, and this step can be achieved by using QGIS, an open source geographical information system software. All these steps are intended to show the spatial distribution of strange tales and look for potential factors that may lead to this specific pattern.

SMART SUSTAINABLE MANUFACTURING

Lynette Gao, Sangkee Min (Mentor)

Our research is focused on analyzing collected data from machines in order to monitor machine health and predict machine anomalies in response to major events. Data will be collected in real-time through Internet of Things to be processed and analyzed. The ability to predict when a significant event is likely to occur, such as machine failure, will enable the manufacturer to run machines as efficiently as possible and increase product output. This research is a part of Smart Sustainable Manufacturing, which plays a role in the bigger picture of Cloud Manufacturing and Industry 4.0, terms used to describe the next big leap in improving manufacturing.

PATIENT-COLLECTED AUDIO FOR PERFORMANCE ASSESSMENT OF THE CLINICAL ENCOUNTER

Diana Garcia-Vidal, Kelsey Baubie (Mentor)

In order to make medical care more efficient, contextualized care must be applied. Every single patient has a different lifestyle and factors that play a big role in how efficient care plans are for them. Therefore, it is important for physicians to take into account the individual and different lifestyle factors that each patient brings into their appointments. This study is using confidential audio recordings obtained from clinical encounters to gather feedback on how well physicians are integrating lifestyle factors into individual plans of care for each patient. Having the ability to analyze these interactions has allowed physicians to receive more positive feedback and simultaneously improve their performance in creating more individualized plans of care.

HOW STUDENTS LEARN ABSTRACT CHEMISTRY CONCEPTS USING THINK ALOUD STRATEGIES

Marisa Gasparri, Sally Wu (Mentor)

This study focuses on how integrating a Think Aloud approach where students verbalize their thinking process, may counter the difficulty undergraduate students experience when solving abstract chemistry problems. This research was conducted using transcripts from a laboratory study that used an online ChemTutor to teach visual representations of an atom (i.e., Bohr model, Energy diagram, etc.). We coded each transcript for students' different think aloud approaches, including reading the problem, guessing, using hints, and elaborating on their thoughts/ideas. These codes were compared to students' log data and pre/post-test scores to determine which think aloud approach was most useful. These findings will identify effective methods for students that help them learn and apply complex chemistry concepts inside and outside the classroom.

CONTENT ANALYSIS OF DEPRESSION PERSONAL ACCOUNT VIDEOS ON YOUTUBE

Quintin Gaus, Megan Moreno (Mentor)

YouTube personal account videos about depression feature a creator who discusses their experiences with depression. While these videos are relevant for adolescents and young adults seeking information about depression, there is relatively little known about them. The purpose of the present study is to identify common elements of these videos and their comments. A content analysis will be conducted on 30 depression personal account videos evaluating common video elements, portrayal of depression, and if hopelessness was expressed. The first twenty top comments will also be content coded based on commenter demographics, comment elements, and the reaction to the video/creator (e.g., helpful or not helpful). Descriptive statistics will be analyzed for prevalence, patterns, and associations.

PERCEIVED BARRIERS AND POINTS OF ACCESS TO MENTAL HEALTH CARE IN PUEBLA, MEXICO

Gabriella Gaus Hinojosa, Melanie N Benito, Stephen Quintana (Mentor)

Researching barriers and points of access to mental health treatment is of great importance for marginalized populations whose low socioeconomic status increases their risk of developing mental illness. The current project builds on transnational findings by studying factors that facilitate and hinder patients and their caregivers from receiving mental health treatment. Conducting a qualitative analysis, we systematically organized 19 case interviews from a specific socio-geographic population in Mexico with the purpose of furthering insight on cultural and social factors associated to treatment access. The author discusses the implications of these findings given that knowledge of how individuals access resources facilitates developing a mental health treatment plan, prioritizing how to allocate resources, and decreasing mental illness burden particularly among non-White populations in Western cultures.

ACCLIMATION RESPONSES OF MARQUETTE GRAPEVINE BUDS WITH EXPOSURE TO ABOVE AND BELOW FREEZING TEMPERATURES.

Elizabeth Geboy, Mike North (Mentor)

Viticulture research has yet to determine whether grapevine buds can fully reacclimate to survive cold temperatures after exposure to warm temperatures for an extended period of time. The purpose of this study is to investigate the acclimation responses of interspecific hybrid grapevine cv. Marquette buds by subjecting them to periods of above freezing temperatures followed by periods of below freezing temperatures. In this quantitative study, grapevine buds will be exposed to temperature treatments to induce deacclimation and reacclimation. The temperature buds will freeze at will be measured using differential thermal analysis (DTA). Experimental data will be analyzed to improve our understanding of the buds' ability to survive cold temperatures and to better understand unseasonal weather impacts on the health of grapevines in the vineyard.

WHO MUST WE SAVE: RECONCILING TRADEOFF SITUATIONS

Grace Gecewicz, Harry Brighthouse (Mentor)

I develop an argument which reconciles my reactions about two tradeoff situations. The first is the life-saving drug case in which we can save either one person who needs all of a drug or five people who each need one-fifth of the drug. The second asks the reader to choose between two different colon cancer screening tests. Test 1 would be offered to all but less precise, Test 2 would be given to only half the patients but offer more accuracy. In the latter case more lives would be saved. I believe that in the life-saving drug case, one must save the five. Numbers seem to matter to my decision. However, in the colon cancer case, I think that one should chose Test 1.

INVESTIGATING THE ROLE OF TCF19 IN MOUSE β -CELL FUNCTION IN RESPONSE TO A METABOLIC STRESSOR USING IMMUNOHISTOCHEMISTRY

Rachel Geroux, Dawn Davis (Mentor)

Diabetes mellites (DM) is a common disease affecting one in ten Americans and is characterized by chronic high blood glucose. Hyperglycemia in DM results from the failure of β -cells in the pancreas to produce enough insulin. In genome-wide association studies, a novel transcription factor, Tcf19, was associated with DM. Tcf19 expression correlates with increased β -cell proliferation and decreased apoptosis. We hypothesize Tcf19 has an adaptive role in β -cells when exposed to a metabolic stressor. This will be investigated by feeding Tcf19 knockout (Tcf19KO) mice and wild type (WT) controls a high fat diet and using immunohistochemistry to analyze the mouse pancreas. We anticipate Tcf19KO mice will have decreased β -cell mass and proliferation compared to WT. This would confirm the adaptive function of Tcf19 in β -cells.

BIOCATALYTIC SYNTHESIS AND PURIFICATION OF NONCANONICAL GAMMA-HYDROXY AMINO ACIDS

Eric Geunes, Andrew Buller (Mentor)

Noncanonical amino acids (ncAAs) have proven significance in the fields of research and medicine. However, efforts to synthesize these are complicated by a high number of steps, harsh conditions, selectivity, and yield. In this project, we turn to one of nature's biocatalysts in order to efficiently synthesize ncAAs with good selectivity in mild conditions. UstD, a recently discovered enzyme involved in the biosynthetic pathway of ustiloxin B, is a pyridoxal phosphate-dependent enzyme that naturally forms the ncAA product via decarboxylation of aspartate and nucleophilic attack into its aldehyde substrate. By exploiting the enzyme's substrate promiscuity and engineering it through directed evolution, we can synthesize a multitude of ncAAs efficiently. This project details efforts to produce and purify gamma-hydroxy amino acids at milligram-scale using UstD.

INDUCING KNOCK-DOWN OF INSECTICIDE-RESISTANT GENES IN THE COLORADO POTATO BEETLE

Maria Golovkina, Michael Crossley (Mentor)

The Colorado potato beetle (CPB) presents difficulties in pest management due to rapid development of pesticide resistance through changes in expression of metabolic detoxification genes. Despite their important role in metabolic detoxification, ATP-binding cassette (ABC) transporters remain unstudied in CPB. We examined the role of two ABC transporters in detoxifying a widely used insecticide, imidacloprid, using RNAi interference and a dsRNA feeding assay. We found that beetles treated with dsRNA from the two ABC transporters exhibited increased moribundity after exposure to imidacloprid. We then confirmed that the dsRNA feeding assay successfully knocked-down expression of one of the two target genes, using quantitative polymerase chain reaction. To further understand the metabolic pathways of insecticide detoxification in CPB, a more holistic examination of ABC transporters is crucial.

AN EXPLORATION OF COMMUNITY-OWNED LAND CONSERVATION

Hannah Gordon, Anna Zibinski, Lena Carlson, Jim Berkelman (Mentor)

Both government-run and community-owned land conservation are used globally, and each has advantages and disadvantages concerning biodiversity, sustainable land use and accessibility. We investigated the feasibility of community-owned land conservation practices in achieving these goals in Mexico, in comparison to government-run practices. This analysis compares these systems to similar and contrasting practices globally, focusing on case studies in Zimbabwe, Europe, and Vietnam. Our results suggest that government-run conservation efforts are more effective in protecting biodiversity than community-run efforts. However, community efforts present unique benefits by providing communities autonomy over land, which gives communities responsibility, ownership, and collective rights to their land use, while protecting biodiversity. This illustrates a longer term solution to land conservation conflicts that arise due to community and government strife.

CHARACTERIZATION OF TOLL-LIKE RECEPTORS IN THE HUMAN LARYNX

Madhu Gowda, Susan Thibeault (Mentor)

The vocal fold (VF) epithelium provides a unique interface with the external environment and protection from various types of injury. The epithelial tissue plays an important role in immune system function as well. The toll like family (TLR) are essential signaling components of the innate immune response. The purpose of this study was to delineate the constitutive expression of TLR in vocal fold tissue and cells in inflammatory versus normal conditions. It was found that TLR1-9 was present in murine and human vocal folds with localization in the epithelium, but constitutive expression of TLR4 did not increase in epithelial cells with an inflamed phenotype. The knowledge gained in this study elucidates host responsiveness and possible targets for modulation of the VF innate immune system.

A FARMERS MARKET FOR ALL? A LOOK INTO THE TRUE ACCESSIBILITY OF FARMERS MARKETS

Chloe Green, Chloe Green, Alfonso Morales (Mentor)

Farmers markets visitors face multiple barriers to attend a market. While some are more obvious, others may be less clear to the general public. Green collected surveys and interviews from over 115 individuals and families at 16 different farmers markets in 6 counties across Wisconsin. The primary goal was to hear from marginalized market visitors about what makes people who may not be the stereotypical market visitor feel welcomed and keep them coming, and how these aspects could ultimately be improved. These findings are now being used to develop and implement a "Model Market" project that intends to create a methodology to make farmers markets more accessible to people using benefits. The project will be piloted this year at Brown Deer Farmers Market in Milwaukee.

DEVELOPMENT OF AN AUTOMATED ANALYSIS TOOL TO CHARACTERIZE VENTILATION DEFECTS IN CHILDREN AND ADOLESCENTS VIA 3HE MAGNETIC RESONANCE IMAGES

Carter Griest, Sean Fain (Mentor)

Magnetic resonance imaging (MRI) with ³He has been developed as a potential diagnostic tool for measuring regional obstruction in asthmatics. In the following study MRI data was acquired pre- and post-puberty from 44 children. Preliminary results revealed strong correlations between asthma and lung microstructure over time, but regional ventilation was scored qualitatively rather than quantitatively due to the lack of a comprehensive automated tool that can account for dynamics of gas distribution during breath-hold. Thus, we have focused on developing and validating an automated tool that quantifies airway obstruction in pediatric patients using a stepwise, generalized linear regression model that is trained on a subset of the data and tested on the remainder—we hypothesize that the degree of obstruction will be associated with asthma severity.

THE EFFECT OF BILINGUALISM ON CHILDREN'S COMMUNICATION SKILLS

Queila Griffin, Margarita Kaushanskaya (Mentor)

It is important to understand whether variability in the way children acquire two languages matters in the development of their communication skills. In this research, I will have access to data on Spanish-English bilingual children between 4 and 5 who have completed a Theory of Mind task (that tests the children's ability to reason about other people's mind, an ability crucial for successful communication) and parents' rating of their children's communication skills. I will examine the relationship between children's age of second language acquisition and these two indexes of communication. Because some studies indicate a connection between bilingualism and development of theory of mind skills, I expect to find that younger age of second language acquisition will be associated with overall better communication skills.

COPING STYLES OF LOW-INCOME COMMUNITY ADULTS WITH SEVERE MENTAL ILLNESS

Jennifer Grissim, Linda Oakley (Mentor)

Low-income community adults with severe mental illness still have to cope with everyday life stress. A goal of our community health promotion team is to offer classes on healthy coping under complex life circumstances. Our first step was to assess coping styles and coping resources in a diverse group of volunteers. Surveys and interviews were used to assess avoidant versus approach coping style, life stressors worried about most, and perceived coping abilities. Approach coping style (M=23.5) was more common than avoidant coping style (M=19.6), worrisome life stressors ranged from depression and loneliness to major disputes, and most volunteers rated their coping abilities as average (M=58.8, max. 100). Guided by these results, our healthy coping class will promote coping willingness and confidence and non-avoidant coping skills.

MODELING THE IMPACT OF NUTRIENT AVAILABILITY ON A SYNTHETIC GUT MICROBIOME COMMUNITY.

Emma Groblewski, Ophelia Venturelli (Mentor)

The gut microbiome's role in human health and disease has become increasingly apparent. Although it is clear that alterations in microbial diversity, abundance, and growth are highly dynamic in accordance with environmental changes such as diet and disease, the underlying mechanisms governing these dynamics are poorly understood. This project aims to assess the extent a microbial community's structure can be determined from nutrient availability by creating a model of community assembly dependent upon environmental concentrations of carbon and nitrogen. The model is constructed using data obtained from responses of individual monospecies to varying concentrations of carbon and nitrogen sources. The predictive capability of this model provides insight to factors shaping community composition, and how a microbial community's structure can be predicted and controlled.

IMPACT OF CANCER-ASSOCIATED MUTATIONS IN SF3B1 ON YEAST PRE-MRNA SPLICING

Brent Groubert, Harpreet Kaur (Mentor)

Numerous human diseases such as myelodysplastic syndromes (MDS), endometrial cancer (UCEC), bladder carcinoma (BLCA), and acute myeloid leukemia (LAML) have been linked to mutations in a highly conserved splicing factor SF3b1. SF3b1 is essential for U2snRNP recruitment to pre-mRNA or splicing. The aim of this study is to introduce cancer related mutations into the homologous yeast protein (HSH155) to gain further insight into the consequences of these mutations on splicing. Temperature-dependent growth assays and an in vivo splicing reporter were used to measure phenotypic responses due to these mutations. These experiments will identify how cancer-linked mutations change conserved, fundamental steps carried out by the spliceosome and how perturbation of these steps can lead to changes in alternative splicing.

MICROWAVE IMAGING FOR SKIN CANCER USING NEAR-FIELD ANTENNA ARRAYS

Yuchen Gu, Daniel van der Weide (Mentor)

Skin cancer is the most common form of all cancers and requires diagnosis by dermatologists, who are often scheduled over six months in advance. Diagnosis of skin cancer is generally done by optical inspection and Mohs surgery. Optical inspection lacks the ability to accurately distinguish the nature and properties of different types of cancers. Meanwhile, Mohs causes significant pain to patients due to the removal of skin tissue. Therefore, a non-invasive in-vivo imaging technique with the ability to distinguish healthy from diseased tissue at appropriate depths is urgently needed. I propose using ultra-wideband microwave reflectometry in near-field arrays, coupled with visual mapping, to accomplish this.

COMPARISON OF EXTERNAL BEAM RADIATION AND MOLECULAR TARGETED RADIATION ON IMMUNE ACTIVATION IN CANCER

Sai Gungurthi, Ravi Patel (Mentor)

Approximately 38% of people will be diagnosed with cancer during their lifetimes. The goal of our research is to develop a long-term cancer treatment utilizing radiotherapy to enhance the efficacy of immunotherapy. External beam radiation (EBRT) is a treatment where the tumor is exposed to high energy photon beams or x-rays. Molecularly targeted radiotherapy (MTRT) contrarily utilizes systemically delivered tumor targeted radionuclides. Radiation stimulates an immune response by promoting the release of tumor neoantigens and making it easier for T-cells to infiltrate the tumor micro-environment (TME). For our current study, mice with a syngeneic B78 melanoma tumor were established and treated with differing doses of MTRT or EBRT. Tumors were then immunophenotyped with flow cytometry and quantitative PCR to compare differences in type radiation.

SPHAGNUM MOSS

Danielle Gygi, Kevin Barrett (Mentor)

This study examines the use of macrofossil remains to reconstruct the history of *Sphagnum palustre* within peatlands of Kohala, Hawaii. We accomplished this through comparing vegetation histories of two peatlands through microscopic analysis of plant macrofossil remains preserved in peat sediment cores. Carbon storage dynamics were analyzed by the loss-on-ignition technique which involves combusting organic carbon content of peat in high temperature. The patterns of carbon storage for the last few centuries are compared between each peatland by using radiometric dating techniques. With these carbon storage patterns, we can see how vegetation change influences carbon dynamics in this tropical ecosystem. Additionally, these two sites are currently being worked on to develop records of past climate change.

NITROGEN FIXATION THROUGH SYMBIOTIC ASSOCIATIONS BETWEEN MEDICAGO AND RHIZOBIA

Hibah Hafeez, Thomas Irving (Mentor)

Plants require nitrogen for growth. Currently, nitrogen fertilization leads to eutrophication. Legumes obtain nitrogen through symbiotic association with rhizobia bacteria that fix atmospheric nitrogen in root nodules. The transcription factor NIN controls development of nodules, but is also present in the non-legume poplar. We hypothesize that the transcription factor CYCLOPS, which is activated by rhizobia, regulates NIN in legumes by binding to the NIN promoter. Poplar NIN genes lack this CYCLOPS-binding element. We have artificially introduced CYCLOPS-binding elements into poplar NIN promoters through GoldenGate cloning, so that symbiotic bacteria induce NIN expression. We have assessed the changes to promoter expression in our constructs. This could allow symbiotic nitrogen fixation in poplar, which could be extended to other plants, thereby reducing fertilizer usage.

BENDING AND WRAPPING OF Δ PR PROMOTOR DNA ON E. COLI RNAP DETECTED BY SINGLE MOLECULE FLUORESCENCE MICROSCOPY

Stephen Halada, M. Thomas Record Jr. (Mentor)

Transcription initiation is regulated in part by interactions between promoter DNA and RNA polymerase (RNAP), which determine the kinetics of formation and stability of transcription complexes. Fluorescence energy transfer (FRET) between labels on promoter DNA has allowed detection of its bending and wrapping on RNAP in ensemble experiments (Sreenivasan 2016). In collaboration with Prof. Aaron Hoskins and his laboratory, we are using single molecule FRET, which provides higher-resolution FRET information in heterogeneous populations, to investigate this bend and wrap phenomenon. Single molecule FRET measurements may elucidate the equilibria and dynamics of interconversion of high-FRET and low-FRET subpopulations of specific promoter complexes. Going forward, we will characterize the behavior of productive and non-productive initiation complexes that are synthesizing RNA after addition of nucleotides (NTP).

TRUTHFULNESS OF SHAKEN BABY SYNDROME (SBS) CONFESSIONS

Natalie Hameister, Keith Findley (Mentor)

Due to ethical challenges with conducting scientific research on the effects of shaking infants, researchers have defaulted to relying on alleged perpetrators' confessions to prove that violent shaking causes brain injury and death. But no research has studied whether the confessions are independently valid. Our data was collected by randomly selecting 30 American police jurisdictions, ranked according to their annual number of Shaken Baby Syndrome (SBS) cases. We are currently coding transcripts that these jurisdictions provided for pressuring interrogation tactics and unsubstantiated accusations. We will communicate our findings to the legal system, in order to prevent accused caregivers of being wrongly convicted of child abuse. This study has the potential to alter both the legal system's fact-finding processes, and the preceding interrogations of suspects.

BIM EXPRESSION REQUIREMENT FOR TREATMENT OF NEOVASCULAR EYE DISEASES

Barbara Hanna, Christine Sorenson (Mentor)

Neovascular eye diseases are a major cause of vision loss. Development of effective therapy is vital to saving sights. The normal activity of Bim protein is essential for proper ocular vascular development and neovascularization. How its aberrant expression contributes to neovascularization and treatment failure in neovascular eye diseases needs further investigation. We previously showed that aortas from mice deficient in Bim demonstrate significantly more sprouting compared to aortas from wild type mice. Here we will test the hypothesis that attenuation of aorta sprouting by antagonizing vascular endothelial growth factor, a proangiogenic factor that drives sprouting, is dependent on Bim expression. Thus, alterations in Bim expression could significantly impact treatment of ocular diseases in the clinic.

GENDER DIFFERENCES IN NATURALLY OCCURRING SOCIAL FUNCTIONAL SMILES

Zoe Hansen, Paula Niedenthal (Mentor)

Through their nuanced ability to reward, reassure, and judge, smiles have a powerful role in daily interactions and accomplish many tasks. A recent social functional approach has determined that there are three distinct types of smiles, which each serve a specific function in social communication. It remains unclear, however, how gender differences in emotional expression map onto these smiles types. Past research shows that, due to their assigned social roles, women consistently smile more and express more reaffirming behavior, whereas men often express more anger. Using video recordings of participants interacting and sharing humorous videos, I aim to determine the types and frequencies of smiles expressed by each gender. I predict that women will express more affiliative smiles, and men will express more dominant smiles.

SUPPRESSORS OF ADH2 MUTATION IN ARABIDOPSIS THALIANA

Caroline Hanson, Hiroshi Maeda (Mentor)

Production of tyrosine and other aromatic amino acids in plants is regulated through the Shikimate Pathway. Knockdown of arogonate dehydrogenase (ADH), an enzyme in this pathway, leads to slowed growth with yellowing, reticulate leaves in *Arabidopsis thaliana*. This knockdown phenotype has been suppressed in some plants when random mutations are chemically induced in the genome of *A. Thaliana*. Recombinant mapping techniques and next-generation sequencing have been used to identify the specific mutation responsible for this phenotypic suppression. Initial mapping experiments have narrowed down the identity of this mutation to a handful of gene candidates. Identification of this suppressor mutation will increase our understanding of regulatory mechanisms in the Shikimate Pathway that are responsible for maintaining tyrosine homeostasis in plants.

SEEDLING ECOPHYSIOLOGICAL RESPONSE TO WATER STRESS AMONG LONGLEAF AND LOBLOLLY PINES

James Hart, Kim O'Keefe (Mentor)

In this study, we compare the physiological response among longleaf pine (*Pinus palustris*) and loblolly pine (*Pinus taeda*) seedlings to a progressive drought treatment. Data on gas exchange, allometry, and water relations was collected between October 26 and December 20, 2019. Seedlings were grown in a greenhouse setting, and five individuals of each species/treatment combination were randomly selected each week for sampling. We expect *P. palustris* to display greater drought tolerance, as seen in higher photosynthetic activity, growth, and lower water potential. Data processing is ongoing, but so far longleaf pine seedlings have appeared to maintain higher functionality throughout our drought treatment than loblolly.

DATING APPS AND SEXUAL BEHAVIOR AMONG COLLEGE STUDENTS

Megan Haug, Megan Moreno (Mentor)

Geosocial-networking (GSN) dating app use has been associated with risky sexual behaviors and negative health outcomes in certain populations. It is unknown whether this same association is present in the general college student population, a group with high prevalence of sexually transmitted infections (STIs). The purpose of this study is to explore the relationship between GSN dating app use and sexual behavior in college students. Students ages 18–29 will be recruited to complete an online survey aimed at assessing their sexual behavior and GSN dating app use. Analysis will include descriptive statistics and correlations between preferred GSN dating app, user characteristics and sexual behaviors. Findings could help identify specific college student populations for future sexual health interventions.

USING PULSARS TO DEVELOP A NEW MODEL FOR THE DENSITY OF ELECTRONS IN THE MILKY WAY GALAXY

Benjamin Havlicek, Ben Havlicek, Robert Benjamin (Mentor)

Pulsars are a type of extremely dense rapidly rotating star composed mainly of neutrons. These stars, as they spin, emit electromagnetic waves at a range of radio frequencies. Astronomers have observed that lower frequency pulses have a delay in arrival time to Earth due to the number of interstellar electrons along the path to the pulsar. This delay is called pulse dispersion. The product of the average electron density times the distance to the pulsar is called the pulsar dispersion measure. I am using a dataset of 238 pulsars with known distances and dispersion measures develop a model of electron density in the Galaxy. This model will be used to predict the distance to the other approximately 2000 known pulsars.

STRENGTHENING LOCAL FOOD SYSTEMS: IMPROVING FUNCTION AND ACCESSIBILITY IN FARMERS MARKETS

Arden He, Chloe Green, Alfonso Morales (Mentor)

Previous literature has proven farmers markets to be a focal point of community health and culture, with economic contributions that develop communities. However, lack of staff, funding, and overall support prevents markets from fully serving their vendors and customers. For example, many markets with low-income customers cannot afford EBT machines, which allow those with government benefits to purchase food. I worked on multiple ongoing projects seeking to strengthen local food systems, and drew on primary and secondary sources to draft reports to support each project. Notable projects included Farm2Facts, an online toolkit to provide farmers market managers with a holistic view of their market, and a Wisconsin Idea Fellowship project that seeks to create a model farmers market accessible to all.

OBSERVING GRADIENTS IN SYNTHETIC X-RAY MAPS OF GALAXY CLUSTERS IN SIMULATIONS OF AGN FEEDBACK

Andrew Heinrich, Yi-hao Chen, Sebastian Heinz (Mentor)

I will present the ongoing preliminary research for my senior thesis looking at simulations of galaxy cluster astrophysical jets. The cooling flow problem in high energy astrophysics examines the discrepancy between expected and observed mass deposition in the center of galaxy clusters, the largest gravitationally bound objects in the universe. I will produce and analyze x-ray images from simulations of the Perseus galaxy cluster using radial profiling techniques, looking at the evolution of the jet over time, and by applying a new post-processing technique which will better identify structures in the images to determine how the jet can suppress the cooling flow by heating the atmosphere. The analysis can then be compared to observational data from the Chandra X-ray Observatory.

USING MKL-1 AS A POTENTIAL FLUORESCENT CELLULAR STIFFNESS REPORTER

Maihlee Her, Brian Burkel, Suzanne Ponik (Mentor)

Fibrosis is characterized as the scarring and thickening of tissues due to excessive accumulation of extracellular matrix (ECM) proteins. This pathological deposition interferes with normal organ functions and in developed countries, is responsible for 45% of all deaths. The causes of fibrosis remain unclear but cellular mechanical cues like stiffness are known to promote further accumulation of ECM proteins thereby accelerating disease progression. MKL-1, a mechanosensitive protein that enhances expression of ECM genes, can be used as a potential reporter to monitor the fibrotic response in cells. Using a combination of fluorescent microscopy and molecular cloning, we aim to create a fluorescent cellular stiffness reporter with MKL-1 to help identify important ECM components and mechanisms that cause fibrosis to progress in further models.

THE EFFECTS OF DRUG TRADE ON CONSERVATION EFFORTS: MEXICO AND THE WORLD

Shelby Herring, Joshua Phillips, Jim Berkelman (Mentor)

The drug trade is growing more rapidly in countries that have high biodiversity and high extinction rates. These countries have an increased need for conservation measures, yet fear associated with the drug trade often hinders those efforts. As part of a study abroad course, we spent time in Jalisco, Mexico where we observed how the risks and threats of drug trade affect conservation efforts. Our research reviews similar threats on conservation around the world that include countries in South America and Asia. Based on actions taken in those cases, we make recommendations for how Mexico can combat the effect of the drug trade on its biodiversity conservation.

UNDERSTANDING THE FUNCTION OF THE C-TERMINAL DOMAIN IN THE HSP70 MOLECULAR CHAPERONE SSB

Paige Hill, Brenda Schilke (Mentor)

The Hsp70 molecular chaperone Ssb found in *Saccharomyces cerevisiae* assists in the folding of newly translated polypeptides. The purpose of this study was to illuminate confounding results in previous studies of Ssb that suggest the C-terminal domain (CTD), which is essential for all other tested Hsp70s, is not necessary for its function. Ssb truncations of varying lengths were constructed to determine the function of the CTD by performing growth assays in yeast strains deleted for the wild type copies of Ssb along with the presence or absence of the co-chaperone Ssz. These truncations were created in the same regions as previously described (Pfund et al. 2001) with adjustments based on new structural information of Ssb. Understanding Ssb's function will provide further insights into protein synthesis.

RELATIONSHIP BETWEEN THE NUMBER AND MASS OF NODULES AND ABOVE GROUND NITROGEN USE BY SOYBEANS

Victor Hinardi, Teal Potter (Mentor)

Soybean plants have mutually beneficial interactions with bacteria called Rhizobia. Rhizobia are able to turn nitrogen gas into a source of nitrogen which is beneficial for plants. Studies have shown that the evidence of this interaction is formation of nodules (bulges on the roots). I am investigating the relationship between nodule measurements and both the chlorophyll content of leaves and bean yields. This study is important for soybean farmers so that they can be assured that counting number of nodules on roots or weighting them is an effective way to determine bean yields from soybean plants. The soybeans used in this greenhouse experiment were grown in low nitrogen soils where each soybean pot received additional soil from one of 11 soybean fields in southwestern Wisconsin.

DCC RESCUES NEURONAL MATURATION DEFICITS OF MBD1-DEFICIENT NEURONS

Johnson Hoang, Xinyu Zhao (Mentor)

Neurodevelopment depends on precise regulation of neuronal genes. Methyl-CpG binding protein 1 (MBD1) is an interpreter of the epigenome and is implicated in neurodevelopment disorders. Gene mutations and polymorphisms in MBD1 have been found in a subset of autistic patients, and the presence of MBD1 mutations is correlated with more severe cognitive phenotypes. However, the precise function of MBD1 in neuronal development remain unknown. Here, we demonstrated that MBD1 is essential for proper neuronal maturation. We found that a subset of neuronal genes, including Deleted in Colon Cancer (DCC) were downregulated in MBD1 deficient neurons and elevating DCC levels in MBD1-deficient neurons rescued maturation deficits. Our study unveils a potential therapeutic application on autism caused by Mbd1 deficiency.

INFLUENCE OF EARTHWORM INVASION ON SUGAR MAPLE ROOT GROWTH AND MYCORRHIZAL COLONIZATION

Kevin Hobbins, Kim (Mentor)

Nonnative earthworms have been shown to significantly alter ecosystem structure and function in communities previously uninhabited by earthworms. Since 2013, European earthworms began declining in response to growing populations Asian earthworms (*Amyntas*) in central Wisconsin. In contrast to European species, *Amyntas* are capable of living at much higher densities and persist primarily in the uppermost soil layers. Due to these differences, we assessed the effects of *Amyntas* and European earthworms on specific root length (SRL) and arbuscular mycorrhizal (AM) fungal colonization of sugar maple fine roots collected from the Arboretum and Lakeshore Nature Preserve. Although we observed minor differences between invaded and non-invaded sites, *Amyntas* does not appear to be having significant effects on AM colonization or SRL during these early stages of invasion.

RECENT STRESS, CORTISOL DYSREGULATION, AND COGNITION IN MIDDLE-AGED AND OLDER ADULTS

Amy Hobday, Amy Hobday, Megan Zuelsdorff (Mentor)

While many studies have addressed the effects of stress on cognition, few have assessed biological mechanisms by which stress may be impacting cognitive aging processes. Clarification of physiological pathways will aid in identification of potential intervention points. The stress hormone cortisol may provoke systemic dysfunction and premature aging, including brain aging, under conditions of chronic stress. The purpose of this research is to examine the role of cortisol dysregulation as a potential mediating variable between recent stress and poorer cognition among approximately 200 middle-aged and older enrollees in two University of Wisconsin cognitive aging studies. The anticipated results are that a negative relationship between self-perceived stressful events over the past year and cognitive test performance will be partially mediated by cortisol dysregulation.

INVESTIGATION INTO THE CORE SPACEFLIGHT RESPONSE GENE BAG6 AND ITS POSSIBLE ROLE IN HEAT SHOCK AND ROS RELATED SIGNALING.

Jacob Hotvedt, Simon Gilroy (Mentor)

The gene, BAG6, in *Arabidopsis thaliana* is known to be involved in response to plant pathogens and abiotic stresses. RNAseq data from the Gilroy Lab BRIC19 experiment noted that BAG6 is upregulated during spaceflight for unknown reasons. The protein interactome suggests that it interacts with members of the Calmodulin family; a family of calcium signaling genes which are important for stress response. Experimental evidence has found binding with a member of the Calmodulin family, CAM5. Results of a gravitropism assay have concluded that BAG6 is not important for gravitropism in the absence of stress. Confocal imaging has shown that BAG6 has a slight response to heat stress, and a strong response to ROS stress.

RELIEF FOR BACK PAIN: A QUALITATIVE STUDY OF WHAT HELPS INDIVIDUALS WITH OPIOID TREATED CHRONIC-LOW-BACK-PAIN

Nguyen Hua, Aleksandra Zgierska (Mentor)

Background: Despite the lack of uniformly effective treatments for chronic low back pain (CLBP), individuals with CLBP try existing measures for relief. OBJECTIVE: To understand what helps individuals manage CLBP. METHODS: 45 participants involved in a larger clinical trial were interviewed about what they find helpful for CLBP. The interviews were transcribed and qualitatively analyzed. Results: Responses indicated that, although specific measures used by individuals were diverse, the most prevalent theme was related to activity level (N=34), with 18 participants identifying specific movements and 12 identifying rest as helpful for managing pain. CONCLUSIONS: Although several main themes emerged, the specific measures for pain relief are individualized, suggesting that treatment for CLBP should be personalized.

CONDITIONAL EXPRESSION OF VIMENTIN-MNEONGREEN IN NEURAL STEM CELLS

Katrina Hunt, Tiara Porter, Katrina Hunt, Darcie Moore (Mentor)

Hippocampal neural stem cells (NSCs) divide and create new neurons, which are important for learning and memory, during adulthood. However, NSCs divide less with increasing age, with the mechanisms unknown. Previous studies have shown that vimentin, an intermediate filament, and ubiquitin, a marker for damaged proteins, asymmetrically segregate between two daughter NSCs during mitosis. The daughter NSC inheriting these proteins has a decreased proliferation rate. Thus, to better understand vimentin dynamics and asymmetric segregation, we will create a novel NSC line where vimentin can be inducibly fused to the fluorophore mNeonGreen using the Cre/loxP system. Cre recombinase excises DNA segments between loxP sequences. Here, loxP sites are flanking a stop codon that precedes mNeonGreen such that with Cre addition, vimentin will be expressed with mNeonGreen.

NARRATIVE PSYCHOEDUCATION: THE ART OF MENTAL HEALTH

Tiffany Ike, Stephanie Graham (Mentor)

With mental health-related conversations increasing in mainstream, it has become quite clear that psychological and emotional well-being cannot be simplified into a categorization - especially when taking cultural differences into account. People experience and exhibit symptoms of trauma differently and with mental health only recently being embraced by the greater public, the language to put words to these experiences is falling behind. This research project studies narrative theory in the fields of psychology and media. The mission was to survey how we as people shape our own diverse narratives and how media reflects it. This was an effort to discover methods for storytelling that focuses on multi-perspective storytelling that also can be used to provide both educational and engaging content related to mental health experiences and services.

GENETIC VARIANTS AND BLADDER CANCER RISK IN DOGS

Brandon Incrocci, Ros Luethcke, Lauren Trepanier (Mentor)

Transitional cell carcinoma (TCC) is an aggressive bladder cancer in dogs, but the causes are largely unknown. Human TCC is linked to industrial and herbicide exposures, combined with genetic variants in glutathione-S-transferase (e.g., GSTM1) enzymes, which degrade environmental chemicals. Our study aim was to determine whether canine GSTM1 gene variants were more common in pet dogs with TCC compared to control dogs. 74 dogs (46 with TCC, 28 controls) have been genotyped at 4 canine GSTM1 loci. Three variant alleles were absent in this population. A deletion variant, *100delT, was found with similar allele frequencies (TCC 0.391, control 0.339, $P = 0.60$). Ongoing GSTM1 genotyping will more fully assess the contribution of this chemical detoxification pathway to bladder cancer risk in dogs.

REGION-SPECIFIC REMODELING OF ATRIAL MYOCYTES IN HEART FAILURE DOWNREGULATES CAVEOLAE STRUCTURES AND DISRUPTS SUBCELLULAR CALCIUM RELEASE

Ashley Irwin, Alexey Glukhov (Mentor)

Caveolae and transverse (t)-tubules are the main structural compartments of cardiomyocytes that regulate subcellular calcium signaling. They have different expression throughout the heart atria with some cells exhibiting greater structure. We hypothesize that cardiac disease affects some regions more than others. To address this we correlated subcellular calcium transient parameters with structural features of cardiomyocytes isolated separately from right atrial appendage (RAA) and intercalated regions (ICR). We found RAA consists of more structured myocytes than ICR. In heart failure (HF) we found a greater calcium desynchronization in ICR myocytes than in RAA cells which positively correlated with downregulation of caveolae structures. Our findings suggest that region-specific remodeling of caveolae structure interfere with calcium release throughout atrial myocytes leading to abnormal contractility and arrhythmic calcium oscillations.

EFFECTIVENESS OF NUMBER OF LANGUAGES SPOKEN ON LEARNING OUTCOMES

Dema Jaber, John Mcginty (Mentor)

Research has tended to focus on the advantages and disadvantages of concrete materials and abstract concepts independent of each other, however it is important to take an approach that combines these two. The purpose of this experiment is to discover if the number of languages spoken will determine better or worse learning outcomes while learning Euler's theorem. The research question is what is the effect of speaking more than one language compared to speaking only one language on learning outcomes through a concreteness fading pedagogical approach? I hypothesize that subjects who speak more than one language will be able to apply their knowledge more effectively because being knowledgeable in more than one language affects the development and efficiency of the brain's multifactorial executive control system.

USING SATELLITE DATA TO ASSESS FORMALDEHYDE OVER CITIES GLOBALLY

Clara Jackson, Tracey Holloway (Mentor)

Formaldehyde (HCHO) is a hazardous air pollutant and carcinogen that can have serious health impacts. Using Level 2 satellite data from the Tropospheric Monitoring Instrument (TROPOMI), the satellite onboard the Copernicus Sentinel-5 Precursor instrument, this study evaluates spatial and temporal patterns of HCHO in cities globally. TROPOMI HCHO files are downloaded for December of 2018, the first month for which data are available, and monthly mean values are plotted using Python. HCHO levels are compared for locations in the Southern versus Northern Hemisphere, as well as downtown versus suburban areas. This study will be useful in the future for considering the issue of how to control ozone formation, as HCHO can be used to estimate Volatile Organic Compound levels, which are a precursor of ozone.

SLEEP APNEA- AN UNRECOGNIZED RISK IN PREGNANCY

Natalie Jacobson, Mihaela Bazalakova (Mentor)

Diagnosis and treatment of obstructive sleep apnea (OSA) is not part of routine pregnancy care. We have established a first of its kind Sleep Pregnancy Clinic at the University of Wisconsin Madison/Meriter Hospital. Pregnant patients were referred for objective sleep breathing testing using the Alice PDX 4-channel home test. 49 out of 105 patients completed testing. 63% met diagnostic criteria for OSA. 77% had mild, 13% moderate, and 10% severe OSA. 48% of patients with OSA chose to start positive airway pressure treatment. In conclusion, completion of objective sleep breathing testing is low at 46% in a real-world pregnant cohort. However prevalence of OSA was high at 63%. Close to 50% of diagnosed women opted to start treatment, suggesting opportunity for therapeutic intervention in pregnancy.

A TEST OF PLANT ALLOCATION THEORY: IMPLICATIONS FOR PLANTATION FOREST PRODUCTION

Samuel Jaeger, Rick Lindroth, Clay Morrow (Mentor)

Limited resources for competing physiological processes is an important constraint to plant fitness. The tradeoff between plant growth and chemical defense against herbivores has implications for forest management. Agroforestry breeding programs that select for tree varieties with superior growth may compromise the sustainability of plantations due to consequences on defense. The relationship between tree growth and resistance to insect attack was investigated in an experimental plantation of aspen (*Populus tremuloides*) using gypsy moths. Foliar chemistry was evaluated to determine the defense mechanism(s) underlying variation in insect performance and preference. Results showed that gypsy moths preferred fast and moderate-growing trees over slow-growing trees. However, defense chemical concentrations did not vary by tree growth-class. It is therefore unlikely chemistry is the sole explanation for insect preference.

MECHANISM STUDY OF PME1 REGULATING PP2A FUNCTION

Mohammed Jaffri, Yitong Li (Mentor)

Diverse protein phosphatase 2A (PP2A) holoenzymes are key players in many aspects of cellular functions. How PP2A holoenzyme functions are downregulated are not clear. Carboxymethylation of PP2A catalytic subunit is crucial for holoenzyme functions. Surprisingly, our preliminary results showed that PP2A methyltransferase (PME-1), which was believed to specifically catalyze demethylation of the PP2A core enzyme, can readily interact with PP2A holoenzymes. This suggests a highly novel mechanism for regulating PP2A holoenzyme functions. This proposal aims to 1) test whether PME-1 demethylates diverse PP2A holoenzymes, 2) investigate and map the interactions between various PP2A holoenzymes and PME-1, and 3) investigate the ability of PME-1 to block substrate recognition by PP2A holoenzymes.

THE RELATIVE DIFFICULTIES OF LEARNING VARIOUS ATOMIC REPRESENTATIONS IN CHEMISTRY

Marshal Jahnke, Sally Wu (Mentor)

Using students' data (n=102) from an online chemistry tutor, we analyzed the relative difficulties that students have with learning different visual representations of atoms (e.g., orbital diagrams and Bohr models). To do this, we examined the number of students' incorrect responses to gauge their ability to understand a given representation and drew from various other metrics, notably the usage of optional hints and the periodic table, to further identify their misunderstandings. Students' struggle with specific representations implies the need for revisions to chemistry curricula for that representation. This research could bolster instruction on students' weaknesses in chemistry and contribute to the potential improvement of educational technologies used both within and outside of the classroom.

ASSESSING COGNITIVE DECLINE IN THE PINK1-/- RODENT MODEL OF EARLY-ONSET PARKINSON DISEASE

Asha Jain, Michelle Ciucci, Cynthia Kelm-Nelson (Mentor)

Parkinson disease (PD) is a progressive neurodegenerative disorder that influences movement and cognition. Several genetic mutations are implicated in PD and are used in translational science to study the onset of PD signs, including the Pink1-/- rodent model. The central purpose of this study is to test for early-onset memory decline in Pink1-/- rats compared to age-matched wild type controls using the Novel Object Recognition (NOR) test. This assay examines the discrimination ratios between the amount of time (sec) the rat spends exploring the novel and familiar objects. Identification of early-onset cognition deficits will be important to understanding the underlying mechanisms of cognitive decline and will allow for the development of future PD treatments.

UTILIZING ENDOTHELIAL CELL VASCULAR NETWORKS IN VITRO TO OPTIMIZE THE TRANSPLANTATION OF STEM CELL-DERIVED PANCREATIC BETA CELLS

Vansh Jain, Sara Dutton Sackett (Mentor)

Diabetes affects millions around the world, causing major late-stage health complications and being a leading cause of death. Thus, promising cell replacement therapies involving stem-cell-derived beta cell (SCBCs) transplantation could improve the lives of many. Efforts to recapitulate the in vivo environment by stimulating vascularization, growth factor and hormone signaling, and extracellular matrix (ECM) interactions may enhance the performance of transplanted SCBCs. We seek to use endothelial cells (ECs) in vitro to form vascular networks that support engraftment and maturation of SCBCs post-transplant. Quantitative data about different SCBC and EC co-culture conditions are being obtained to establish optimal pre-vascularization techniques. Results from this research will be used to develop cell replacement approaches for possible future use in clinical therapies for diabetes.

EMOTION REGULATION ACROSS SOCIODEMOGRAPHIC CONTEXTS

Dk Jang, Yuri Miyamoto (Mentor)

The purpose of this study is to find out whether there is a socioeconomic difference in downregulation of negative emotions. The study also seeks to examine the effect of attentional control on negative emotion regulation strategy and test whether lower-SES individuals will be less likely to dampen their negative emotions compared to higher-SES counterpart.

INVESTIGATING WHITE MATTER PATHWAYS ASSOCIATED WITH RATIO PROCESSING IN SCHOOL-AGED CHILDREN

Monica Janz, Yunji Park, Edward Hubbard (Mentor)

Success in understanding fractions relates to improved higher-order math skills. Therefore, understanding how children learn fractions, why they struggle, and how we can overcome these difficulties, is critical to improving math outcomes. Our lab has proposed that fractions understanding might build on a "ratio processing system" (RPS). To examine the role of the RPS in fractions understanding, our lab is collecting longitudinal behavioral and brain imaging data from 2nd and 5th graders. To examine the brain systems that support the RPS, I will analyze diffusion tensor imaging (DTI) data to measure white matter pathways that have been associated with number processing. I hypothesize that one year after their first scan, 2nd and 5th graders will show greater coherence in these white matter pathways.

DEVELOPMENT OF AN IN SITU CANCER VACCINE VIA COMBINATIONAL RADIATION AND BACTERIAL MEMBRANE NANOPARTICLES

Abigail Jaquish, Ravi Patel (Mentor)

Immunotherapy has revolutionized cancer treatment; however, these treatments have limited success in some immunologically "cold" cancers. One strategy to enhance immune recognition of these "cold" cancers is to treat with immunostimulatory radiation. Radiation can function as a potent in situ vaccine that allows a patient's immune system to recognize cancer neoantigens. For this study we designed a multifunctional bacterial membrane-coated nanoparticle (BNP) that when combined with radiation can provide a vaccine treatment to eradicate difficult to treat "cold" tumors. Our BNP is designed to enhance neoantigen uptake and activate dendritic cells, enhance T cell activation, and finally stimulate an anti-cancer immune response. In vivo studies, in mice bearing syngeneic melanoma confirmed that combination radiation and BNP results in marked immune mediated tumor regression.

EFFECTS OF VIMENTIN ON CELLULAR SENEESCENCE

Murt Jatoi, Darcie Moore, Katrina Hunt, Tiaira Porter (Mentor)

Cellular senescence is an undesirable cell stage distinct from the normal cell cycle, where cells can no longer replicate and release a variety of unhealthy secretions. Senescence, associated with aging, arises from the shortening of telomeres during cell division. Our project aims to reveal the relationship between vimentin, an intermediate filament protein, and senescence in different organs. Studies have shown that vimentin aids in the recombinogenic damage repair to fibroblast nuclei. Continuing on these investigations, we will compare sections of different tissues taken from wild-type vimentin and vimentin-knockout mice. Tissues will be stained for the transcription factors p16 and beta-galactosidase, or SASP (senescence-associated secretory phenotype) hoping to find results helpful in preventing senescence in aging cells and, therefore, preventing the cellular dysfunction associated with senescence.

EFFECTS OF SPORADIC *L. MONOCYTOGENES* ON DAIRY CATTLE FECAL MICROBIOTA

Alexander Kurt Johnson, Justin Chow, Tu Anh Huynh (Mentor)

Dairy cattle are a natural reservoir for many food-borne pathogens, such as *L. monocytogenes*, which is responsible for Listeriosis in humans. Understanding more about how the pathogen affects the gut microbiota of dairy cattle is an important step in preventing bovine Listeriosis and thus increasing host health. This study focuses on the correlation between gut microbiota diversity and fecal shedding events. *L. monocytogenes* is quantified in fecal shedding of cows, a genomic analysis of the animals microbiota allows links to be made between diversity of the microbiota and *L. monocytogenes* shedding events. A bovine infection model is then used to examine post-infection gut microbiota alterations. The sample set and model generated from this study can potentially be used in future projects and with other pathogens.

EFFECTS OF FGF8 ON DEVELOPMENT OF GnRH NEURONS THROUGH CELL DIFFERENTIATION

Isaac Johnson, Kim Keen, Ei Terasawa (Mentor)

Gonadotropin releasing hormone neurons (GnRH) in the hypothalamus are indispensable for puberty and reproduction. Patients with idiopathic hypogonadotropic hypogonadism (IHH) lack GnRH neurons in the hypothalamus, or are missing GnRH neuronal regulation circuits, obstructing puberty and reproduction. No cure has been discovered; synthesizing pure GnRH neuron populations will help us to understand IHH and provide tools for future treatments. This lab utilizes embryonic stem cell's capability to become various types of cells to differentiate GnRH neurons. This lab proved fibroblast growth factor 8 (FGF8) to be integral in the differentiation of GnRH neurons, but it does not produce pure populations of neurons. This project aims to identify other neurons found in culture and improve understanding on how to produce functioning mature GnRH neurons.

NAVIGATING SYMBOL-EXCLUSIVE LEARNING EXPERIENCES

Nate Jones, John McGinty (Mentor)

Teaching practices vary by educator. Here, we examine four teaching practices with varying degrees of object, icon and symbol interaction. Current theory suggests concreteness fading (object learning followed by icon learning followed by symbol learning) is a successful mathematics teaching practice. Our qualitative research question asks: how do students maneuver around cognitive roadblocks in a symbol-exclusive learning condition? We expect symbol-exclusive learning to be most challenging due to its lack of clear grounding. We expect students to express frustration frequently and perform worse on post-tests (relative to object- and icon-inclusive teaching practices). Results will inform the efficacy of symbol-exclusive teaching.

COMPARATIVE ANALYSIS OF FOOD AND HEALTH INEQUITIES IN URBAN AND RURAL COUNTIES IN WISCONSIN

Lauren Jorgensen, Leann Tigges (Mentor)

Place is a paramount influence on health outcomes. State policies can be powerful tools to protect constituents from being subjected to poor environments (physical, social, etcetera). Unfortunately, policies enacted by states do not always account for the needs of individual communities. This multi-part quantitative-qualitative hybrid research aims to uncover the role of place in health and food inequities in Wisconsin. The methodology for our research includes the statistical selection of case study counties, case study interviews, and a cross-case study analysis. We aim to highlight the differences between urban and rural community's food security issues and biggest health concerns by contextualizing these places with the strategies that are implemented by community actors.

ASSESSING GAIT IN RHESUS MACAQUES PRENATALLY EXPOSED TO ZIKA

Sabrina Kabakov, Kathryn Bach, Aubre Poole, Kathryn Bach, Karla Ausderau (Mentor)

Pregnant woman infected with Zika virus (ZIKV) are at risk for transmission to unborn fetus, which may lead to birth defects. Research is needed to understand newborn development when prenatally exposed to ZIKV. The current study analyzes infant rhesus macaque gait and motor performance at 14, 21, and 28 of life using the CatWalk™ XT. 5 trials were collected to analyze footfalls, stance, stride length, and body position. Aim 1) significant differences in gait development of rhesus macaques across the three developmental time points. Aim 2) exposure to ZIKV during pregnancy will demonstrate different gait patterns. Findings can be applied to humans to understand the effects of ZIKV on gait development in newborns exposed prenatally.

CYTOSKELETAL DYNAMICS OF PHOTORECEPTOR TERMINALS VS. RETINAL GANGLION CELL GROWTH CONES.

Yochana Kancherla, Sarah Rempel, Timothy Gomez (Mentor)

A prospective treatment for photoreceptor (PR) degeneration is transplantation; however, little is known about their axon guidance and cytoskeletal dynamics. 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. Previous studies show that cytoskeletal components are essential for axon guidance and can be disrupted using pharmacological agents. In contrast to traditional projection neurons such as retinal ganglion cells (RGCs), PR terminals have shown unique structure and dynamics. The aim of this study was to characterize cytoskeletal features of PRs and compare to (RGCs) in fixed cells. PRs have shown reduced G/F actin ratios in comparison to RGCs, suggesting that they have different mechanisms of neurite extension.

EPHA2 IS A NOVEL TARGET IN HUMAN CETUXIMAB-RESISTANT HEAD AND NECK CANCER

Grace Kang, Deric Wheeler (Mentor)

Head and neck squamous cell carcinoma (HNSCC) is the sixth most common cancer in the world. Despite treatment with surgery radiation treatment and/or chemotherapy, more specific drug-targeting therapy is needed to prevent further metastasis and recurrence of tumors. Recently, few studies showed that high erythropoietin-producing hepatocellular receptor A2 (EphA2) expression was significantly associated with poor outcomes in Triple Negative Breast Cancer and Colorectal Cancer. In this study, we explored the targeting EphA2 in a cetuximab-resistant HNSCC. We found that EphA2 was over-expressed and phosphorylated in many HNSCC cell lines and patient-derived xenografts. Also, targeting EphA2 by ALW-II-41-27, a multi-kinase inhibitor of EphA2, overcame the resistance to cetuximab in HNSCC. These results indicated that dual-targeting EGFR and EphA2 would be beneficial in the cetuximab-resistant setting.

SUCCESSOR CEOS

James Kardatzke, Yaron Nili (Mentor)

In the past decade, there has been a push towards separating the roles of CEO and chairperson of the board in corporations. One way that companies can achieve this separation is by appointing an independent director as chair. However, many companies have taken a different approach, in which the current CEO-chair steps down as CEO while remaining as the chair of the board. This “successor CEO” phenomenon can cause a pseudo-independence which is potentially harmful to shareholders. To examine this phenomenon, and the effects which it may have on corporate governance and investors, we investigate the prevalence of successor CEOs in S&P 1500 companies, and the effects that a successor CEO has on other aspects of companies’ governance.

CORPORATE GOVERNANCE PLAGIARISM

Christopher Kardatzke, Yaron Nili (Mentor)

The New York Stock Exchange (NYSE) requires companies to create corporate governance guidelines and make them publicly available in order to be listed on the stock exchange. There are not, however, any qualifications put on the originality of these guidelines. My research examines the similarity between corporate governance guidelines of S&P 1500 companies, and highlights instances of plagiarism between corporations. My colleagues and I compiled a first-of-its-kind database of links to corporate governance documents, which I parsed and examined using Python. I used cosine similarity to compare the text of the different documents and pinpoint instances of plagiarism. These results reveal a pattern of intellectual theft in corporate governance documents and a need increased regulation regarding the production of corporate governance guidelines.

ENDEMISM IN TROPICAL MONTANE ECOSYSTEMS

Auna Kaufmann-Schwartz, Olivia Graves, James Berkelman (Mentor)

While global biodiversity tends to concentrate in tropical rainforests such as the Amazon, endemism occurs at higher rates in geographically isolated areas, such as montane forests. Mountain endemism can be seen in locations across the globe, including Africa, China, Australia, and Latin America. Mountains can serve as mechanisms of speciation by geographically isolating organisms on “sky islands,” leading to unique adaptations. Species tend to move upslope when the climate warms, which means that montane endemics face shrinking ranges as the climate warms. Because endemics are restricted to one area, populations are typically small. This also makes them susceptible to challenges such as inbreeding depression, genetic drift, and population fragmentation.

FLOW CYTOMETRY DISPLAYS EXPRESSION OF CXCL12 AND CXCR4 IN NEUROBLASTOMA AND RHABDOMYOSARCOMA CANCER CELL LINES

Simran Kaur, Ankita Shahi De, Mario Otto (Mentor)

CXCL12 is a CXC chemokine which binds to receptor CXCR4, a seven transmembrane G-protein coupled receptor. CXCL12 and CXCR4 are known to have increased expression in certain cancers such as pancreatic cancer, breast cancer, ovarian carcinoma among others. Their interactions are known to affect growth, angiogenesis, and metastasis of cancer. To determine CXCR4 and CXCL12 expression status of our murine cancer cell lines neuroblastoma (NXS2) and rhabdomyosarcoma (M3-9M and M3-9M-Luc), we evaluated cell surface CXCR4 and intercellular CXCL12 expression by flow-cytometry. Human osteosarcoma (MG63) was used as a positive control for CXCL12 and mouse thymocyte for CXCR4 to ensure functionality of the protocol. Our study demonstrates expression of CXCL12 in NXS2 and M3-9-M Luc cell line whereas, CXCR4 was expressed in M3-9-M-Luc cell line.

THE CYTOTOXIC EFFECT OF GIFT15 REGULATORY B CELLS ON CD4+ T CELLS

Adam Kelly, Jacques Galipeau (Mentor)

Auto-reactive T cells have been implicated in the development of cell-mediated autoimmune disorders. Regulatory B cells (Bregs) have shown promise as a potential therapeutic tool to inhibit inflammation. The fusion between GM-CSF and IL-15, GIFT15 fusion protein, readily converts B cells into IL-10 producing B cells (GIFT15 Bregs) which have been shown to ameliorate symptoms of a murine model of multiple sclerosis (MS): experimental autoimmune encephalomyelitis (EAE), although the mechanism behind amelioration is not fully understood. Through in vitro co-cultures of CD4+ T cells and GIFT15 Bregs, we found that GIFT15 Bregs have a cytotoxic effect on activated and resting T cells. We show that GIFT15 Bregs kill in both a secreted pathway and in a cell-contact mediated manner.

REGULATION OF TRANSCRIPTION THROUGH PHOSPHORYLATED TYROSINE-1 ON THE RNA POLYMERASE II CTD

Ryan Kempen, Aseem Ansari (Mentor)

Central to regulating transcription is the carboxyl-terminal domain (CTD) of RNA polymerase II (Pol II), which is a repetitive heptad (Tyr1-Ser2-Pro3-Thr4-Ser5-Pro6-Ser7). Its phosphorylation recruits factors critical for all stages of transcription to occur. While the presence of phosphorylated Tyr1 of the CTD is known, it has been under-studied compared to other CTD post-translational modifications. To identify the role of this poorly understood mark, I used a western blot analysis to screen for kinases that could phosphorylate Tyr1 in vitro. From this, Mck1 was identified as a potential Tyr1 kinase. To confirm that Mck1 phosphorylates Tyr1 in vivo, rationally designed substitutions were made to enable inhibition of Mck1. Western blot analysis was then conducted to determine the effects of inhibition on relative phospho-Tyr1 levels in vivo.

PSEUDOKNOT VS. STEM-LOOP: ELUCIDATING THE FUNCTIONAL FRAMESHIFT ELEMENT IN HIV-1

Jacob Kentala, Magdalena Murray, Samuel Butcher, Nathan Sherer (Mentor)

Human immunodeficiency virus-1 (HIV-1) virion assembly is driven by viral proteins Gag and Gag-Pol. Gag-Pol translation is regulated by a RNA -1 ribosomal frameshift regulatory element (FSRE). There are two proposed FSRE structures; a stem-loop (SL) or pseudoknot (PK). We demonstrate that mutations predicted to disrupt PK but not SL formation have no effect on Gag:Gag-Pol ratios. Investigation of the FSRE region revealed a downstream site capable of initiating ribosomal slippage when mutated (C1680U). This mutation is observed in patient-derived viruses resistant to protease inhibitors². We show that mutation C1680U improves viral infectivity in the presence of the HIV-1 protease inhibitor Saquinavir. Our results confirm HIV-1 encodes a FSRE SL structure, and a secondary, cryptic FSRE that may provide evolutionary advantages under selective pressures.

HERG POTASSIUM CHANNEL MODULATION TO TREAT CARDIAC ARRHYTHMIA

Aliyah Keval, Gail Robertson (Mentor)

Sudden cardiac death is prevalent in many seemingly healthy young people. Dysfunction in the human ether-a-go-go-related gene (hERG), which encodes a potassium ion channel responsible for repolarization of heart muscle, causes the cardiac disorder long QT syndrome (LQTS). LQTS is an inherited or acquired condition in which slowed cardiac repolarization increases likelihood of catastrophic cardiac arrhythmia. I plan to use heart cells derived from patients carrying a genetic form of LQTS, a sort of “heart in a dish,” to test the efficacy of a new potential treatment. I will test the hypothesis that small chain variable fragment antibodies (scFvs) targeting hERG can reverse the defective repolarization characteristic of patients with long QT syndrome. Such reagents may prolong the lifespan of patients suffering from cardiac arrhythmias.

THE HUMANE EXPERIMENT

Jasmine Kiah, Colleen Conroy (Mentor)

The Humane Experiment is a series of interdisciplinary performances that focuses on blackness and how blackness responds and interacts in the face of white supremacy. It compares and contrast whiteness, which assumes humanity, gender, etc.; and blackness, which is the opposite of whiteness. This series uses artistic mediums such as acting, poetry, dance, song, movement, visual arts, and film to demonstrate and communicate its purpose.

SATELLITE WITNESSES TRAFFIC POLLUTION

Andrew Kieckhefer, Tracey Holloway (Mentor)

This study uses satellite data to examine weekday and weekend nitrogen dioxide (NO₂) variances over Phoenix, Arizona. Phoenix is selected as the study site because it has a large urban area with high vehicle emissions where we expect weekday-weekend differences to be observable from space. The satellite data used is from the TROPospheric Ozone Monitoring Instrument (TROPOMI) which produces the highest resolution satellite data for NO₂. Traffic is known to have an impact on NO_x emissions, especially over cities, and past studies have quantified weekday-weekend changes in vehicle emissions from satellite data. Being able to discern the difference in weekday and weekend NO₂ emissions helps evaluate estimates of vehicle emissions over Phoenix to support air quality planning and public health.

MEASURING PHYSICIAN BURNOUT IN A PEDIATRIC DEPARTMENT

Madeline Kieren, Sarah Webber (Mentor)

This project seeks to determine rates of burnout and professional fulfillment in a moderate sized academic pediatric department for the purpose of quality improvement. The project follows the methods and guidelines suggested by the Institute for Healthcare Improvement. In November 2018, a Redcap survey that inquired about burnout and professional fulfillment was administered via email to 90 pediatricians. We compared the results of the 2018 survey to a survey given in 2017. We found burnout increased from 30% to 51% and professional fulfillment decreased from 36% to 24%. These results suggest the importance of addressing burnout and creating more joy in work to improve professional fulfillment.

ELECTROCATALYTIC OXIDATION OF IMINES TO AZINES VIA COPPER CATALYST FOR HYDRAZINE SYNTHESIS

Yeon Jung Kim, James Gerken (Mentor)

Hydrazine has various applications such as a high-energy fuel and a reagent for synthesis. Due to its instability of towards (possibly explosive) decomposition and toxicity, there is a need for a method to obtain hydrazine as needed by forming the N-N bond from two N-H bonds with minimal energy waste. Here, we describe a two-step catalytic process to generate hydrazine electrochemically from NH₃ (g). This project focuses on the electrochemical synthesis of azines from imines which are intermediates in the production of hydrazine from ammonia. Electrochemical reaction conditions have been optimized and the redox potential of the copper oxidant catalyst necessary for the reaction has been determined.

NEXT-GENERATION SEQUENCING OF HEPATITIS C VIRUS - GLOBAL HEPATITIS OUTBREAK AND SURVEILLANCE TECHNOLOGY

Coleton T. King, Alana Sterkel (Mentor)

It is estimated that 90,000 people in Wisconsin are infected with the Hepatitis C Virus (HCV), and more than half of those cases remain undiagnosed. Since the implementation of widespread blood supply screenings in 1990, there has been a dramatic shift toward intravenous drug use, particularly through needle sharing, as the primary transmission route for HCV. Global Hepatitis Outbreak and Surveillance Technology (GHOST) is a cloud-based epidemiological tool that gives researchers the ability to rapidly track HCV transmission and plan effective intervention strategies. By validating an assay for GHOST at the Wisconsin State Laboratory of Hygiene, we intend to streamline regional specimen processing to allow for larger sample sizes and faster turnaround in an effort to help contain new outbreaks and prevent future ones.

EFFECT OF HEAT SHOCK PROTEIN EXPRESSION ON ARABIDOPSIS THALIANA RESPONSE TO GRAVITROPIC STIMULI

Noah Kinscherf, Richard Barker, Noah Kinscherf, Simon Gilroy (Mentor)

Botanists can use a microgravity experiment to explore fundamental questions of how gravity affects biological systems in plants. Statistical analysis of the data from experiments such as the NASA Biological Research In a Canister (BRIC) studies identified a core set of genes that had significantly different expression levels in spaceflight compared to terrestrial controls. A subset of these core space genes encode heat shock proteins (HSPs). Transgenic *Arabidopsis thaliana* plants that are homozygous for HSP knockouts are tested in gravitropic assays. The hypothesis of this study is that downregulation of HSP-encoding genes is detrimental to survival and recovery of *Arabidopsis* during abnormal gravitropic conditions, relative to wild-type and rescue lines with the target gene re-inserted.

REFRESHING OCCUPATIONAL FATIGUE IN NURSING

Rebecca Kish, Linsey Steege (Mentor)

Occupational fatigue is linked to negative patient and nurse outcomes. This study aimed to evaluate the effectiveness of a multi-component intervention, REducing nurse Fatigue to impROVe Safety in Hospitals (REFRESH), on knowledge and perceptions of safety, and describe nurses' healthy coping behaviors. REFRESH is comprised of: fatigue attitudes and knowledge education, unit culture change, and night shift napping. REFRESH was implemented on two adult and one pediatric inpatient units in two hospitals. Results indicate nurses' use of health coping behaviors peaked at the mid-point of the intervention period. The most frequently reported behaviors were taking a 30-minute break and making healthy food choices. This study provides an important foundation for a sustainable and effective approach to address fatigue and associated safety risks.

DYSPNEA AND FATIGUE IN HEART FAILURE: ARE THEY RELATED TO BRAIN FLOW?

Anna Klar, Lisa Bratzke (Mentor)

Heart failure is characterized by debilitating symptoms, in particular dyspnea (painful breathing) and fatigue (extreme tiredness). The etiology of dyspnea and fatigue are unknown and gaps in our understanding of dyspnea and fatigue exist. We aim to examine the relationship between dyspnea and fatigue and a possible etiology, i.e., reduced cerebral blood flow. We will analyze data from 39 clinically stable, older adults diagnosed with heart failure using a novel neuroimaging approach, phase contrast vastly undersampled isotropic projection imaging, and a well validated symptom survey, Kansas City Cardiomyopathy Questionnaire. Findings from this study will inform future research studies designed to identify the etiology of dyspnea and fatigue. Clinical implications include offering providers a better understanding of differences in symptom perception in this population.

THE WISCONSIN REBOUND: THE FALL AND RISE OF HOUSING PRICES IN WISCONSIN DURING THE GREAT RECESSION

James Klau, Bryan Luetzgen, William Gartner (Mentor)

This paper details the Wisconsin housing market during the Great Recession. We explore how race, income and density factored into the fall and rise of housing prices from 2003 to 2018, a period spanning before, during and after the recession. We used a mix of GIS-created graduated color scheme and cluster maps, Spearman's Rho correlations and scatter plot graphs and interviews to garner our data. We found that the relationships between the percentage changes in housing prices and race, income and density were fairly weak-to-moderate statewide. However, the relationship between the percentage change in housing prices and race was moderate-to-strong when we limited our data to areas in the state that contained the highest minority population concentrations.

PH ALTERATION OF CIRCUMNEUTRAL AEROBIC PYRITE OXIDIZING COMMUNITIES

Margaret Klein, Eric Roden (Mentor)

Microbes known as chemolithotrophs are capable of utilizing minerals to generate metabolic energy, and thereby influence weathering and erosion of subsurface sediments. In this study we sought to determine if groundwater communities at two locations in the Shale Hills Critical Zone Observatory in Pennsylvania were able to accelerate the aerobic oxidation of pyrite (FeS₂) at circumneutral pH in culture systems with varying amounts of buffering capacity. Having obtained positive results in an initial experiment, culture subsamples were transplanted to buffered versus unbuffered medium to assess how microbial community structure and activity would respond to changes in geochemical conditions. Results show that only transplants from one of the sites into buffered medium showed significant pyrite oxidation. Analysis of microbial community structure in these cultures is underway.

EARLY INTRODUCTION OF STEM THROUGH SUSTAINABLE ENGINEERING

Tyler Klink, Angela Pakes (Mentor)

To educate the next generation of scientists and engineers, it is important to cultivate critical thinking within the context of sustainability. *Eva the Engineer*, an elective course developed by UW–Madison engineering students, uses sustainability-focused civil engineering lessons to (1) introduce middle school students to sustainable engineering practices, and (2) encourage young women to pursue science, technology, engineering, and mathematics (STEM). Students explore the environmental, social, and economic impacts of the infrastructure around them and practice decision-making with hands-on activities. By the end of the program, students exhibit understanding in contemporary environmental challenges, basic engineering principles, and benefits of recycled materials in engineering applications. Engaging the next generation of engineers and scientists in discussion of present issues is proving to be beneficial for all involved.

STATEWIDE LIFE CYCLE ASSESSMENT ON NORTH CAROLINA RECYCLED MATERIALS USAGE

Sydney Klinzing, Angela Pakes (Mentor)

Roadways are constantly being constructed and maintained as they provide a key connection between society and the economy. Lack of quantitative research on the environmental and economic costs of using virgin materials in roadway construction has prevented many state departments of transportation and construction companies from utilizing recycled materials. The purpose of this proposed project is to verify the triple bottom line of sustainability by quantifying the environmental, economic, and social savings of using recycled materials in place of virgin materials in roadways. For this research, two unique life cycle assessment systems will be used to verify the relative environmental and economic impacts of virgin materials and recycled materials in road construction applications with regards to North Carolina's Department of Transportation's recycled material usage data for one fiscal year. This research is important in further quantifying recycled material usage in roadways to encourage increased implementation of recycled materials in the future on the part of the states, the national government, and private construction companies.

PATTERNS OF MICRO-ANATOMICAL LEAF TRAITS IN FERNS AMONG ENVIRONMENTAL GRADIENTS

Chad Kluender, Kim O'Keefe (Mentor)

Ferns demonstrate varying morphological strategies to deal with contrasting habitats. Leaf venation density, stomatal area, and stomatal density are some microanatomical traits that can be investigated to deduce how individual species have adapted to fit particular environmental conditions.

CARNIVORES AND PREY: COMPARING THE BEHAVIORAL CHANGES OF SPOTTED HYENAS AND ZEBRA FOLLOWING LION REINTRODUCTION TO AKAGERA NATIONAL PARK, RWANDA

Jessica Knackert, Adrian Treves (Mentor)

Apex predators play key roles in ecosystems, and their restoration is a major focus in conservation. Changes at the top of the trophic pyramid can have cascading effects. We examined how lion reintroduction affected hyena and zebra activity inside Akagera. Using camera traps, we estimated frequency, time spent, average duration, and party size of visits to camera sites. Zebra frequency and time spent increased in the long term, perhaps suggesting zebras may use familiar paths and move slower thus being more vigilant. Hyena frequency, time spent, and average duration increased in the long term, suggesting hyenas may not respond as expected according to mesopredator suppression. Rather, hyenas may respond competitively and try to reverse dominance over large areas. We recommend quantifying consequences of our hypotheses.

ROBOTICALLY ASSISTED SONIC THERAPY (RAST) WITH HISTOTRIPSY FOR TRANSCOSTAL HEPATIC ABLATION IN A PORCINE MODEL

Emily Knott, Fred Lee (Mentor)

RAST is an emerging ablation modality using focused ultrasound to destroy tissue via histotripsy. To date, RAST has been used in a porcine model for liver ablation with a subcostal transducer position for the best ultrasound window, though many liver tumors are best accessed through the ribs. The purpose of this study was to perform hepatic RAST ablations through full rib coverage. 6 female swine underwent a 3cm spherical treatment followed by magnetic resonance (MR) imaging, necropsy, and histology. Ablation zones were well-circumscribed, close to the prescribed volume, and completely necrotic. Minor muscle edema and lower lobe lung injury was present in 4/5 swine. RAST is effective in producing ablation zones through full rib coverage, with minor side effects including mild alveolar hemorrhage and muscle edema.

EXAMINING THE EFFECTS OF RADIO GALAXIES ON THEIR ENVIRONMENT

Katherine Kolman, Eric Wilcots (Mentor)

Radio galaxies are galaxies that are very luminous at radio wavelengths and possess active galactic nuclei. There exists evidence that these types of galaxies tend to live in galaxy groups, a collection of galaxies that are gravitationally bound. For a set of radio galaxies, we have gathered data on their neighboring galaxies from the Dark Energy Survey (DES). We will obtain the spectroscopic redshifts of these galaxies from the Southern African Large Telescope (SALT) and use these observations to determine if the radio galaxy is in a group and if so, analyze the dynamical state of that group. Ultimately, we hope to further understand the role a radio galaxy may have in the evolution of its host environment.

REDUCED MITOCHONDRIAL FUSION AND HUNTINGTIN LEVELS CONTRIBUTE TO IMPAIRED DENDRITIC MATURATION AND BEHAVIORAL DEFICITS IN FMR1-MUTANT MICE

Tomer Korabelnikov, Xinyu Zhao (Mentor)

Fragile X syndrome results from a loss of the RNA-binding protein fragile X mental retardation protein (FMRP). FMRP-deficient immature neurons exhibit impaired dendritic maturation, altered expression of mitochondrial genes, fragmented mitochondria, impaired mitochondrial function, and increased oxidative stress. Enhancing mitochondrial fusion partially rescued dendritic abnormalities in FMRP-deficient immature neurons. We show that HTT mediates FMRP regulation of mitochondrial fusion and dendritic maturation. Mice with hippocampal Htt knockdown and Fmr1-knockout mice showed similar behavioral deficits that could be rescued by treatment with a mitochondrial fusion compound. Our data unveil mitochondrial dysfunction as a contributor to the impaired dendritic maturation of FMRP-deficient neurons and suggest a role for interactions between FMRP and HTT in the pathogenesis of fragile X syndrome.

STRUCTURAL INVESTIGATION OF THE BACTERIAL PHYTOCHROME KNOT

Nicholas Koranda, Katrina Forest (Mentor)

Phytochromes are light sensors, known for using red/far-red light to function as a signal transducer in plants, bacteria, and fungi. Photoreception occurs through a covalently bound chromophore, causing a conformational change in the protein, that creates signal transduction. Phytochromes typically comprise three conserved domains and a variable output domain. Structural analysis of phytochrome from *Deinococcus radiodurans* revealed a figure-of-eight knot in the protein that links sections of two domains crucial for chromophore binding. Few proteins across life have been identified to have similar knotted architectures, provoking the question of the function of the knot in protein folding, stability and signal transduction. To gain insight into this question, knotless variants of *Deinococcus radiodurans* phytochrome were created and will be screened for signal transduction capability.

IDENTIFYING STRUCTURE IN THE ANTLIA CLUSTER USING SPECTRAL CLUSTERING

William Korbitz, Eric Wilcots (Mentor)

The vast amount of data produced by telescopes and sky surveys gives astrophysicists the opportunity to learn more about how our universe functions. Taking data from groups of galaxies and using it to investigate their structure can help explain how individual galaxies evolve and interact with their surroundings. Methods for analyzing the structure of groups of galaxies based on galactic velocity exist but do not take advantage of all the data available. Spectral clustering is a computational method that creates groupings based on similarities between galaxies. By applying spectral clustering to clusters of galaxies, we aim to identify substructure and correlations between physical location, velocity distribution, and other physical properties of the galaxies within the Antlia cluster.

WEBCOMIC AS A CONTEMPORARY MEDIUM AND “OUTSIDER ART”

Benjamin Koziol, Frederick Stonehouse (Mentor)

The art world has been historically fascinated by the problem of outsiders and untrained practitioners. “Outsider” artists break the formal and professional rules of the art world, inhabiting spaces off-limits to the academic artist. Webcomics are one of today’s many outsider mediums, facilitated by a growing digital media culture. Though considered low-brow in the academy, webcomics can simultaneously reach a mass public and demonstrate significant creative craft. This creative project unites two students in creative writing and printmaking around the goal of exploring the aesthetic and social potential of comic art beyond academic conventions. Their collaborations utilize the comic as a bold form of storytelling and social commentary relevant to contemporary youth experience.

ASSOCIATION BETWEEN PARENTING STYLE AND PARENT CHILD RELATIONSHIP IN FAMILIES OF CHILDREN WITH ASD

Taylor Krahn, Brianna Gambetti (Mentor)

Little is known about how parenting styles impact the parent-child relationship for children with autism spectrum disorder (ASD). As such, the present study sought to identify parenting styles employed by mothers and fathers of children with ASD and examine associations between parenting style and parent-child relationship quality. Participants ($n=377$) were part of the Family Outcomes in ASD study. Parents completed the Parenting Style and Dimensions Questionnaire and the Bengston Questionnaire. Descriptive analyses revealed that authoritative parenting was most common, and Pearson correlations indicated significant associations between parent-child relationship quality and authoritative ($r= .494, p= .00$), authoritarian ($r= -.302, p= .00$), and permissive ($r= -.140, p= .01$) parenting styles. These findings indicate that the more authoritative the parenting style, the higher the parent-child relationship quality.

INVESTIGATING THE ORIGINS OF OXYGEN ABUNDANCE GRADIENT ANOMALIES WITH MANGA

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

As gas cools and collapses within galaxies, stars form and evolve, ultimately ejecting chemical elements back into the gas. 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 automated 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.

MONOALLELIC EXPRESSION OF GFAP IN HUMAN ASTROCYTES

Brandi Kreger, Linghai Kong (Mentor)

Alexander’s Disease (AxD) is a rare yet fatal brain disorder that is caused by mutations of GFAP, an astrocyte specific protein. Studies from others indicate a random monoallelic expression of GFAP in mice. If the same pattern applies to human, both healthy (WT-GFAP expressing) and AxD astrocytes (AxD-GFAP expressing) would mosaically coexist in AxD patients, which potentially contributes to the heterogeneous symptoms. To test the hypothesis that human GFAP expression is monoallelic, we first used CRISPR-mediated HDR to generate an H1 (human embryonic stem cell line) based cell line, in which one of the two GFAP alleles is tagged with GFP. These cells were differentiated to astrocytes, in which GFAP was visualized after immunostaining. Our results suggest that hGFAP is monoallelically expressed.

INTERACTION AT THE ANTIPARALLEL COILED-COIL OF SPC42 PROTEIN

Kasey Kroiss, Ivan Rayment, Amanda Drennan (Mentor)

The primary role of both the spindle pole body in yeast and the centrosome in higher eukaryotes is to organize microtubules during cell division. Spc42, a protein component of the spindle pole body, forms a hexameric scaffold at which other spindle pole body components assemble. Here, we attempt to reconcile whether the Spc42 C-terminal antiparallel coiled-coil interacts within a dimer or between two dimers to support the Spc42 hexagonal array. We purified the mutant protein His-Gp7-Spc42(72-363)_C332A_C335A_I265C, evaluated multimerization of the protein via non-reducing polyacrylamide gels, and used spectroscopy assays to evaluate sulfhydryl availability and sulfhydryl-reactive crosslinking. Our results suggest that removing TCEP after reduction and quenching the reaction with IAA immediately after TCEP removal is essential to obtaining a cysteine-mediated crosslink within this protein construct.

INVESTIGATING THERMOSENSORY BEHAVIOR IN FILARIAL PARASITES

Katie Kudrna, Mostafa Zamanian (Mentor)

Filarial nematode parasites are the etiologic agent of many veterinary and medically important diseases, including dirofilariasis (heartworm) in dogs and lymphatic filariasis (elephantiasis) in humans. Severely limited pharmacologic options make control of these diseases difficult. Therefore, other prevention strategies need to be explored. Larval stages of filarial parasites are the targets for existing antiparasitic chemotherapies. These stages are hypothesized to exhibit thermosensory behaviors, which are potentially used during transmission and early infection of the mammalian host. In order to characterize thermosensory behaviors, we performed thermokinetic assays in larval-stage filarial nematodes. We expect that our findings will help identify specific genes that mediate thermosensory behaviors and help expand prevention strategies to control filarial diseases.

THE MIDBODY: ONE CELL'S TRASH IS ANOTHER CELL'S TREASURE

Elif Kurt, Randall Dahn, Ahna Skop (Mentor)

Cytokinesis is the final stage of mitosis, in which cellular constituents are partitioned to daughter cells. The midbody is a proteinaceous knot that appears between daughter cells during cytokinesis, defining and regulating their final abscission. Historically thought to be mitotic debris, midbodies are now known to be released by dividing cells, and internalized by neighboring cells to regulate proliferation rates, cell polarity, and potentially cell fate. Our study examines the role of two master regulators of cytokinesis, the MKLP-1 and RacGAP gene products, using a combination of cell culture, immunohistochemistry, and confocal microscopy. Our mechanistic contribution to understanding midbody biology should provide some insight into this novel means of cell-cell communication, with potential implications for stem cell biology, cancer, and neurodegenerative disease.

MODELING CONNECTIONS ABOUT FUTURE CAREERS: THE IMPACT OF PROFESSIONAL DEVELOPMENT EVENTS

Caroline Lamke, Amanda Siebert-Evenstone (Mentor)

Campus career services provide resources for students to advance their understanding of the world and push students towards a path after graduation. In this study, we use a SuccessWorks resource to find the impact of such events on an individual's decisions about their future. By utilizing recent Learning Sciences research methods, we investigate the differences in how students describe their experiences by focusing on the structures of connections among knowledge elements. Preliminary data is showing that overall, students made strong connections between current academic and career interests, information they gained from the event, and actions they can take or plan to take in the future. These preliminary results suggest that participation in professional development events leads students to accumulate new connections about their futures.

EXAMINING THE EFFECTS OF CHOICE IN UTILITY-VALUE INTERVENTIONS

Lisa Larson, Judith Harackiewicz (Mentor)

Utility-value (UV) interventions, which ask students to relate course material to their lives, can increase students' interest and achievement in STEM courses. Research suggests that UV interventions can be even more effective when participants have more choices during them. However, no research has yet explored whether choices that are central to the task (and more meaningful to participants) yield better outcomes versus choices that are more peripheral. The present study examined this by assigning participants to one cell of a 2 (choice vs. no choice in intervention) x 2 (central vs. peripheral task feature) experiment, or to a fifth control cell. Results showed that any UV intervention promoted outcomes, and choices promoted some outcomes for low-confidence students. There were no differences between central and peripheral choices.

KINEMATICS OF IONIZED GAS AND THE EVOLUTION OF THE INTERACTING GALAXY NGC 7465

Lauren Laufman, Jay Gallagher (Mentor)

NGC 7465 is an interacting galaxy accreting gas from a nearby neighbor. We study how this accretion affects the galaxy's evolution and behavior on a range of spatial and temporal scales. We use spectra obtained with the WIYN 3.5m telescope to examine properties of ionized gas in the central region of the galaxy. Accretion is evident in an HI tidal tail leading into a polar ring of CO rotating about the galaxy's main disk, and velocity measurements are used to study orbital motions and rapidly outflowing gas in a galactic wind. Data were reduced using astronomical software to achieve a precision of 10 km/s for radial velocities. The results will be analyzed in the context of gas accretion and outflows as mechanisms for galaxy growth.

TOXOPLASMOSIS GONDII

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. 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.

MEASURING STATE-BUSINESS RELATIONS UNDER DICTATORSHIPS

Daniel Ledin, Susanne Mueller (Mentor)

We currently know little about what attitudes non-democratic governments have towards economic policy. With a lack of empirical data compared to the abundance focused in western societies, our understanding of economic practices in these nations can be easily skewed. Albeit, there is still significant variation across regimes regarding the governance of state-business interactions. The aim of this project is to collect cross-national data on these economic landscapes, to gain a comprehensive understanding of their individual practices. Currently gathering data on Uganda and Vietnam, we will draw comparisons between the two and touch upon their attitudes toward trade relations and exports. A subsequent goal would be comparing how propaganda framed by non-democratic states on economic policies and initiatives compare to their relative outcomes.

THE SYNTHESIS OF INTERRELATED PENTADIENENITRILE ISOMERS: MOLECULES OF ASTROCHEMICAL SIGNIFICANCE

Danny Lee, Sam Kougias (Mentor)

Analysis of the interstellar medium and other astronomical objects reveals an abundance of nitrile containing molecules. Saturn's largest moon Titan, for example, has a thick nitrogenous atmosphere with photochemical processes thought to resemble that of Earth's before it could sustain life. The compounds in study by the McMahan Group have been detected in the laboratory by the Miller-Urey experiment; a simulation of Earth's early atmosphere, whereby a gaseous mixture of water, methane, ammonia, and hydrogen are subjected to an electrical charge, but have not been isolated or studied in the modern era. These nitriles have great astrochemical significance, thus rotational spectroscopy is being performed on these molecules. This will allow scientists and astronomers to detect them in the interstellar medium or atmospheres of celestial bodies.

EFFECTS OF VARIATIONS IN CONCRETENESS FADING ON MATHEMATICS DOMAINS

Chloe Lee, John McGinty (Mentor)

Appreciating human variability in learning, I am interested in examining the nature of learning, specifically the cognitive mechanisms involved in grounding interpretants. Four different conditions are designed to maximize the effectiveness of manipulatives, iconic representations, and symbolic representations. Comparing conditions can identify the most effective way to maximize stimulation of the neural mechanisms underlying good performances in mathematics. My research question is: How do reactivated simulations from condition one, which incorporates a full concreteness fading sequence, compare to reactivated simulations from other conditions, which incorporate variations of concreteness fading? My hypothesis is that, although condition one implements a full concreteness fading sequence, the reactivated simulations resulting from other conditions will produce more effective learning outcomes due to advantages from more focused sensory stimulations.

BIOCHEMICAL CHARACTERIZATION OF A PUTATIVE EPIGENETIC REGULATORY PROTEIN COMPLEX

Morgan Lentz, John Denu, Spencer Haws (Mentor)

Although metabolic stress has previously been shown to be capable of regulating the epigenome, there is currently a limited understanding of the mechanisms which mediate these responses. Previous studies have identified a highly conserved epigenetic response to methyl-metabolite depletion which I hypothesize is supported by a Mat2A-Mat2B-CBX5 protein complex. To begin testing this hypothesis, I have coupled in vitro crosslinking experiments with luminescence based assays in an attempt to characterize these proposed protein-protein interactions. Validation of this complex would reveal a novel mechanism by which metabolic perturbations may be capable of affecting the epigenome.

SEX SPECIFIC DIFFERENCES IN PARKINSON DISEASE

Samantha Lettenberger, Cynthia Kelm-Nelson (Mentor)

Studies report that Parkinson disease (PD), a progressive neurological disorder affecting 10 million people worldwide, occurs 1.5 times more frequently in males than females, suggesting a sex specific difference in disease progression. To study the complexities of PD, this study uses a validated genetic model of PD, the Pink1^{-/-} rat. This study, the first using Pink1^{-/-} females, analyzes limb motor performance on a tapered balance beam, anxiety with light/dark box behavioral assay, and monitors estrous phase with cytology. Previous data in males demonstrates progressive declines in motor performance; however, our most recent preliminary findings in females do not indicate the same pattern. We hypothesize that females may undergo a slower disease progression compared to males due to the presence of circulating estrogen.

EULER-LAGRANGIAN DATA ASSIMILATION OF COMPLEX TURBULENT FLOWS

Yuchen Li, Nan Chen (Mentor)

Discuss the filtering skill of Kalman filter as a function of the parameters of the model. And try to combine Eulerian and Lagrangian observations to get better estimation. Maybe something about the optimization of the location of the Eulerian observation in two dimensional velocity field.

OPTIMAL CONTROL OF SUPERCONDUCTING QUBIT WITH SINGLE FLUX QUANTUM PULSE SEQUENCES

Kangbo Li, Robert McDermott (Mentor)

The hardware overhead associated with microwave control is a major obstacle to the scale-up of superconducting quantum computing. An alternative approach to qubit control involves irradiation of the qubits with trains of single flux quantum (SFQ) pulses, pulses of voltage whose time integral is precisely quantized to the magnetic flux quantum. In this presentation, I will describe an approach for the derivation and validation of complex SFQ pulse sequences with variable pulse-to-pulse timing. Such optimized sequences allow fast, coherent rotations in the qubit 0-1 subspace while suppressing leakage out of the computational manifold. I will present simulation results and demonstrate that the performance of optimized SFQ control sequences is comparable to that of microwave-based sequences, with significantly reduced hardware requirements.

THE TOROIDAL HELICON EXPERIMENT

Haoran Li, Oliver Schmitz (Mentor)

This research is a continue of the project of building toroidal helicon wave experimental device. The basic design of the device is developed as a SOLIDWORKS model. All the parts of the designed model have been manufactured with help from Team Lab from Engineering Department. Some of the parts is redesigned in accommodation to Team Lab's requirements. The development of this experiment device is for testing equations that regulate helicon waves in toroidal geometry, which could give some insights for future study of helicon waves. The future work on this project is to assemble the device and prepare for conducting future experiments.

MODELING THE CONTRIBUTIONS OF INDIVIDUALS TO COLLABORATIVE PROBLEM SOLVING USING EPISTEMIC NETWORK ANALYSIS

Zheming Lian, Zachari Swiecki (Mentor)

Collaborative problem solving (CPS) is widely recognized as critical 21st Century Skill. CPS is characterized as interactive, interdependent, and temporal, but extant approaches to measuring it often model individuals as isolated, independent, and atemporal actors. Here, I present Epistemic Network Analysis (ENA) as an approach to modeling individual CPS processes while accounting for the time-dependent relationships between the contributions of an individual and the contributions of other team members. Specifically, I compare quantitative models of CPS that ignore these relationships to ENA models in order to demonstrate the utility of ENA in CPS contexts.

OPEN COMPLEX STABILITY REGULATES TRANSCRIPTION INITIATION BY *E. COLI* RNA POLYMERASE FROM THE RIBOSOMAL PROMOTER

Guanyu Liao, M Thomas Record Jr., Kate Henderson (Mentor)

Initiation of transcription by *E. coli* RNA polymerase (RNAP) begins with specific binding to promoter DNA and ends with promoter escape. Recently, we found that the discriminator determined the lifetime of the open complex and the escape point of RNAP in initiation from productive promoter complexes and predicted that escape from the unstable ribosomal promoter should occur at a very short RNA-DNA hybrid length. In transcription assays with promoters containing the ribosomal discriminator, we find a significant fraction of promoters that initiate rapidly. At these conditions, we find that only the shortest RNAs are made by nonproductive complexes on the time scale of productive initiation. We conclude that the current results are consistent with the proposal of early escape of RNAP from the ribosomal promoter.

A LOW-COST AND OPEN-SOURCE PLATFORM FOR AUTOMATED IMAGING

Max Lien, Philip Townsend (Mentor)

Remote monitoring of plants using hyperspectral imaging has become an important tool for the life sciences. It has applications in field environments to analyze crop responses to factors such as drought. However, the field setting introduces uncontrolled variables that make validation of spectral responses challenging, so lab-deployed systems for plant studies are of increasing interest. We developed an open-source, hyperspectral reflectance-based imaging system for lab-based plant experiments: the HyperScanner. HyperScanner was validated using drought and salt stress experiments with *Arabidopsis*. The reflectance images showed changes in narrowband red and infrared reflectance for each of the tests prior to visual manifestation of stress symptoms. HyperScanner increases the capacity for spectroscopic analytical tools in the laboratory by providing access to an open-source platform for hyperspectral analyses.

EFFECTS OF DISEASE-ASSOCIATED MUTATIONS ON THE ENZYMATIC ACTIVITY AND DISASSEMBLY OF ATCDC48/P97

Hannah Lier, Sebastian Bednarek (Mentor)

P97 functions in numerous critical cellular processes, including cytokinesis, and degradation of proteins associated with the endoplasmic reticulum. Mutations, p97R93C and p97R155C, are associated with defects in human muscle tissues and hinder the disassembly of mammalian protein p97. My research focuses on the orthologous plant mutants CDC48R97C and CDC48R159 to determine if disassembly and ATPase activity of the hexameric complex is affected. My hypothesis is that the mutants have ATPase activity and hindered disassembly. Preliminary data through binding assay showed that the point mutants and wild type bound to PUX1 with the same affinity. Kinetic and disassembly assays are currently being performed. This research will inform my understanding of CDC48/p97 enzymatic activity and turnover while contributing to a model related to disease associated p97 mutants.

INVESTIGATING THE ROLE OF THE COMFA ATPASE IN POWERING DNA UPTAKE DURING BACTERIAL TRANSFORMATION

Xiaoxuan Lin, Hannah Foster, Briana Burton (Mentor)

Natural transformation promotes bacterial biodiversity through lateral exchange of genetic materials and involves a membrane-associated protein machinery. ComFA, a member of a DEAD-box helicase family and a ssDNA-dependent ATPase, is postulated to provide the forces needed for DNA import. In this study, we made a series of mutants to analyze the roles of highly conserved residues in *Streptococcus pneumoniae* ComFA. First, we show that several mutants exhibit significant transformability defects *in vivo*. Second, we show that ATP hydrolysis is not required for DNA binding but is required to stimulate DNA release. Moreover, we present *in vitro* data suggesting coupling mechanisms between ATP hydrolysis and ComFA-DNA binding. Overall our results support the hypothetical structure of ComFA and suggest how it powers DNA uptake in transformation.

IDENTIFICATION AS A HIGH FALL RISK: OLDER ADULT PATIENTS' PERCEPTIONS

Madeline Lindhart, Barbara King (Mentor)

Falls account for 70% of inpatient accidents, and are the number one cause of injuries and death in adults 65 and older. One strategy used by acute care nurses to prevent falls is mobility restriction. Little is known about the patient experience with fall prevention during a hospital stay. A qualitative study using inductive content analysis was conducted to explore older adult patients' (N=20) perceptions of being identified as fall risk. Two critical themes were identified, Act of Caring and Being Restricted. Accepting or Rejecting Restriction determined the level of immobility patients endured. Understanding the patient experience is critical to developing patient centered interventions to reduce falls that do not impose negative consequences on patients. Additional research is needed to further explore this phenomenon.

EXPLORING THE WORK OF INFORMAL CAREGIVERS OF PATIENTS WITH DEMENTIA USING A HUMAN FACTORS ENGINEERING APPROACH

A.J. Lingg, Nicole Werner (Mentor)

Informal caregivers of person with dementia (PwD) spend thousands of hours annually providing care. These caregivers provide care without the requisite training or support needed, resulting in negative outcomes such as high levels of burden and stress. To effectively design interventions to mitigate negative outcomes and support caregiving work, we need to improve our understanding of caregiving work. To identify the types of work caregivers perform for PwD, we conducted a content analysis on (N=20) caregiver interviews. We identified 13 unique types of caregiving work, which broadly fell into three categories: (1) illness related work, (2) everyday life work, and 3) biographical work. These results suggest that caregiver support interventions should account for the disparate types of caregiving work.

PHILOSOPHY 101: THEN AND NOW

Jessica Lipaz, Harry Brighthouse (Mentor)

This research project analyzed the changes in pedagogy surrounding university level courses between the 1950s and today. Our goal was to compare UW–Madison's current Philosophy 101 to Philosophy 1a, the course equivalent created in 1952. By reading the UW System's Department of Philosophy meeting minutes, we were able to gain syllabuses, student climate surveys, and learn more about the initial intentions of the department from 1952–62. We plan to compare these findings with survey, interview, and focus group findings concerning the current practices of the department. In this way, our research was able to determine the progress of the department, in hopes of improving flaws, and continuing positive aspects that draw students into the major.

TRIGGER FINGERS TURN TO TWITTER FINGERS: THE SOCIAL MEDIA(TED) CRIMINALIZATION OF BLACK GIRLS IN SCHOOLS

Tashiana Lipscomb, Bianca Baldrige (Mentor)

This project uses critical discourse analysis to examine tweets responding to news announcements of officer a Spring Valley High Resource officer who assaulted a Black teenage girl. The author uses previous scholarship surrounding zero-tolerance discipline in schools to parallel on-line zero tolerant sentiments with the realities of Black girls in schools as it pertains to discipline and anti-Black violence often facilitated through discipline. The author suggests that collected tweets display zero tolerant sentiments for perceived deviance, disturbance, and defiance of Black girls in schools. These zero-tolerant sentiments shown within the tweets suggest a reflection of the criminalization of Black girls in schools via zero-tolerance discipline policies in schools—policies suggested to “push out” (Morris 2016) Black girls from schools and further into systems of formal incarceration.

ADVANCING SILVOPASTURE IN WISCONSIN

Tz-Ruei Liu, Diane Mayerfeld (Mentor)

The objective of this project was to evaluate the impact of silvopasture in Wisconsin on animal welfare and environmental outcomes. Silvopasture is the practice of integrating management of livestock, forages, and trees on the same site. Studies in the southern U.S. have shown that silvopasture may reduce animal heat stress; however, there is no research on the animal welfare impact of silvopasture in the upper Midwest. This study compares animal welfare and environmental outcomes of silvopasture and three other land management practices at Lancaster, Wisconsin. The findings show an improvement of welfare with access to shade. The silvopasture and grazed wood treatments show a slight increase in soil resistance compared to the un-grazed control.

DOES THE MILKY WAY HAVE A HEART ABNORMALITY?

Eowyn Liu, John Gallagher (Mentor)

The host of solar system, Milky Way is a barred spiral galaxy that has an inactive center with a large amount of gas but little star formation (Star formation rate=0.1 solar mass per year). It is yet unknown how typical Milky Way is among spiral galaxies. This study sampled and analyzed the gaseous content and star formation activities in the centers of 17 nearby galaxies morphologically similar to the Milky Way, using the 22-micron emission originated from the interstellar dust heated by young stars and the 3.4-micron emission from dust heated by old stars. Combined they show how fast stars are produced in the centers of galaxies. This presentation will discuss the evidence of how unusual our Milky Way is compared to the chosen samples.

CARBON DIOXIDE CAPTURE

Guy Lohoua, Greeshma Gadikota (Mentor)

Reducing water use for energy recovery from subsurface environments is a major societal challenge. We produce hybrid nanomaterials that are liquid-like in the absence of CO₂ and turn into hydrogels in the presence of CO₂. These materials can be used to divert fluid flow and create fracture networks. We develop these materials from silica nanoparticles and tether polymer chains to the surface. We characterize these materials using Fourier transform infrared spectroscopy to characterize the binding behavior of these materials. We have been able to determine the CO₂ uptake capacities using gas chromatography measurements. This methodology allows us to evaluate the performance of synthesized materials and the influence of the size of the nanoparticle and the polymer have on rapid hydrogel formation.

THE EFFECTS OF HOMOZYGOSITY OF CEP41 ON FERTILITY IN MALE ZEBRAFISH

Jacky Lor, Cara Moravec (Mentor)

The role of maternal factors in fertility and development has been well researched while the role of paternal factors has been overlooked. Recent studies have already shown that paternally acquired genes play a major part in fertility. Previous studies have shown that centriolar biogenesis genes are essential during spermatogenesis by contributing the only inherited centrioles. We hypothesize that mutations in *cep41*, a sperm-specific centriolar gene, in zebrafish will lead to altered early development. Preliminary results show that mutant *cep41* males have a significantly decreased rate of fertility likely caused by multi-flagellated sperm. Currently, we are working on investigating the cause of this irregular morphology. Once the cause has been discovered, we can determine what effects homozygosity in *cep41* has on fertility.

NATURAL TRANSFORMATION: THE ROLE OF ECSA AND ECSB IN BACILLUS SUBTILIS

Christian Loyo, Briana Burton (Mentor)

Bacillus subtilis (*B. subtilis*) is one of many species of bacteria that can undergo natural transformation, a type of horizontal gene transfer. This process allows genes to spread dynamically throughout bacterial populations and catalyzes the spread of antibiotic resistance. Genetic screens led us to identify two genes, *ecsA* and *ecsB*, which together compose an uncharacterized ATP-Binding Cassette (ABC) transporter. We discovered that when this transporter is deleted from the genome, transformation efficiency in *B. subtilis* is decreased by two orders of magnitude, leading us to hypothesize *ecsA* and *ecsB* contribute to natural transformation. We are further exploring activation of transformation associated genes using expression reporters and flow cytometry in order to characterize the function and role of the EcsAB transporter.

KEEP YOUR ENEMIES CLOSER: BENEFITS OF TAKING THE ADVICE FROM AN OPPONENT

Mary Lu, Lyn Van Swol (Mentor)

Taking advice can be beneficial for making a good decision, as the advisor is able to bring in another perspective. Yet not everyone is willing to take advice from different others, especially when individuals make decisions collaboratively in dyad. In our study, participants first predicted football game results, either individually or collaboratively in dyad. They then received advice from either a fellow fan or a fan from the opponent team. We predict that although individuals are more likely to ignore advice from an opponent, especially when they are in dyad, they will make a more accurate prediction when they do utilize such advice.

UNDERSTANDING HEALTH DISPARITIES FOR INDIVIDUALS WITH INTELLECTUAL DISABILITY USING PHOTOVOICE

Savi Lurie, Karla Ausderau (Mentor)

Understanding how individuals with intellectual disabilities (ID) experience participation in and access to health promoting occupations, or meaningful activities, was the driving force behind this research. Individuals with ID are at an increased risk of preventable health conditions (e.g., obesity and heart disease) and experiencing poorer health compared to the general population. This study used Photovoice, an accessible participatory method for individuals with diverse communication and cognitive abilities. Photovoice uses photographs and narrative descriptions to capture participants' thoughts and lived experiences. Findings from this study identified how individuals with ID perceive their health, and identified barriers and facilitators of health-promoting occupations. Our findings highlight that individuals with ID have a strong personal identity of health, and experience interpersonal and concrete barriers to participation in occupations.

SEQUENTIAL EROSION TISSUE IMAGING OF THICK FLUORESCENT SAMPLES

Yiqun Ma, Niklas Gahm, Kevin Eliceiri (Mentor)

Although widely used, fluorescence imaging faces a key limitation: the maximum depth of imaging, which is constrained by how far light can penetrate into tissue. This means that only samples within this range of depth can be effectively imaged. Sequential Erosion Tissue Imaging (SETI) is a novel and accessible technique that integrates physical sectioning with computational fluorescence imaging. Automated physical sectioning enables fast and high-quality imaging of the entire thickness of a sample. Computational optics reject background light and allow for fluorescence to be precisely isolated in milled tissue. This integration enables high-quality yet affordable imaging of thick tissues.

FIRST GENERATION ACADEMIC PROFESSIONALS AND WRITING

Mckenzie Maccaux, Calley Marotta (Mentor)

Current writing studies research on first-generation identities has largely examined student writers. Scholars like Jessica Rae Jorgenson and Bernice Olivas argue for the creation of pedagogical interventions and continued support for first-generation students in the composition classroom, but what happens after those students attend graduate school and become academic professionals? What unique perspective do first-generation academic professionals have when interacting with student writing? In my research, I draw from literature on intersectionality and working class memoirs, as well as interviews with first generation faculty members. I ultimately argue that understanding the full impact of the first-generation status on academic writing professionals requires recognition of the other identities that shape them as well.

SYMBIOTIC RELATIONSHIP BETWEEN NITROGEN FIXING BACTERIA AND SORGHUM PLANTS

Angelo Madruga, Apoorv Kondapelli, Vania Pankievicz (Mentor)

The purpose of the experiment is to focus on the understanding of nitrogen-fixing bacteria present in mucilage produced by aerial roots in sorghum plants. We hypothesize that border cells are responsible for producing mucilage to sustain nitrogen-fixing bacteria, which can contribute to 30–80% of the nitrogen input for corn. Nitrogen-fixation can help decrease the need for chemical fertilizers that currently use 1–2% of the total global energy supply. Chemical fertilizers cause long-term damage to the soil as they don't promote healthy soil. We are testing different sorghum genotypes to comprehend its diazotroph dependency on plants and how it correlates with its survivability, hopefully leading with the implementation to make the plants uptake part of its nutrients from nitrogen-fixing bacteria rather than only on chemical fertilization.

ASSESSING SOURCES OF GENETIC RESISTANCE TO COLORADO POTATO BEETLE

Mary Magnuson, Mike Crossley, Benjamin Pelissie (Mentor)

The Colorado Potato Beetle (CPB) is a voracious, global potato pest. For over a century, it has repeatedly evolved resistance to any pesticide used to control its populations, forcing the continuous development of new pesticides. The resulting economic and industrial burden, along with the threat it imposes on natural ecosystems forces scientists to develop new, sustainable control strategies, like potato plants genetically modified to be constitutively resistant to CPB. Such candidate varieties have been developed from crosses between cultivated and wild potato species. We evaluated the resistance level of five resistant-bred potato varieties to CPB larvae by performing feeding assays. Our results suggest that some of those varieties might be repelling CPB larvae and could represent good candidates to replace regular potatoes in crops.

REAL-TIME SOLUTIONS TO STOP THE SPREAD OF FAKE NEWS

Yogesh Balaje Mahendran, Varun Jog (Mentor)

Fake news online is a modern plague that is slowly affecting the societal structure and well-being. The proposed research provides three solutions that aims to give real-time network solutions that guide users and network administrators. Our first solution analyses positive and negative responses to Facebook posts to find a threshold that is indicative of viral fake news articles. The second solution involves modelling the effects of increasing or decreasing the user response time to disturb normal spreading patterns of viral fake news. The final solution studies the effect of changing network structure to decrease the diffusion of the fake news. The research will help solve one of the significant problems of the 21st century and provide a fresh outlook on the subject.

MODULATION OF CHICKEN INTESTINAL MALTASE ACTIVITY BY DIETARY STARCH, PROTEIN, AND LIPID SIGNALS

Don Mai, William Karasov (Mentor)

Omnivores generally have the ability to modulate digestive enzyme levels to match their current diet; however, birds may not modulate all enzymes and some enzymes may be suppressed by non-substrate nutrients. We hypothesized that modulation of digestive enzymes would be controlled by multiple nutrients in chickens and suppressed by at least one non-substrate. We report results on intestinal maltase on chicks raised for 18 days on three diets varying in starch, protein, and lipid contents. Considering other studies, we predicted that the intestinal maltase activity would be enhanced by dietary starch and suppressed by lipid, assuming no suppressive effect of dietary protein. The study will highlight fundamental mechanisms on how the digestive function uses specific nutrient signals to adjust to changes in dietary environment.

FOOD SECURITY AT MADISON COLLEGE: WOLVES SHARE INITIATIVE

Susan Maloney, Randy Stoecker (Mentor)

Recently, there has been increased recognition of student hunger on college campuses across the nation, as supported in research by the Wisconsin HOPE Lab. At a local level, the Madison College Student Senate initiated conversation about student hunger through a survey circulated during the fall of 2017. In partnership with Madison College, this Wisconsin Idea Fellowship project incorporates local knowledge and community action in an effort to discuss and address the sources of student hunger at the community college level. The main objective of this project is to compile a comprehensive understanding of the impact of food insecurity as it affects students and staff on and off campus. This, in turn, continues to foster student-led efforts to increase resources and support for hungry students.

THE MIDBODY: ONE CELL'S TRASH IS ANOTHER CELL'S TREASURE

Caitlin Marks, Randall Dahn (Mentor)

Cytokinesis is the final stage of mitosis, in which cellular constituents are partitioned to daughter cells. The midbody is a proteinaceous knot that appears between daughter cells during cytokinesis, defining and regulating their final abscission. Historically thought to be mitotic debris, midbodies are now known to be released by dividing cells, and internalized by neighboring cells to regulate proliferation rates, cell polarity, and potentially cell fate. Our study examines the role of two master regulators of cytokinesis, the MKLP-1 and RacGAP gene products, using a combination of cell culture, immunohistochemistry, and confocal microscopy. Our mechanistic contribution to understanding midbody biology should provide some insight into this novel means of cell-cell communication, with potential implications for stem cell biology, cancer, and neurodegenerative disease.

EFFECT OF A COMMUNITY-BASED BALLROOM DANCE AND BALANCE EDUCATION PROGRAM ON COGNITION IN OLDER ADULTS

Alexis Mashl, Susan Frikken (Mentor)

Dance classes have been shown to improve cognition in older adults. The objective of this prospective review is to evaluate the impact of a balance class using dance on cognition in older adults. Cognition was assessed using the Trail Making Test (TMT) after the first session and prior to the last dance session. Weekly classes lasted 90 minutes and ran for 6–12 weeks. A paired two sample t-test for means indicated a significant effect for the TMT for the slower 15% of participants when comparing pre- to post-program scores ($T=4.28$, $P=0.001$). For the fastest 15%, there was no significant improvement. From these preliminary results, it is suggested that those with the large cognitive deficits can improve their cognitive abilities from a balance class using dance.

FEAR OF DOTS TASK

Jacob Massonet, Brendon Nacewicz (Mentor)

The goal of our research project is to build a functional test that analyzes how threat of an electric shock makes it harder to take another person's perspective, measured by differences in accuracy and reaction times in response to visual stimuli. We will use an established task asking people to explicitly answer from another point of view or answer from their own point of view without being distracted by someone's conflicting point of view. We will combine this with another task with a countdown to a possible electric shock and see if the added pressure causes people to ignore the point of view of others. This will open up a new field of research in psychiatry testing the degree to which fear impairs social connection.

AUDIT CROSS VALIDATION

Maggie Mataczynski, John Curtin (Mentor)

Diagnostic screeners play key roles in clinical research and practice. While most screeners are built using items that correlate with clinical outcomes, diagnostic screener cut-points are at worst arbitrarily assigned, and at best overestimate performance due to reliance on in-sample tests of performance. Since screeners are used to generalize findings to certain psychiatric populations and may dictate who is further assessed for disorders, critical assessment of cut-point diagnostic ability in new samples is paramount. Cross validation for selection of diagnostic cut-points is a potential method for providing less biased estimates of cut-point performance in new data. We model this method through evaluation of the Alcohol Use Disorders Identification Test in diagnosing undergraduate alcohol use disorder and find significantly reduced performance metrics compared to established literature.

DIFFERENTIAL EXPRESSION IN ASPEN GENOTYPES WITH HIGH AND LOW LEVELS OF CONSTITUTIVE DEFENSES EXPOSED TO HERBIVORY

Thomas Matoska, Jennifer Riehl (Mentor)

Populus tremuloides (quaking aspen) displays astonishing variability in phenolic glycoside (PG) concentrations, largely due to genetic variation, but little is known about the genetic architecture of this important defense trait against herbivores. This investigation aimed to identify the genes and genomic regions that govern PG concentration in *Populus tremuloides*. Eight aspen genotypes with genetically-determined high and low PG concentrations were exposed to two conditions: with and without damage by gypsy moths. Following this treatment, RNA sequencing and phytochemical analyses were carried out on foliar tissues. Current analyses showed no significant difference in PG concentrations between the damage and control treatment. However, results showed significant differences in PG concentrations among genotypes. The RNA sequencing data is currently being analyzed.

CAN A CHILD'S ABILITY TO MANIPULATE A TOUCHSCREEN PREDICT THEIR STEM LEARNING FROM INTERACTIVE SCREEN MEDIA?

Erin Matusinec, Heather Kirkorian (Mentor)

We measured children's abilities to perform screen manipulation tasks and how those abilities related to their learning from interactive screen media. Children (3.0-5.9 years, N=66) completed pre- and posttests assessing their science knowledge and played an interactive science learning game on a touchscreen device. Also, children's memory, motor, and touchscreen skills were tested through a variety of tasks. The main research question was to understand how age and ability to manipulate touchscreens may affect learning from media. The results signified touchscreen manipulation abilities increased with age and were positively correlated with increased post-test scores which suggests learning. This information can be used to better understand children's interactions with media and the processes underlying learning from interactive screen media.

EFFECT OF TRAIL OBSTRUCTION ON LEAF TRANSPORT IN ATTA CEPHALOTES

Nicholas Maxfield, Catherine Woodward (Mentor)

Leaf-cutter ants are tropical, fungus-growing ants living in much of the Americas. These ants maintain a well kept path on the forest floor, removing any debris that accumulates on it. We set out to find the effect that obstacles have on the ant's rate of leaf transport back to their nest. This research was done in one week at Tiputini Biodiversity Station in Ecuador. We found that the placement of obstacles had no significant effect on the ant's leaf transport, and to investigate why we designed a second experiment to test the ant's physical response to an obstacle. This test showed that after obstacle removal the ants significantly sped up to "make up ground" and maintain the original rate of leaves returning to the nest.

DO GESTURES ALTER CHILDREN'S UNDERSTANDING OF NOVEL WORDS?

Grace Mccune, Jenny Saffran (Mentor)

Children's gesturing influences the development of their oral communication abilities. Do gestures that children observe also impact learning? In this study, we manipulated gestures that children saw while learning novel words. The gestures were either consistent or inconsistent with the attributes of the object. We then used a standard word learning test. Children saw two side-by-side images of the trained objects and heard the label for one. We measured how quickly and accurately children looked at the labeled object. Half of the trials consisted of objects trained with consistent gestures and half with inconsistent gestures. We hypothesized children would learn the objects trained with consistent gestures better. This research provides insight into how gesturing affects learning and whether the consistency of gestures and information matters.

MONOCHROMATIC PULSED PHOTON SOURCE FOR CALIBRATION OF X-RAY MICROCALORIMETER

Mari McPheron, Dan McCammon (Mentor)

Recent improvements in X-ray detector energy resolution require improved calibration systems. The atomic emission lines currently used to calibrate X-ray detectors are much broader than the improved detector resolution. Short pulses of ultra-violet laser photons can be used to simulate an X-ray event. Our group has simulated X-ray emission lines less than 3 eV wide for energies up to ~400 eV. I am working to push this calibration scheme to even higher energies.

INVESTIGATING ICE STREAMS, AN IMPORTANT CONTRIBUTOR TO SEA-LEVEL RISE, USING THE RHEOLOGY OF ICE TO GAIN KNOWLEDGE ON THE GRAIN STRUCTURE AS IT IS SHEARED.

Eve Meltzer, Lucas Zoet (Mentor)

Ice streams are fast moving sections of an ice sheet that are responsible for discharging most of Antarctica's ice to the ocean, and so are a fundamental contributor to sea-level rise. It is important to understand the geometry and processes regulating ice streams because this knowledge can help inform continental scale models of ice sheets in a simplified way. One aspect that regulates the flow of ice streams is the rheology of temperate ice. We conduct a study aimed at quantifying the rheology of temperate ice by making thin sections (<.5mm) of ice and analyzing them under a cross polarizing filter. This allows us to investigate how the grain structure and fabric alignment of the ice changes as the ice is sheared to greater strains.

ELUCIDATION OF THE REGULATORY MECHANISM OF TYR PRODUCTION IN ARABIDOPSIS THALIANA

Yusen Men, Hiroshi Maeda (Mentor)

L-Tyrosine (Tyr) is an essential amino acid for protein biosynthesis across all species. It serves as a precursor for synthesis of secondary metabolites. In plants and microbes, Tyr can be synthesized through either ADH or PDH pathway, respectively. However, Tyr accumulation is refrained from negative feedback inhibition on ADH enzymes in plants. Previous studies showed that a single mutant plant (AtADH2 D241N) accumulated more Tyr by releasing ADH enzyme inhibition. Then, a double mutant plant (AtADH2 D241N&E179D) in T1 generation demonstrated even more Tyr production; however, plant growth was severely compromised. Molecular experiment is being conducted to elucidate the reason why this double mutation leads to such results. This study sheds light on how to bioengineer plants to increase their secondary metabolite production.

CONSTRUCTION OF A BLUE LASER COOLING SYSTEM FOR A MULTIPLEXED STRONTIUM OPTICAL LATTICE CLOCK

Brett Merriman, Shimon Kolkowitz (Mentor)

Atomic optical lattice clocks (OLCs) are the most accurate and precise measurement devices. The OLC we are building will use strontium atoms as the atomic reference due to their narrow optical clock transition and accessible cooling transitions. The strontium atoms need to be laser cooled to micro-Kelvin temperatures for trapping in the optical lattice. The first cooling stage makes use of the 461 nm, 1S0-1P1 transition requiring a stable, high-power light source at this wavelength. This work will discuss the purpose and design of a compact, low cost, high-power 461 nm system by injection locking 3 bare laser diodes to a stable external cavity diode laser and propose an approach to maintain the injection lock over large frequency ranges covering all stable strontium isotope transitions.

A FORGOTTEN COMMUNITY: POVERTY, RACE, AND POLICY IMPLICATIONS IN CRISP COUNTY, GEORGIA

Alyssa Meurer, Leann Tigges (Mentor)

Crisp County, Georgia, is a classic example of a place of concentrated poverty. However, it is remarkable in its extreme income inequality between Whites and Blacks. The main issues it faces, affecting Blacks more than Whites, are child poverty, low education, high unemployment, and a poor labor market. These issues also affect women to a greater extent than men, particularly because a quarter of households are led by single mothers in Crisp. As a result of the economic situation in Crisp County, as well as the blatant racial disparities, policy must be implemented from a community or federal level to boost the education, employment, and family support for African American residents specifically and to improve the wellbeing of the community.

WATERSHED RESTORATION PRACTICES AND TECHNIQUES IN NE PACIFIC REGION

Michal Michiels, James Berkelman (Mentor)

Years of development and anthropogenic influences have led to degraded watersheds and severe habitat loss, endangering Northeastern Pacific salmonids, such as Coho, Chinook, and Steelhead. Over the past few decades, millions of dollars have been spent on watershed restoration aimed at increasing salmon populations. Restoration projects are often created with no understanding of what an ecosystem requires to improve in quality. Despite uncoordinated restoration efforts, the number of salmonids using watersheds in the northeastern Pacific region has increased, implying that at least some restoration attempts have been successful. For my project, I researched watershed restoration and compared their results to determine how we can improve them. I discuss techniques and plans that I believe will further enhance the Northeastern Pacific watersheds.

COMBINING FGFR INHIBITOR AZD4547 WITH RADIATION IN HEAD AND NECK CANCERS.

Margot Miller, Saakshi Kaushik, Lindsey Abel, Randy Kimple (Mentor)

Fibroblast growth factor receptors (FGFR) are a family of four receptor tyrosine kinases involved in tumor progression and invasion. In head and neck squamous cell carcinoma (HNSCC), FGFRs are frequently amplified or overexpressed. FGFRs have been shown to be upregulated after radiation and are active in multiple pathways involved in the radiation response. We assessed the potential of a selective FGFR-kinase inhibitor, AZD4547, to act as a radiosensitizer in HNSCC cell lines and xenografts. Our findings indicate that AZD4547 can augment the response of FGFR-expressing HNSCC to radiation both in vitro and in vivo. Improved approaches to identify tumors most likely to benefit from FGFR inhibition could enable the selection of patients for combination therapy and potentially improve outcomes in these difficult to treat cancers.

CAN PRESCHOOLERS INTENTIONALLY FORGET?

Hailey Miller, Haley Vlach (Mentor)

The ability to forget information is critical for intact memory. The directed forgetting (DF) paradigm assesses this capacity in older children and adults. Researchers argue the ability to intentionally forget does not arise until late elementary school, coinciding with improved inhibitory control. However, a recent study has found a DF effect in a sample of 4 to 5 year-old children. The present study intended to replicate this finding using two different stimuli sets (picture cards vs. real-life objects). Children ages 36–72 months completed a list-method DF task using picture cards (n = 65) or real-life objects (n = 39). Results replicated the finding of successful intentional forgetting in preschoolers. Currently, we are investigating how individual differences in metamemory and executive functions mediate this ability.

EXPLORE DIVERSITY IN DIETETICS WITHIN THE UW DIDACTICS PROGRAM

Samantha Miller, Cassandra Vanderwall (Mentor)

With diversity rapidly increasing in the U.S., it is imperative to increase diversity within the dietetics profession to provide optimal, individualized care to a changing population. Efforts must be focused on recruiting and retaining diverse individuals to Accredited-Dietetics (ADIP) programs and Didactic-Programs in Dietetics (DPD) throughout the country. We intend to plan an outreach event that will include a discussion of key information about the UW-ADIP program and dietetics profession, emphasizing the importance of a diverse workforce and career options which may be of interest to a diverse audience. Additionally, we are formulating a scholarship to distribute to a UW-ADIP student who meets the qualifications of a traditionally underrepresented student in dietetics as an initiative to increase retention within the program.

IMPROVING FUNCTION AFTER NERVE INJURY VIA MICROPARTICLES

Christopher Mitry, Amgad Hanna (Mentor)

Current growth factor therapies for nerve injuries have limited ability for tailored release of growth factor on a desired time-frame. We hypothesized that mineral coatings on micro-particles will bind, stabilize and release biologically active GDNF and NGF, and growth factor release kinetics can be tailored for time needed to grow axons the length of graft. To test this hypothesis, mineral coated microparticles loaded with growth factors were incorporated on the distal end of 10 mm sciatic nerve isograft in male Lewis rats. After grafting, hind limb function was tested until 12 weeks post-operatively. Half the rats were injected with an axon tracer distal to the nerve graft. Remaining rats were tested using electrophysiology, grafts harvested, and myelin labeled axons counted. Our preliminary results appear positive.

STIMWAVE SINGLE 4 ELECTRODE

Christopher Mitry, Alaa A. Abd-Elseyed (Mentor)

Sixty-one year-old female with history of anxiety, depression, hypertension, hypertriglyceridemia, and tobacco use disorder presents with chronic right ankle pain. Her pain was not well controlled with conservative therapy. She tried physical therapy and massage therapy. She tried right sural nerve blocks but the length of relief was less than 24 hours. She also tried Aleve, Tylenol, and Gabapentin. She rates the pain a 9/10. She received a Stimwave single 4 electrode contact lead close to the right sural nerve with the receiver placed vertically up the leg. After the procedure, she rates the pain 2/10 with 100% pain reduction. She has had pain relief for approximately two months since the procedure.

REGENERATIVE CAPACITY OF ADULT DROSOPHILA BRAINS WITH AND WITHOUT BRAT MUTATION

Kent Mok, Grace Boekhoff-Falk (Mentor)

According to the Centers for Disease Control, neurodegenerative diseases like Alzheimer's affect over 5.7 million Americans. My lab previously showed that a novel mutation in the *Drosophila* brain tumor (brat) gene exhibited both overproliferation of cells in the brain and progressive neurodegeneration. My laboratory also has found that Penetrating Traumatic Brain Injury (PTBI) leads to proliferation and regeneration in the adult *Drosophila* brain. I am quantifying the proliferation of cells in the brain of brat mutants and comparing this to wild-type brains at 24 and 48 hours after a penetrating injury to test the hypothesis that brat mutants have higher regenerative capacity. Parallel analysis investigating the mechanisms regulating proliferation in adult *Drosophila* brains, may allow us to unlock key features of neural regeneration.

UNDERSTANDING THE RELATIONSHIP BETWEEN GVHD PROBABILITY AND MONONUCLEAR CELLS' STIMULATORY CAPACITY IN DIFFERENT HSCT GRAFT SOURCES

Isabel Monti, Jenny Gumperz (Mentor)

Over 20 million people in the U.S. have been diagnosed with an autoimmune disease. One treatment, hematopoietic stem cell transplantation (HSCT), for these diseases is able to prolong life, but at the risk of some potentially lethal side effects. HSCT removes the diseased immune system and replaces it with a healthy one at the risk of graft-vs-host disease (GVHD). There are three main graft sources for hematopoietic stem cells transplantation, bone marrow (BM), mobilized blood (MB), and umbilical cord blood (CB). Each source is susceptible to GVHD, but some are more prone than others. Through ELISAs, this project has investigated the different stimulatory capacities of mononuclear cells to compare the production of inflammatory cytokines amongst the graft sources that is involved with GVHD pathology.

VIRTUAL REALITY WITH CONSTRUCTION SITES

Hunter Morlock, Zach Cui, Hannah Blum (Mentor)

Improved visualization allows students to immerse themselves and to obtain a deeper understanding of educational concepts. The purpose of this research is to determine if students' understanding of structural framing and construction sites improves when presented with Virtual Reality in the classroom. Various 360-degree photos and videos were recorded of a skyscraper under construction in downtown Chicago, and are viewable in the Oculus Go headset. This standalone headset is ideal for classroom use as there are no wires, no attached computer is required, and the lack of motion tracking prevents students from bumping into one another. Results from this study are used to understand how to best create and implement Virtual Reality for educational purposes.

MODULATION OF INTESTINAL PEPTIDASE ACTIVITY IN RESPONSE TO MULTIPLE DIETARY MACRONUTRIENT SIGNALS IN DOMESTIC CHICKENS

Elizabeth Morrow, Yushi Oguchi, Elizabeth Morrow, William Karasov (Mentor)

It is commonly known that the digestive enzyme activity of omnivores is induced by the level of the respective substrate consumed in their diet. However, it has been observed that the suppressive effects of nonsubstrate nutrients can also affect digestive enzyme production, which is underexplored in chickens. We hypothesize that digestive enzymes are controlled by multiple macronutrient signals. We will report the inductive and suppressive effects of protein, starch, and lipid on aminopeptidase-N by raising chicks on three diets differing in the composition of these macronutrients. We predict that aminopeptidase-N activity will be induced by protein and suppressed by starch. This study advances knowledge of mechanisms that permit animals to adjust to changing nutrient opportunities in their environments.

BURNOUT AND DISTRESS IN MD-PHD STUDENTS EVALUATED THROUGH WELLNESS CURRICULA

Pahder Moua, Jessica Babal (Mentor)

More than 50% of medical students display symptoms of burnout but the frequency of MD-PhD student burnout is unknown. This study aims to evaluate MD-PhD student burnout and distress during various stages of the program. Forty-eight MD-PhD students responded to a survey at the beginning of a 6-week wellness curriculum to evaluate burnout and distress. Burnout was scored using measures of Emotional Exhaustion and Depersonalization. Distress was measured using the PHQ-4 scale. Findings showed that 67% of students met the criteria for burnout and 53% were classified as having some level of distress. On average, MD-PhD students experienced slightly higher levels of burnout and distress compared to medical students, but any person is susceptible to burnout. Therefore, MD-PhD students could benefit from targeted wellness interventions.

EFFICACY OF POLYETHYLENE GLYCOL 6000 INDUCED DROUGHT ON MINI-CORE POPULATION OF BARLEY (HORDEUM VULGARE) AS A PROXY FOR DROUGHT RESISTANCE

Liam Murphy, Mali Mahalingam (Mentor)

Barley is an important cereal crop and model for genetic studies focused on drought resistance. This project tests if Polyethylene Glycol (PEG) 6000 induced droughts during the germination period serve as an effective proxy for drought simulations in the greenhouse. PEG induced drought was inflicted on 160 spring lines of the Mini-core barley. Root lengths and biomass were measured and compared to root and seed yield from the greenhouse. No strong correlation was observed. There was strong reduction of root length in early growth stages of plants exposed to PEG. This was not observed if the plant was exposed to traditional pot culture drought treatment. Additionally, identifying well-supported criteria would promise a better understanding of the efficacy of PEG at imitating traditional drought conditions.

PREDICTING MODELING OF ALGAL BLOOMS ON THE LAKES OF MADISON, WISCONSIN

Alliot Nagle, Dimitris Papailiopoulos (Mentor)

Madison's lakes Mendota and Monona, and other lakes within the Yahara watershed, are contaminated by runoff from farmland and other phosphorus-containing sources. One negative side effect of phosphorus draining into these lakes is algal blooms, which color the water green or blue-green, produce a foul-smelling odor, and pose health risks to beachgoers and wildlife. This research project has been one of many on UW-Madison's campus to better understand the behavior of these algal blooms. Our approach utilizes machine learning and data science to create a predictive model to forecast algal blooms. After investigating several machine learning models, we present our results and discuss our findings, with a special focus on the efficacy of neural networks.

PREDICTING THE THERMODYNAMIC STABILITY OF PEROVSKITE OXIDES USING MACHINE LEARNING MODELS

Yaseen Najeeb, Lane Enrique Shultz (Mentor)

Perovskite oxides can be used to create solar panels, which have an increasing presence in renewable energy. Therefore, there is an incentive to investigate new perovskite materials that could have desirable properties. However, the material has to be stable for any manufacturing application. The goal of this project is to predict the stability of materials in a perovskite structure using machine learning. The stability criterion used is the energy above the convex hull. Both ab-initio data and public databases will be used to train machine learning models for prediction of the energy above the convex hull.

INVESTIGATING CHEMISTRY BACKGROUND AND LEARNING STRATEGIES

Lauren Nave, Sally Wu (Mentor)

The goal of this research is to determine which of the learning strategies employed in a laboratory study were found most useful by students of varying chemistry backgrounds. In this study, 103 students engaged with Chem Tutor, an online based program, where the main focus was to increase student's understanding of the concept of the atom. Students can engage in various strategies to better understand the atom. I investigated how students' chemistry background correlates to strategies they found most helpful, using a survey completed after using Chem Tutor. Findings can suggest design recommendations for specialized versions of Chem Tutor that relate to a student's chemistry background. These findings can transfer to many other fields of study which utilize online learning programs.

TRANSPORTATION ENERGY, EMISSIONS, AND SATELLITE DATA

Emma Nelson, Tracey Holloway (Mentor)

This study compares nitrogen dioxide (NO₂) satellite data to highway freight trends to understand air quality and pollution in the United States. The recently-launched Tropospheric Ozone Monitoring Instrument (TROPOMI) produces a high-resolution analysis of pollution data. Freight transportation by diesel vehicles including trains and trucks releases some of the most NO₂ in the country. Assessing this pollution's impact is important human and environmental welfare. Satellite data allows patterns in rural areas to become apparent and shows clearer results than ground-based measurements. The Freight Analysis Framework (FAF) provides annual data on the country's freight transportation, and comparing spatial patterns of TROPOMI NO₂ with FAF patterns using Python software will allow for insight into the impact of freight pollution in the US.

GOING BEYOND °BRIX: MATURITY MARKERS FOR COLD CLIMATE INTERSPECIFIC HYBRID RED WINE GRAPES

Andi Nelson, Amaya Atucha (Mentor)

Analytical methods for monitoring grape berry maturation in cold climates primarily rely on a sugar estimation measurement (°Brix). Sugar estimation data present a good linear relationship for berry maturation, however, °Brix is only one component that determines the quality of the wine produced. Currently, important phenolic, acidity, and protein concentrations are overlooked by growers. Red wine grape cultivars Frontenac, Marquette, and Petite Pearl were sampled from veraison to harvest throughout the 2017–18 growing seasons, at the West Madison Agricultural Research Station. We investigated total phenolic, total protein, percent polymeric color, tannin, and monomeric anthocyanin assays as potential tools for monitoring berry maturation for growers and winemakers. The data presented also serves to report on the ripening profile of Frontenac, Marquette, and Petite Pearl.

USING TOOLKIT TO SUPPORT FAMILIES WITH CHILDREN WITH AUTISM IN CULTURAL INSTITUTIONS

Nicole Nelson, Karla Ausderau (Mentor)

Literature suggests families with children with autism have limited access to cultural institutions. We developed a toolkit to assess accessibility for these families in cultural institutions. The toolkit provides mechanisms to evaluate a number of aspects of the public institution through structured observations of space and programs, website materials, and stakeholder and institution feedback. The toolkit has been distributed to approximately 200 institutions worldwide. Data collection will occur to report on the institutional feedback and propose changes to the toolkit. The purpose is to increase the usability of the toolkit by revising the contents based on feedback from different cultural institutions. Findings can be used to identify areas of strength and need, and to measure the impact of initiatives designed to increase accessibility for this population.

INCREASING EFFICIENCY FOR HIGH-THROUGHPUT MAJOR HISTOCOMPATIBILITY COMPLEX GENOTYPING

Emma Neumann, Roger Wiseman (Mentor)

Major histocompatibility complex (MHC) genotyping is crucial in understanding immune responses, disease pathogenesis, testing vaccines and transplant tolerance strategies in non-human primate models. It is increasingly important for MHC genotyping to develop accurate and efficient high-throughput methods to process hundreds of samples for deep sequencing. Currently, the process is labor intensive and prone to human error. Over the past year, we have developed protocols utilizing robotics to increase consistency and provide more time for researchers to analyze the resulting sequence data. Nucleic acids are now isolated from barcoded blood samples using an automated Maxprep/Maxwell48 system, amplified via multiplex Fluidigm chips, sequenced on an Illumina MiSeq and analyzed with a Python workflow. These methods have increased the efficiency and accuracy of our MHC genotyping assays.

STUDENT MEMORY, THEN AND NOW

Rena Newman, Catherine Phan (Mentor)

College campuses have ephemeral populations. Memory of past community issues have short-term staying power. A question arises for activists and historians alike: how do we keep student memory alive? As the student historian in residence at the UW Archives for 2018–19, I've worked to both research student movements during the Vietnam War era and document student activism in the present campus community. Drawing inspiration from my research into 1960s student organizing, both the UW Black Student Strike and a previously unwritten-about student-led course called EPS 900: Experiments in Teaching and Learning, I seek to encourage my peers to see themselves as historical subjects, empowering them to exercise agency over their personal legacy and the memory of our University as a whole.

INCREASED NUMBER OF ANTIBIOTIC PRODUCING IN SOIL INVADED BY JUMPING WORMS (*AMYNTHAS AGRESTIS* AND *AMYNTHAS TOKIENSIS*)

Charlene Ngandu, Brooke Herschleb, Briana Dibenedetto, Josh Pultorak (Mentor)

Invasive species of jumping worms (*Amyntas agrestis* and *Amyntas tokiensis*) alter the soil composition, which could lead to different types of microbial life in the soil, potentially effecting antibiotic-producing bacteria holding the key to the antibiotic crisis. We isolated bacteria from soil collected at worm invaded sites at the UW–Madison Arboretum and performed screens for antibiotic production and biochemical assays. Results showed significantly more antibiotic producing bacteria in the topsoil where the invasive worms live, opposed to the deep soil. This was consistent with the other studies indicating impacts of worm activity on microbial communities.

INVESTIGATION OF THE STRUCTURE-FUNCTION RELATIONSHIP OF B. SUBTILIS SSB MONOMER INTERFACES

Thanh Phuong Nguyen, James Keck, Katarzyna Dubiel (Mentor)

Bacterial single-stranded (ss) DNA binding proteins (SSBs) serve critical roles during genome maintenance reactions. While SSB has been studied extensively in *E. coli*, much less is known about the paralogues, SsbA and SsbB, found in gram-positive bacteria such as *B. subtilis*. *B. subtilis* SSBs bind ssDNA through an oligosaccharide/oligonucleotide binding (OB) domain and function as homo-tetramers. Crystal structures of SsbA and SsbB have revealed molecular interfaces that suggested that mixed-tetramers are unlikely to form in vivo. We hypothesize that complementary mutations at this interface may allow SsbA/SsbB hetero-tetramer formation. If mixed tetramer variants are discovered, we will test the effects of mixed-tetramer formation in vivo and further probe the functions of SSBs in gram-positive bacteria.

IN VIVO CHARACTERIZATION OF THE SPLICEOSOME PROTEIN ECM2 IN SACCHAROMYCES CEREVISIAE

Brandon Nikolai, Charles Schneider, Clarisse van der Feltz, Aaron Hoskins, Aaron Hoskins (Mentor)

Eukaryotic mRNA molecules are modified before leaving the nucleus in order to code for the correct protein. One modification consists of removal of the introns within the transcript by a large RNA-protein complex called the spliceosome. While the functions of many spliceosome proteins are known, there still remain some components, like ECM2, whose role in splicing is unclear. Cryo-EM structures of the spliceosome show that ECM2 contacts two of the snRNAs (U2 and U6) and sits adjacent to PRP8. PRP8 is the largest, most conserved protein in the spliceosome, and functions to cradle the RNA catalytic center. We believe ECM2 provides a central anchor point to stabilize RNAs and allow for spliceosomal rearrangements during the early steps of splicing.

MORPHOLOGICAL EVOLUTION OF GALAXIES IN ARP 2197: FROM SUPERGROUPS TO CLUSTERS: PREPROCESSING AND THE JELLYFISH

Ian Norwood, Jay Gallagher, Ralf Kotulla (Mentor)

We present deep (U, B, V, and R) images of Arp 2197 (Upper Hercules Supercluster) obtained with the WIYN .9-m telescope on Kitt Peak. Using the NASA/IPAC Extragalactic Database, it was determined that there was asymmetric dynamic processes (morphologies) on gas and dust of infalling galactic members. Once we matched previously catalogued members of the cluster with new data, radial velocities centered on the “Central/Dominating” or CD galaxy NGC 7173 were used to confirm infalling objects. Our systematic analysis shows evidence of morphologies prior to directly falling into the core (preprocessing) and is observed seen in various disturbed galaxy populations, an example being observed Jellyfish galaxies lying on the red sequence.

CHASING DOWN VARIABLE STARS FROM A DECADE-LONG DATASET

Nikki Noughani, Ralf Kotulla (Mentor)

Finding and characterizing variable stars is at the heart of a relatively modern branch of astronomy named time-domain astrophysics. Variable Stars are ordinary stars that change in brightness on widely varying degrees. Characterizing the details of how this brightness fluctuates and on what timescales, as well as the star’s average properties (mean brightness, temperature, etc.), is greatly important to understanding the process of stellar evolution. For this project, we use data over 10 years from the 0.5 meter Sloan Digital Sky Survey telescope. We have developed the tools that can identify several variable stars, estimate their variability periods and timescales, and determine the shape of their brightness variations over this time. Next, we will use machine learning to characterize the nature of each source.

SOCIAL JUDGEMENT IN SAFETY SITUATIONS

Jessica O'Neill, Kristin Shutts (Mentor)

Which people do we see as deserving of our help and why? Using Amazon Mechanical Turk, we observed how participants donation behavior was affected by how a potential recipient became misfortunate (i.e., responsible for their misfortune or not) as well as the recipient wealth (low or high). Participants earned money by answering quiz questions, and then were given the opportunity to donate their earnings to different kinds of recipients. We predicted that participants would be more generous toward recipients who were not responsible for their misfortune and those who were lower in wealth. The results of this research shed light on factors influencing how adults decide to distribute resources and also have implications for policy.

ON THE TRANSLATES OF GENERAL DYADIC SYSTEMS ON R

Connor Olson, Theresa Anderson, Connor Olson, Zeyu Wei, Bingyang Hu, Liwei Jiang, Betsy Stovall (Mentor)

It is well-known that the dyadic technique plays an important role in harmonic analysis. The key idea for this technique is to allow one to understand some certain object (for example, operator, function space, etc) via its dyadic version, which is often much more fruitful and easier to handle. One of the recent successful applications of such an idea is in the proof of the A2 conjecture using sparse domination. In this proof, distinct grids play an important role, so we wanted to study what determines whether some given grids are distinct.

HUMAN-HYENA CONFLICTS: A STUDY OF HYENA ACTIVITY IN LOCAL COMMUNITIES AROUND AKAGERA NATIONAL PARK, RWANDA

Jacob Olson, Adrian Treves (Mentor)

Preserving nature would be advanced by humans coexisting with wild animals. To understand how hyenas are affecting the local communities around Akagera, we investigated hyena kill sites, dens, and trap sites. Hyenas are responsible for the largest number of human-wildlife conflicts around Akagera. We have not detected hyenas crossing the fence bordering Akagera, so the inside/outside populations are treated separately. We focused our efforts in communities adjacent to the southern part of the park, but did manage to gather data in the central and north communities. Despite the 95 hyena kill-sites, we did not discover any active hyena dens of the 7 identified dens. It is possible that we identified seasonal dens, which were inactive. We hope to promote carnivore coexistence with the local communities.

TIANLAI PATHFINDER

Calvin Osinga, Peter Timbie (Mentor)

The Tianlai Pathfinder is a radio interferometer that is designed to demonstrate the feasibility of the 3D mapping of the large-scale structure of the universe using the 21 cm line of hydrogen. The Tianlai Pathfinder consists of two arrays of cylinder telescopes and dish antennas located in a radio-quiet zone in China, to compare the two methods of observation. Using the arrays, we survey neutral hydrogen over large areas of sky, over two redshift ranges. The most significant challenge for the Pathfinder is foreground removal, as the foreground is much stronger than the weak cosmological signal. To overcome this challenge, we must have exact knowledge of the instrument and the foreground signals.

EXPRESSION, PURIFICATION, AND CRYSTALLIZATION OF CHITIN-BINDING PROTEIN D (CBPD)

Brita Ostermeier, Katrina Forest (Mentor)

Pseudomonas aeruginosa is a Gram-negative, pathogenic bacterium. The proteins secreted by *P. aeruginosa* can contribute to the virulence of the bacterium and are excreted by three mechanisms; Type I, II, and III secretion systems. The Type II secretion system is involved in the translocation of exoproteins across the inner membrane including the protein of interest, chitin-binding protein D (CbpD). I prepared both CbpD and CbpD without domain 4 (CbpD-delta-4), as the fourth domain is unique to CbpD. I found that the both CbpD and CbpD-delta-4 dimerize in solution within a week when expressed in *E. coli*. I will purify CbpD secreted from its native cell, *P. aeruginosa* and I will compare the oligomeric state that CbpD exhibits when expressed in *E. coli* and *P. aeruginosa*.

MEASURING ANXIETY IN A RAT MODEL OF EARLY-ONSET PARKINSON DISEASE

Natalie Pahapill, Cynthia Kelm-Nelson (Mentor)

Parkinson disease (PD) is a neurodegenerative disorder that affects nearly 10 million people worldwide. Anxiety is common in PD and often appears early in disease manifestation, prior to onset of hallmark limb motor signs. Using a genetic rat model of early-stage PD, Pink1 *-/-*, we studied anxiety utilizing two behavioral tests: Elevated Plus Maze and Light/Dark Box. We hypothesized that Pink1 *-/-* rats would demonstrate increased anxiety-like behaviors when compared to wild-type controls. These data will help validate the progression of anxiety in early-onset PD and provide further insight into the optimization of treatment, leading to earlier diagnosis and better disease outcomes.

PROTEIN DYNAMICS IN MICELLE VS. IN BILAYER: MOLECULAR DYNAMICS SIMULATION OF VOLTAGE-GATED POTASSIUM CHANNEL VOLTAGE-SENSOR DOMAIN

Stephen Pan, Junkun Pan, Baron Chanda (Mentor)

Voltage-gated potassium channels are responsible for electric signal conduction throughout human body. The malfunctioning of these channels could lead to devastating diseases like traumatic brain injury, pulmonary heart diseases, and hearing loss. Since most NMR experiments of potassium ion channel are being done in micelles, an environment that has many differences from lipid bilayer, we strive to understand how the environment would affect the dynamics of the protein. In this research, we systematically compared the behavior of potassium ion channel Kv1.2 voltage sensing domain in micelles with its behavior in lipid bilayer. Additionally, we compared the average dihedral angles calculated from the simulation with those from NMR experiments.

RNA BINDING PROTEIN BRUNO REGULATES INDIRECT FLIGHT MUSCLE FUNCTION IN DROSOPHILA

Andi Pan, Maria Spletter (Mentor)

mRNA precursors undergo splicing that removes introns and joins exons before they become mature mRNAs. Alternative splicing joins different exons from the same gene, resulting in different proteins, and is regulated by splicing factors such as Bruno. Just as mis-regulation of alternative splicing in human muscle leads to diseases such as myotonic dystrophy, mutation of Bruno in *Drosophila* results in flightlessness and loss of flight muscles. In my project I used confocal microscopy to study mechanical changes in Bruno mutant muscles. We found that deletion of an RNA recognition motif in Bruno increased twitching frequency and changed the twitching pattern, suggesting Bruno is essential for muscle function. As Bruno is evolutionarily conserved, my project may contribute to further understanding of human muscle development and diseases.

RADIOSENSITIZATION OF HRAS-MUTANT BLADDER CANCER

Aastha Pandey, Randall Kimple (Mentor)

We have identified an activating mutation in HRAS in the cell line T24 (HRASG12V). Initial studies, using colony formation and clonogenic assays, show that targeting the epidermal growth factor receptor (EGFR) through the use of cetuximab, is ineffective in this cell line. This mutation may render these cells resistant to therapy targeting upstream of this signaling node (i.e., EGFR). However, the inhibition of the downstream MEK/ERK and PI3K/MTOR pathways by selumetinib and BEZ-235, respectively, show promise as radiosensitizers for HRASG12V expressing bladder cancer.

CONTRASTING IMPLICIT AND EXPLICIT AFFORDANCES OF PHYSICAL AND VIRTUAL REPRESENTATIONS FOR LEARNING OF ABSTRACT CHEMICAL CONCEPTS

Radhika Patel, Martina Rau (Mentor)

Instructional materials require visual representations to demonstrate abstract concepts. They contain implicit and explicit affordances within movements required to complete tasks. The goal was to determine which movement and representation mode will aid students learn abstract chemistry concepts. Two groups of students with no prior chemical knowledge were recruited for the experiment and were randomly assigned to a physical/virtual mode group. Each condition was broken into two subgroups where the movements required to complete the tasks varied; each group/subgroup performed and was tested. The students were then asked to describe their knowledge. Through analyzing their movements during the experiment, answering questions and comparing those movements to the learning outcomes, we determine the movements that create an implicit understanding of the optimal abstract modes.

ORAL HISTORIES OF TRIBAL FOOD SOVEREIGNTY

Isabelle Paulsen, Becca Jo Dower (Mentor)

This research uses oral histories told by Oneida Nation activists as a form of data collection to document the experiences of cultural and environmental change in tribal food sovereignty movements. Food Sovereignty is the right for communities to define their own food systems with culturally appropriate and location specific methods that aim to dismantle structural oppression and to build collective agency within the tribal foodshed. We will analyze primary and secondary sources surrounding changes in tribal foodways along with these first-hand accounts to reveal the tensions and successes of contemporary food sovereignty initiatives in practice. The intent of this research is to establish indigenous methodologies in academic research of foodways and elevate the work that is ongoing within these communities.

MATH EDUCATION LEARNING AND DEVELOPMENT LAB

Italo Paz-Cuervo, Percival Matthews (Mentor)

Is understanding a number line related to a child's mathematical ability? Past research has proven that performance on number line estimation tasks is the indicator of an individual's numerical magnitude representation. In order for someone to be proficient in number line estimation they must accurately translate between symbolic and non-symbolic magnitudes. A variety of people believe that kids have curved performance on number line estimation due to their logarithmic representation of number magnitudes. We conduct an experiment where we take measures of children's numerical knowledge to evaluate the log-to-linear claims. Analyzing the children's data will help us understand the mechanism underlying developmental change.

THE IMPORTANCE OF POLYAMINES FOR SALMONELLA ENTERICA SURVIVAL ON ALFALFA SPROUT ROOTS

June Pen, Jeri Barak (Mentor)

Salmonella enterica is a bacterial pathogen commonly associated with food-borne illnesses. It is important to investigate the mechanisms this pathogen utilizes to colonize on plants in order to advance our understanding of plant-microbe interactions and reduce illnesses derived from consumption of contaminated food products. Plants can detect and react to *S. enterica* and produce reactive oxygen species (ROS) and nitric oxide (NO) as a defensive response. Past research has indicated the possibility that *S. enterica* uses polyamines to protect itself from these plant-derived defenses, allowing it to colonize the roots of sprouting seeds. To further investigate this, I constructed bacterial mutants which lack the ability to utilize spermidine at the *S. enterica* wildtype level and perform competition assays to determine if colonization defects are apparent.

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 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. Thermogenesis is enabled by uncoupling protein 1 (UCP-1) (expressed in BAT), which generates heat by metabolizing free fatty acids (FFAs). When thermogenesis declines, FFAs remain stored in white adipose tissue (WAT), contributing to obesity. In mouse models, estrogen receptor alpha (ER α) enables the expression of thermogenesis-enhancing genes such as UCP-1. To test whether the same is true in a female primate model, and thus likely humans, we silenced ER α expression in hypothalamic metabolism-regulating neurons of prepubertal female rhesus macaques, and investigated the consequences.

TEACHING STYLES

Nicholas Perron, John McGinty (Mentor)

Teaching styles differ from classroom to classroom, and even educator to educator. In the current education system the most popular style is “lecture style” where the instructor gives long one way lecture presentations while students take notes and learn. In this study we will be examining four different teaching styles with changing degrees of symbol, icon, and object representation. My research question is: What teaching method generates the highest post teaching exam results? I am expecting symbol-exclusive to be the most cognitively difficult for participants to learn from. I expect students to score higher on post learning evaluations following learning sessions following condition 1 (Object-icon-symbol) because it is the most effective form of teaching.

STEAROYL-COA DESATURASE 1 DEFICIENCY PROMOTES NONALCOHOLIC STEATOHEPATITIS (NASH) INDEPENDENT OF HEPATIC STEATOSIS

Yar Xin Phang, Sarah Lewis (Mentor)

Non-alcoholic fatty liver disease (NAFLD) is a risk factor for chronic liver diseases and affects a large population in the United States. Western diets, high in carbohydrates cause fatty liver (hepatic steatosis). Hepatic steatosis can progress to more serious stages of NAFLD such as non-alcoholic steatohepatitis (NASH), cirrhosis and liver cancer. To identify the role of Stearoyl-CoA desaturase 1 (SCD1) in NAFLD, mice with a liver-specific knockout of SCD1 (LKO) were generated by Cre-lox technology. On high-sucrose-very-low-fat (HSVLF) diet, LKO mice show no sign of hepatic steatosis but increase in liver inflammation and fibrosis markers, signatures of NASH, compared to *Scd1* flox/flox (LOX) controls that show signs of steatosis. This suggests that NASH can occur independent of steatosis in LKO mice.

HOW CHILDREN LEARN TO PLACE FRACTIONS ON THE MENTAL NUMBER LINE

Erin Plummer, Edward Hubbard (Mentor)

In Western societies, we represent numbers on a left-to-right oriented mental number line (MNL). One way to measure the internal MNL is through the use of the spatial-numerical association of response codes (SNARC) effect: responses to smaller numbers are faster on the left side of space and larger numbers on the right. Although the MNL is well studied for whole numbers, little is known about how children learn to place fractions on the MNL. We measured the SNARC effect in 42 3rd- and 46 6th-grade students. The SNARC effect was significant in 3rd graders, but not 6th graders. We are currently expanding this to explore the relationship between how children place fractions on the MNL and how accurately they compare fractions (e.g., $\frac{1}{2}$ vs. $\frac{7}{9}$).

PANCREATIC ISLET MORPHOLOGY IN PRENATALLY ANDROGENIZED PCOS-LIKE RHESUS MACAQUES IN RELATION TO TYPE 2 DIABETES

Emily Poellinger, Emily Poellinger, Aiden Jacobs, David Abbott (Mentor)

Polycystic ovary syndrome (PCOS) often coincides with obesity, insulin resistance, and type 2 diabetes (T2D). Although the etiology of PCOS is largely unknown, exposure of female rhesus macaque monkeys to prenatal androgen (PA) excess during early-to-mid gestation produces a comprehensive nonhuman primate model for PCOS. We wanted to assess if women with PCOS store fat ectopically in pancreatic islets of Langerhans, impairing insulin release and predisposing to T2D. To test this, we characterized the islet morphology of PA infant and adult rhesus macaques. We found that PA female infant and adult monkeys have an altered pancreatic islet morphology which suggests that in utero exposure to androgens alters the development of mature pancreatic islet cells which may precede the development of PCOS and T2D.

DEVELOPMENT OF POWERED DYNAMIC WALKING ROBOTS TO STUDY EFFECTS OF HIP-ANKLE GAIT ACTUATION AND TORSO ANGLES ON ENERGY CONSUMPTION

Thana Pongcharoenyong, Peter Adamczyk (Mentor)

Powered dynamic walking models have been used to study human walking. Still, the relationship between energy consumption in walking and gait powering methods has not been investigated in a physical prototype. This project aims to develop a powered dynamic walking robot to study the effects of different gait actuations: hip, ankle, and combined-hip-ankle actuations, and of torso angles on energy consumption in level walking. The project consists of three phases addressing ankle, torso, and hip control challenges. The first two phases have been accomplished. First, Rando, the past walking model, was duplicated and demonstrates walking motion from pure-ankle actuation. Second, a rimless-wheel robot with a torso was developed and proves an ability to control moving speed by regulating the torso angle.

MOTHER INFANT INTERACTIONS IN PRIMATES EXPOSED TO ZIKA

Aubre Poole, Kathryn Bach, Karla Ausderau (Mentor)

In 2015, Zika virus (ZIKV) surfaced in America, putting many child-bearing women and their unborn fetuses at risk in certain parts of the world. The current research investigates the impact of prenatal exposure of ZIKV on the neurodevelopment of their infants and interaction with their caregiver. Researchers captured weekly 30-min video observations in the animals' home cage at the same time of day of both mother-infant dyads exposed to ZIKV and control dyads. Videos were then coded using Observer XT for parent, infant, and dyad variables. Coders were blind to ZIKV versus control condition. Researchers hypothesize a difference in the both the individual behavior and interactions between mother and infants exposed to ZIKV compared to control dyads.

USING NONSYMBOLIC RATIOS TO PROMOTE FRACTIONS KNOWLEDGE

Nya Pottinger, Percival Matthews (Mentor)

Can nonsymbolic ratios be used to help adolescents acquire fraction knowledge? Previous research has shown that most individuals have a hard time understanding how fractions represent magnitudes. Recent research using tasks that involve comparing nonsymbolic ratios, such as the relative size of two circles or lines, has shown that there is a positive correlation between sensitivity to nonsymbolic ratios and an improved performance in accuracy with tasks involving symbolic ratios. In the MELD lab, we are investigating if nonsymbolic ratios may be an effective tool for teaching symbolic fraction knowledge and help provide a foundation for algebraic concepts.

EVALUATING USE OF PATIENT - COLLECTED AUDIO RECORDED ENCOUNTERS FOR PROVIDER AUDIT FEEDBACK TO REDUCE CONTEXTUAL ERRORS

Nikki Prado, Nasia Safdar (Mentor)

Contextualizing care is the process of adapting care plans to patients' individual needs and circumstances; this project focuses on the uniqueness of contextualizing veteran care. Increasing the dosage of a veteran's insulin rather than addressing obstacles the patient may have, is termed a "contextual error" because it is an inappropriate plan of care that can lead to clinical deterioration and greater health care cost. This project utilizes a framework to assess the reach, effectiveness, adoption, implementation, and maintenance of the intervention (RE-AIM). This project assesses and expands a pilot program in which patients volunteer to audio record their appointments for the purpose of collecting information to improve their care teams' attention to their individual needs and circumstances or context.

E. COLI RNAP TRANSCRIPTION INITIATION KINETICS AND PROMOTER ESCAPE

Jack Prazich, Kate Henderson (Mentor)

In order to study the transition from transcription initiation to elongation, otherwise known as promoter escape, we studied the kinetics of *E. Coli* RNA polymerase (RNAP; $\alpha 2\beta\beta' \omega \sigma 70$) by measuring the abortive and productive initiation rates and short RNA product distributions. We observed three nascent RNA elongation steps that were kinetically slower independent of the nucleotide incorporation for the Δ PR promoter. We propose that the three slower kinetic steps are due to the stepwise breaking of the discriminator, -10, and -35 promoter interactions. Further kinetic investigations into other promoter variants including LPR(T7A1) and T7A1 are ongoing.

THE LEVEL OF FAMILY ENGAGEMENT IN NURSING HOME CARE CONFERENCES

Emilie Price, Tonya Roberts (Mentor)

Family engagement in healthcare improves quality, safety and patient satisfaction. Care conferences are the only structured family engagement opportunity in nursing homes. However, it is unknown how often and what families contribute to care conferences and how this affects patient care. The purpose of this study is to understand family engagement in care conferences. A descriptive observational study will be conducted in a local nursing home. We will recruit a convenience sample of families from 15 care conferences. Care conference conversations will be audio recorded and field notes taken. Frequency, sequencing, context and impact of conversations on the care plan will be evaluated using event-sequencing methods. Results of this study will be used to identify targets for future interventions to improve family engagement.

TESTING THE REQUIREMENTS FOR ANAEROBIC GROWTH IN YEASTS

Ritika Punathil, David Krause (Mentor)

Studying anaerobic growth in yeasts have implications for both industry and our understanding of yeast ecology. Studying anaerobic growth provides insight into the conditions that shaped metabolic gene evolution. The yeast *Kluyveromyces lactis* is a valuable non-traditional model system for biofuel production, but its inability to grow anaerobically is an obstacle. We tested the anaerobic growth capabilities of species related to the classic anaerobic model yeast *Saccharomyces cerevisiae* and *K. lactis*. Anaerobic growth in *S. cerevisiae* requires several adaptations; however, we found that variation in sterol uptake genes likely contributed the most to variation in anaerobic growth among our tested species. We are currently genetically engineering *K. lactis* with the *S. cerevisiae* sterol uptake machinery and testing the resulting strains for anaerobic growth.

CHARACTERIZATION OF ALLOY 600 AFTER CORROSION IN MOLTEN CHLORIDE SALT

Jake Quincey, Adrien Couet (Mentor)

Molten salt reactors, one of the promising Generation IV nuclear reactors designs, take advantage of liquid salts as either a coolant, fuel carrier, or both to operate a safe, more efficient, perhaps cheaper nuclear power plant. Terrapower is a promising startup in the reactor development world. Their design uses a molten chloride salt. Terrapower has provided UW–Madison with samples from a flowing microloop to test the corrosion resistance of Alloy 600. UW–Madison performed general characterization of the samples from different areas of the loop in order to quantify the effectiveness of Alloy 600 for use in the reactor. Effectiveness is judged through metrics such as salt attack depth in the hot leg, change in mechanical properties post-corrosion, and weight gain in the cold leg.

QUANTIFYING EXPRESSION OF NEURODEVELOPMENTAL GENES IN DOWN SYNDROME USING HUMAN IPSCS

Drew Quiriconi, Anita Bhattacharyya (Mentor)

Trisomy-21, also known as Down Syndrome, is the most common genetic cause of intellectual disability. One well documented atypical feature of DS cortical tissue is an abundance of astrocytes, a support cell, relative to neural cells, although the mechanism underlying this disparity is unknown. Brain development within the initial months of pregnancy begins with a wave of neurogenesis followed by subsequent gliogenesis. It is plausible that the atypically high astrocytes:neurons ratio characteristic DS is caused by a premature end of neurogenesis and beginning of gliogenesis. We assayed the expression of several important neural and astrocytic development genes at early stages of growth of trisomy-21 human iPSCs differentiated to neural progenitors in order to determine if levels of expression varied from DS samples and controls.

COMBINATION OF CCR4 ANTAGONIST AND RADIATION INDUCES TUMOR GROWTH IN NEUROBLASTOMA MOUSE MODEL

Mackenzie Rabas, Mario Otto, Ankita Shahi (Mentor)

CCR4 is a chemokine receptor that binds with ligands CCL17 and CCL22 which are secreted by activated mature dendritic cells. CCR4 is found in various cancer cell types and attracts T-regulatory cells to the tumor. CCR4 antagonists may inhibit tumor growth resulting in infiltration of cytotoxic T-cells to the tumor microenvironment, which makes them an interesting development in cancer treatment to increase therapeutic effectiveness. In our study, AJ/B6 mice were inoculated with NXS2 neuroblastoma cells and were treated with excipient, CCR4 antagonist, 90Y or a combination of both. Mice were monitored via tumor growth measurements and CBC results to study the overall toxicity of our treatment strategy. Our study shows induced tumor growth from the pre-clinical CCR4 antagonist and 90Y in a mouse model.

VERSICAN PRODUCTION IS DRIVEN BY BOTH EPITHELIAL AND STROMAL CELLS IN PANCREATIC CANCER

Hanna Rainiero, Dustin Deming (Mentor)

Pancreatic ductal adenocarcinoma (PDAC) is a leading cause of cancer-related death with a survival rate of 8% that has had little improvement despite evolving therapies. One of the hallmarks of PDAC is an abundant stromal compartment, consisting of fibroblasts and other supportive or immune cells, which has a drastic effect on tumor biology by increasing metastasis, immune cell exclusion, and resistance to effective therapies such as immunotherapy. Versican (VCAN) is an immunoregulatory matrikine that envelopes sites of PDAC preventing CD8+ T cell infiltration into tumors. We investigated the role of two major stromal cell types, pancreatic stellate cells (PSCs) and macrophages, in the production of the immunosuppressive proteoglycan versican (VCAN) as a precursor to the identification of novel mechanisms that may enhance therapeutic response.

VOICES OF HIP-HOP IN MADISON

Toni Ray, Elisa Guerrero, Maire Cait Mullen, Randy Stoecker (Mentor)

As a continuation of a project with local non-profit Urban Community Arts Network, undergraduate students in the Community and Environmental Sociology Department conducted interviews and focus groups with members of the Madison Hip-Hop community about their experiences in the scene. We interviewed 30 individuals and held three focus groups, and then we analyzed the data to determine how Hip-Hop community members feel Hip-Hop is perceived by the larger Madison community, what barriers they face, and what they hope Madison Hip-Hop will look like in the future. Our results indicate that negative stereotypes about Hip-Hop music and shows, coupled with lack of access to venues, are perceived to hinder the progress of Hip-Hop in Madison and that overcoming those barriers is necessary for the scene to grow.

MOSQUITO SPECIES IDENTIFICATION USING GOOGLNET

Tayfield Reed, Duncan Carlsmith (Mentor)

Multiple species of mosquitoes were distinguished using the MATLAB convolutional neural net GoogLeNet. This allowed for the identification of the species of a mosquito given a picture of it taken with a phone through a microscope.

EVALUATION OF RAT ULTRASONIC VOCALIZATION ACOUSTICS AFTER METHYLPHENIDATE ADMINISTRATION

Amy Regenbaum, Cynthia Kelm-Nelson (Mentor)

Parkinson disease (PD) is a progressive neurodegenerative disease that is linked to dopamine loss. Vocal communication deficits appear in 90% of individuals with PD and currently there are few effective treatments for these deficits. Methylphenidate is a stimulant that acts by redistributing catecholamines and has been shown to modify the number and acoustic features of ultrasonic vocalizations (USVs) in rats. The primary goal of this study is to evaluate the effects of varying doses of methylphenidate on rat USVs. Additionally, we hypothesize that methylphenidate will mitigate the vocalization deficits present in a genetic rat model of PD. Identification of potential treatments for vocal deficits is critical in enhancing the quality of life in patients with PD.

IMPROVING CLINICAL TRAINING AND DATA ANALYSIS THROUGH ADAPTIVE ARTIFICIAL INTELLIGENCE

Peter Rehani, Peter Rehani, Quan CHEN, Joshua Medow (Mentor)

Computerized signal analysis and interpretation have long been lauded as the next generation of medical equipment technology. However, none have looked to understand key points where machines are able to detect features that humans cannot and improve the process. Here, we attempt to develop a method to understand key problem areas within medical signals and scans that lead to misdiagnoses for training clinicians. Initial attempts are being designed with de-identified Electrocardiogram (ECG) signals: the base structure employs an 'ideal' student through a hybrid convolutional neural network (CNN). This CNN dynamically selects the highest accuracy artificial learning technique to provide the best response both for classification of the signal in question and for the student's input data, and attempts to correlate key signal features to responses.

AN ENTANGLEMENT MODEL FOR CASCADED STRINGS

Wangping Ren, Jean-luc Thiffeault (Mentor)

The purpose of this project is to investigate the mechanical properties of a net of entangled strings using applied mathematical analysis. This includes the exploration of the 'spring constant' arising from Hooke's law that is associated with each entanglement model. Starting from the basic two-string entanglement, the physical structure involves two frictionless strings entangled together that forms a single knot anchored at fixed points. Under perturbations of the first order at the anchor points, the position of the knot position can be determined under both pre-stressed and loose conditions. Compared with the case of crossed strings which are not entangled, the entanglement model shows significant differences. We then extend our interests to a net of cascaded strings that are built upon the two-string entanglement model.

EFFECTS OF BILINGUALISM ON EPISODIC MEMORY IN FEMALES AND MALES

Autumn Reppe, Margarita Kaushanskaya (Mentor)

Purpose: There is evidence suggesting that the ability to speak two languages positively affects episodic memory. However, it is unclear whether the effect of bilingualism interacts with the effects of gender on episodic recall. The goal of this research is to examine whether bilingualism positively affects episodic memory and whether this effect is similar across genders. Participants: English monolingual and English-Spanish bilingual adults performed episodic memory tasks. Episodic memory was tested using a cued recall technique with images and participants were asked to describe life events associated with the image. Responses were transcribed and coded for Idea Density. Predictions: It is predicted that bilingual individuals will produce denser episodic memories than monolinguals. Within the two language cohorts, it is predicted that females will outperform males.

ASSESSMENT OF TEACHING AND LEARNING IN THE OPERATING ROOM

Narik Riak, Sarah Sullivan (Mentor)

Responding to a recent web-based survey, members and leaders of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) indicated that one of their most important research questions was how to best train, to assess, and maintain proficiency of surgeons and surgical trainees in flexible endoscopy, laparoscopy, and open surgery. While previous studies have identified and categorized teaching techniques and gestures used during intraoperative teaching of surgical cases to residents, research has not yet explored the potential effectiveness of these techniques. We propose to meet this need by video-recording and analyzing the experiences of general surgery residents as they progress through their minimally invasive surgery rotations. We will focus on cases involving laparoscopic inguinal hernia repair and use collected data to develop an instructor guidebook.

USING THEIR WAYS OF THRIVING TO PROMOTE HEALTH: WHAT WE LEARNED FROM VULNERABLE LOW-INCOME ADULTS LIVING WITH MULTIPLE DISABILITIES

Carley Richards, Linda Oakley (Mentor)

We developed a survey that asked diverse low-income residents of a large housing community, primarily adults with disabilities, to describe their health and thriving. The survey's purpose was to evaluate "Mind-Body-Spirit" health promotion services offered on site by nurses and chaplains. Specifically, we wanted to better understand the impact of childhood trauma on health and coping in vulnerable adults. Volunteers (N=20) responded to an online survey after using the ACE to self-rate and score their childhood trauma. The mean ACE score = 3.95, 45% rated their health as fair, and 55% said their childhood trauma impacted their current health. All described themselves as thriving; ranging from meeting basic needs, being helpful to others, and being content. We concluded that despite health costs, thriving happens.

CONSIDERATION OF TIME, TEMPERATURE, AND HOST PLANT IN THE REARING OF RED-HEADED FLEA BEETLES

Stephanie Rink, Benjamin Jaffe (Mentor)

The red-headed flea beetle is a common pest of cranberry plants across central Wisconsin. Perfecting the parameters to rear a colony of flea beetles is integral in developing pest management strategies for both adult and larval forms. By understanding the full life cycle of the insect and having a colony for extended studies, one could deduce the most vulnerable points of development and utilize them in pest prevention. In this ongoing research, the variables of incubation time, incubation temperature, and host plant preference are being studied. Current information suggests that 15 weeks of incubation at 5°C in a broccoli, alfalfa, or corn medium will be most successful, but as research continues, these parameters will be made more specific.

USING HUMAN NEURAL PROGENITOR CELL MODELS TO CONDUCT LARGE-SCALE DRUG SCREENS FOR FRAGILE X SYNDROME

Ryan Risgaard, Xinyu Zhao (Mentor)

Fragile X syndrome (FXS) is the most common inherited cause of intellectual disability and a major genetic cause of autism. FXS is caused by mutational trinucleotide expansion in the FMR1 gene leading to hypermethylation and gene silencing. One potential therapeutic strategy is to reactivate the silenced FMR1 gene, which has been attempted using candidate chemicals. However, molecules that reactivate the silenced FMR gene have not been identified. This project demonstrates the creation of a robust FMR1-Nluc reporter hiPSC line using CRISPR/Cas9 genome editing method. The FMR1-Nluc reporter line is a good resource for drug screening as well as for testing potential genetic reactivation strategies. Here we present the screening of over 320,000 novel compounds from NIH's MLPCN compound library along with identification of potential gene reactivators, paving the way for potential therapeutic discovery

SAY YA TO DA NORT, EH? DIALECT PERCEPTION IN TWO BORDER TOWNS

Rebecca Risner, Joseph Salmons (Mentor)

People may speak the same, but it does not mean their speech is perceived the same. There are asymmetries in what people think they hear and what they actually hear. Marinette, Wisconsin, and Menominee, Michigan, separated by a state border and a river, present such an asymmetry in dialect perception, Wisconsin versus the Upper Peninsula. In discussing Yooper talk, locals negotiate identity in relation to language and location. People use borders, real and imagined, to gauge who can claim Yooper identity and who cannot, all through speech. By analyzing surveys, interviews, and a map-drawing exercise, I show how locals portray the division and how a geographical marker can influence dialect perception in two separate but integrated cities.

A QUALITATIVE ANALYSIS: IMPACT OF OPIOID PAIN MEDICATIONS ON THE LIVES OF PATIENTS WITH OPIOID-TREATED CHRONIC LOW BACK PAIN.

Sam Rivera, Aleksandra Zgierska (Mentor)

High prevalence of opioid-related harms, including overdoses and limited evidence on opioid efficacy in chronic pain have contributed to stigmatization of and push toward opioid therapy discontinuation in patients with chronic pain. The aim of the present study was to assess patient perceptions about opioid therapy's impact. Forty-five adults with opioid-treated chronic low back pain, a subsample from a larger ongoing clinical trial (N=766), were interviewed about it; their responses were transcribed, then analyzed using qualitative-analysis methods. Participant responses formed several major themes, the top-two indicated that although opioids helped reduce pain (N=12), participants were also fearful of opioid-related harms, particularly addiction (N=8). These findings suggest that long-term opioids can be useful for chronic pain management, yet fear of harms is present among opioid-treated adults.

INVESTIGATING PROSPECTS

Jessica Robling, Li Chiao-Ping (Mentor)

This piece was an experimental collaboration of modern and ballet. I was interested to see how I could take my qualities of movement and apply them to a dancer whose movements contrast with mine. Working with ballet-trained Alice Svetic, I saw more dynamic accents added to my piece. I created a solo from my background in Chinese traditional dance and modern dance that showcased, Alice, the performer. The second step to this experimental process is to keep the dance and the intentions behind it but change the dancer. I am interested in how my interpretation of the piece and of my stylistic approach as a dancer will affect the way I execute this solo.

LEARNING BY OBJECTS, ICONS, AND SYMBOLS.

Jacob Rock, John McGinty (Mentor)

This study looks at Euler's theorem, looking at how people learn best with different methods. People want to know the best way to teach mathematical basics and concepts, by utilizing different methods. Subjects will work with a combination of symbols, objects, and icons. The purpose of this study is to discover how different instructional materials influence learning for participants at the University of Wisconsin. At this stage in the study, instruction is defined as combining symbols, icons, and objects differently in four specific conditions. As my research question, I ask, do people learn best when using physical tangible objects, compared to symbols? I hypothesize that people will learn best with objects and symbols, via sensory input and translating learned concepts, opposed to with just symbols.

TRAJECTORY ANALYSIS USING EPISTEMIC NETWORK ANALYSIS

Melanie Rogers, Melanie Rogers, Elizabeth Rybacki, Brendan Eagan (Mentor)

Researchers with qualitative data often use Epistemic Network Analysis (ENA) to quantify and analyze connections between elements in the data. This tool visualizes results by creating weighted network models which display the structure and pattern of connections within a dataset. Yet, researchers are often interested in exploring the process of development throughout a study. ENA trajectories offer a new representation of data which allows researchers to analyze finer grain changes over time that can guide their feedback and pedagogical decisions. As highlighted by themes in Shakespeare's Hamlet and Romeo and Juliet, this presentation will discuss and compare the methodology of creating and interpreting both ENA summative plots and ENA trajectory plots.

CONVEYING YOUR MESSAGE; A QUALITATIVE ANALYSIS OF THE EARNED MEDIA COVERAGE OBTAINED BY THE WISCONSIN OBESITY MAP

Charles Rojas, Martín Brubaker (Mentor)

Dissemination is an important part of the research process, but often little effort is made to analyze dissemination efforts. The Obesity Prevention Initiative (OPI) evaluation team aims to improve communications using mixed methods. We used Dedoose software to qualitatively analyze coverage of a newly released ZIP Code level obesity map. Of 54 news stories, 95% of earned media contained a key message, or findings that we hoped to convey. Of all messages placed, 86% were key messages and 14% were messages we did not want media to pick up. The most frequent messages placed were about rural-urban obesity disparities and how where you live impacts obesity. Going forward we hope to use our evaluation to ensure more accurate dissemination of research.

EFFECTS OF HURRICANE MARIA ON SOIL CARBON AND PH

Alexander Roman, Elliot Vaughan (Mentor)

With their combination of strong winds and heavy rainfall, hurricanes have the ability to affect ecosystem and soil properties. For example, flooding, mudslides, loss of soil minerals, and changes to plant and animal communities can change soil carbon levels and pH. For this study, Oxisol soils were collected in Cayey, Puerto Rico, a month before Hurricane Maria and several collections were taken during the months after it. I will be presenting data on soil pH and soil carbon from Puerto Rico soils before and after Hurricane Maria. Climate change is projected to increase hurricane frequency in the near future, making it important for us to understand how these storms may affect soil.

EFFECTS OF DYSREGULATED CORTISOL ON PREDICTING PULSATILITY FOR CEREBROVASCULAR HEALTH

Alexander Romantz, Megan Zuelsdorff (Mentor)

Chronic stress exposure is implicated in morbidity, including Alzheimer's disease and related dementia (ADRD), but pathways linking stressors to brain health is unclear. We are exploring associations between stress-provoked cortisol dysregulation and novel cerebrovascular markers. Participants are from two UW cognitive aging studies. Key predictors include cortisol awakening response and bedtime cortisol. Cerebrovascular outcomes include pulsatility and mean blood flow, determined from brain MRI data. Dysregulated cortisol should predict greater pulsatility and lower mean blood flow. In preliminary bivariate models, older age was associated with lower flow. Ultimately, linear regression models will explore predictor-outcome relationships while controlling for age and other covariates. These findings should improve our understanding of the influence of stress on cognition and preclinical ADRD in aging populations.

THE BARLEY RESPIRATORY BURST OXIDASE HOMOLOGUE (HVRBOHF1) GENE AND ITS ROLE IN THE GERMINATION AND MALTING OF BARLEY

Jenna Rosinski, Ramamurthy Mahalingam (Mentor)

Reactive oxygen species are involved in many cellular processes including cell signaling. The expression of the HvrBOHF1 gene, is induced strongly one day after growth during the malting of barley. Four other members of this family are also induced to different levels during early stages of malting. We are testing the expression of these genes during normal germination conditions. This study will enable us to determine which of the HvrBOH genes are unique to the malting process or germination.

TARGETING ACTION OF THE HERBICIDE 2,4-D ON FATHEAD MINNOW CORTISOL LEVELS DURING A STRESS RESPONSE

Evan Routhier, William Karasov (Mentor)

We tested whether ecologically relevant doses of the herbicide 2,4-Dichlorophenoxyacetic acid (2,4-D) formulation DMA®4IVM negatively impacts the corticosteroid stress axis of larval fathead minnows and if these effects are age dependent. Our preliminary study found that fish exposed to 0.05 ppm 2,4-D, when compared to controls, had lower cortisol concentrations 30 minutes after an acute handling stressor. We then exposed fathead minnows to 0.00 or 0.05 ppm 2,4-D from (i) fertilization to 21 dph, (ii) 35dph to 56dph, or (iii) 54dph to 56dph and measured the "stress response" the same way. Preliminary analysis indicated no depression in stress response in larvae in group (i) that were tested at 56 dph. However, groups (ii) and (iii) showed a depressed stress response when tested at 56 dph.

ABORIGINAL WOMEN AND SHELLWORK PRODUCTION IN NEW SOUTH WALES, AUSTRALIA

Madeline Rowe, Jonathan Kenoyer (Mentor)

Aboriginal Australians have been a marginalized group since European colonization. In anthropological research, women are marginalized by traditional Western gender roles imposed upon them, as well as poor representation due to androcentrism. In my research, I analyzed the role that modern Aboriginal Australians play in their communities and the larger society through their work experience and jobs. Then, I focus my research upon Aboriginal women in New South Wales to analyze the intersectionality of their experiences as indentured servants and craftspeople, creating and selling handmade shellwork in the greater Sydney area. Finally, I compare the timelines of Aboriginal indentured servitude with the creation and expansion of shellwork and conclude that shellwork was developed from Victorian era crafts during Aboriginal women's servitude to European households.

WIRE FED T91 CHARACTERIZATION

Grant Rupkalvis, Adrien Couet (Mentor)

The goal of this project is to characterize the test specimen, a wire fed additively manufactured grade 9 steel, to understand and evaluate its grain structure and deformities. Along with that, to look into its microhardness as well as the effect of direct heat treatment to see possibilities for improving the materials characteristics. Comparing these qualities along the layers will also occur to determine how they change as the specimen was manufactured. Some experimental and characterization methods to be used are optical microscope, scanning electron microscope (SEM), microhardness tester, and heat treatment testing. After using these techniques, we will understand its structure and properties more thoroughly, and see how different heat treatments can enhance the materials properties for additive manufacturing applications.

RUXOLITINIB ON MSC IMMUNOBIOLOGY

Molly Ryan, Jacques Galipeau (Mentor)

Inflammation is a major problem in human disease. The FDA approved drug, Ruxolitinib, has historically been used for treatment of myeloproliferative disorders (of the blood and bone marrow). However, Ruxo also has an enormous impact on immune cells and has been most recently developed to treat immune disorders like GVHD. Its mechanism of action is still under investigation. We hypothesize that Ruxo acts not only on immune cells, but also on the body's local stem cells, like mesenchymal stromal cells (MSCs). MSCs are critical tools in regenerative medicine with roles in housekeeping, inflammation modulation, and tissue repair. Interrogating the relationship between Ruxo and our body's stromal populations has translational relevance and could elevate our understanding of the mechanisms behind effective cell therapies.

HEART RATE VARIABILITY IN ADULTS WITH FAMILY HISTORY OF ALZHEIMER'S DISEASE

Mark J Saari, Jill Barnes (Mentor)

The sympathetic and parasympathetic branches of the autonomic nervous system innervate the heart, affecting heart rate and contractility. Heart rate variability (HRV) serves as a noninvasive procedure to monitor the balance of sympathetic and autonomic tone. Impaired HRV is a cardiovascular risk factor and may be associated with the progression of cognitive decline or Alzheimer's disease (AD) by affecting brain blood flow. The purpose of this study was to determine the impact of family history of AD on HRV in adults ages 55–65 years. Autonomic function was assessed through HRV analysis of beat-to-beat heart rate obtained using a 3-lead electrocardiogram. We hypothesized that people with a familial history of AD would exhibit decreased HRV at rest and in response to physiological stressors.

ELLIPTICAL BODY MAPPINGS FOR GARMENT DESIGN

Michael Sachen, Marianne Fairbanks (Mentor)

Most clothing design, both experimental and consumer oriented works within a rectilinear matrix of the human body. Mapping the body along elliptical planes, on the other hand offers a wealth of new design possibilities. While elliptical considerations of the body have existed in clothing design since the 1930s, the theory behind it has been relatively unexplored, especially in consumer clothing. An elliptical map of the body allows for practical clothing applications, such as improved ergonomics, more accurate tailoring and more efficient use of fabric for pattern making. Considering the body within this system also creates manifold artistic possibility for exploration of novel form, volume and line within clothing design.

COULD CHOLECYSTOKININ TREATMENT IN BETA CELL COUNTER THE HYPOXIC APOPTOSIS?

Steve Sacotte, HyungTae Kim (Mentor)

Hypoxia results from a deficiency of oxygen. Clinically, pancreatic islet transplantation is a curative therapy for diabetic patients. However, removal of islets from endogenous vasculature decreases its endocrine function and viability. Islet dysfunction following transplant therapy mostly comes from hypoxic stress as the organ is removed from its endogenous microenvironment. Low intracellular oxygen levels result in the activation of pro-apoptotic signaling pathways via hypoxia induced factor (HIF) which increases the inducible nitric oxide synthase (iNOS) expression, resulting in DNA damage. Cholecystokinin (CCK) is a peptide hormone that can mitigate the effect of apoptotic stress caused by proinflammatory cytokines that are known to increase NO in beta cells. We have tested if hypoxia induced apoptotic progression of beta-cells can be mitigated via exogenous CCK peptide.

THE ROLE OF NEUROTRANSMITTERS FOLLOWING A TRAUMATIC BRAIN INJURY IN DROSOPHILA

Amanda Scharenbrock, David Wassarman (Mentor)

Traumatic brain injury (TBI) is the leading cause of mental health problems throughout the world; yet, there is no current treatment for TBI. To address this problem, the Wassarman lab created a *Drosophila melanogaster* TBI model. As found in numerous studies, the adrenergic nervous system contributes to outcomes of TBI. Neurotransmitters in the fly adrenergic system, which are similar mammalian epinephrine, have receptors expressed throughout the fly, including the intestine. An outcome of TBI is intestinal permeability which is highly correlated with mortality. To determine the role of the adrenergic system in promoting these TBI outcomes, I have used beta-blockers that antagonize adrenergic receptors. I found that these beta-blockers significantly reduced intestinal permeability and mortality when fed to flies following TBI.

PLEASING

Megan Schimke, Liz Sexe (Mentor)

Artist Statement: To be accepted can be one of the greatest fears for humans. But is being accepted worth the sacrifice of one's identity? We all feel the need to be loved, and sometimes we become consumed in the task of satisfying that need. We might lose, search, and find ourselves in the process of understanding what will really make us happy in the grand scheme of things. My work focuses on manifesting these emotions in movement, exploring the concepts of self-love, self-less love, and affectionate love. Rather than using words, the body tells the journey of struggling to recognize the importance of self.

GIRLS VS. BOYS WITH AUTISM SPECTRUM DISORDER (ASD): DIFFERENCES IN SYMPTOM PRESENTATION

Theresa Schinkowitch, Sigan Hartley (Mentor)

There is limited research examining differences in symptom profiles of girls and boys with Autism Spectrum Disorder (ASD). The overall objective of this study is to examine sex-based differences in a matched sample of boys and girls with ASD (N=27) participating in a larger study of families and children with ASD (N=188, ages 5 to 12). Participants in this sample were matched on child characteristics (age, IQ and adaptive functioning). Parent self-report measures of ASD symptom severity, child behavior problems, and social skills were collected and analyzed to determine differences in the severity of ASD symptoms, social-emotional difficulties, and child behavior problems. Females showed higher levels of internalizing symptoms (depression/anxiety) whereas males showed higher levels of externalizing symptoms (aggression/inattention). Implications for practice will be discussed.

PHARMACOLOGICAL MANIPULATION OF PROSTAGLANDIN SIGNALING IMPAIRS NF1-DEPENDENT HABITUATION LEARNING

Natalie Schmidt, Marc Wolman (Mentor)

Mutations in the gene neurofibromin 1 (NF1) cause Neurofibromatosis Type 1 (NF1), a neurodevelopmental disorder in which children exhibit attention-based learning impairment. The molecular and cellular mechanisms by which NF1 regulates attention-based learning remain unclear. To identify therapeutic targets to combat cognitive disability in NF1 patients, we must define the molecular pathways that regulate NF1-dependent learning. Using a larval zebrafish model of *nf1*, we tested the hypothesis that increasing prostaglandin (PG) signaling would rescue Nf1-dependent habituation. Results showed that both pharmacologically increasing and decreasing PG signaling with PG dehydrogenase inhibitors and COX inhibitors, respectively, impaired Nf1-dependent habituation learning. This outcome may suggest that an optimal range of prostaglandin signaling mediates Nf1-dependent habituation.

BLOGS VS VLOGS: END-OF-LIFE EXPRESSION BY AYAS WITH CANCER

Sophia Schmidt, Megan Moreno (Mentor)

Cancer is a leading cause of death among adolescents and young adults (AYAs) in the U.S., leading to more than 10,000 deaths annually. AYAs are increasingly turning to online written blogs and video blogs (vlogs) to share their end-of-life cancer experiences. The purpose of this study is to determine how content posted by AYAs varies between written blogs and vlogs. Content analysis and Linguistic Inquiry and Word Count (LIWC) analysis will be used to examine differences in content posted between these two mediums. Coded variables, informed by Timmerman's Awareness of Death Theory, will evaluate common sentiments at three stages of death awareness. The findings from this study may help adapt care and support systems to better meet the unique end-of-life concerns of AYAs.

QUANTIFYING LIPID PRODUCTION OF OLEAGINOUS YEASTS

Rachel Schneider, Chris Hittinger (Mentor)

Oleaginous yeasts are well known for their ability to produce lipids; which can be used in an array of everyday products such as paints, lubricants and cosmetics. The focus of this project is to produce lipids by growing oleaginous yeasts, specifically in the genera *Lipomyces*, in different environments including conversion residue (CR), a waste product from the production of isobutanol from switchgrass hydrolysate. I propose to screen a variety of oleaginous yeasts, in the subphylum Saccharomycotina, for growth on CR and other biofuel relevant conditions. Those yeasts that can grow on CR, will be further tested for lipid production and quantification. Determining yeasts that can produce lipids on CR is the first step in sustainably producing oleochemicals.

MECHANISMS CONTROLLING THE ACTIVITY OF THE STEM-CELL REGULATOR ZELDA DURING DEVELOPMENT

Jack Schnell, Melissa Harrison (Mentor)

Over development, neural stem cells (neuroblasts) divide to give rise to the diversity of cell types in the central nervous system. These stem cells divide asymmetrically, creating an identical daughter cell and a partially differentiated progeny cell. Therefore, stem-cell fate must be tightly regulated to prevent over proliferation and tumorigenesis. Zelda (Zld), a zinc finger transcriptional activator, governs cell fate in the *Drosophila* embryo and is expressed in the neuroblasts. Overexpression of Zld at either stage of development is detrimental. Thus, in both tissues Zld activity must be precisely regulated. We are investigating the role of the RNA-binding protein Brain tumor (Brat) in repressing Zld translation in both tissues and in so doing will elucidate common mechanisms controlling stem-cell fate during development.

ASSESSMENT OF ETHOVISION XT FOR AUTOMATED ANIMAL BEHAVIORAL QUANTIFICATION.

Keegan Schoeller, Xinyu Zhao (Mentor)

Rodent behavioral testing is widely used for assessing the impact of genetic mutations or drug treatment on behaviors. The data analyses depend on tedious manual quantification of videos. A faster and objective method is needed. The goal of this study is to determine whether Ethovision XT, an automated animal tracking software, can be used to quantitatively assess animal behavior. We assessed this program for elevated plus maze (EPM), novel object recognition (NOR), light dark transition test (LDT), and novel location test (NLT). We found that the data obtained for LDT and EPM, but not NOR or NLT, were consistent between Ethovision XT and human counting. Therefore Ethovision XT is a potential improvement over manual human counting for some behavioral tests.

COMBINING SIMULTANEOUS AND SPACED PRESENTATIONS: DISTRIBUTED PAIRS IN CHILDREN'S GENERALIZATION OF STEM CONCEPTS

Lindsay Schoff, Yi Tong, Alexis Hosch, Haley Vlach (Mentor)

The ability to generalize concepts is a fundamental process in cognition and development. Previous research suggests that the timing of presentations can affect children's ability to generalize science categories. Our current study examines whether a presentation schedule that combines simultaneous and spaced presentations, i.e., a distributed pairs schedule, will facilitate children's acquisition and generalization of STEM concepts across timescales. We recruited 155 preschool-aged children and showed them 16 new science concepts using a simultaneous, spaced, or distributed pairs learning schedule. Contrary to expectations, we found that children in the distributed pairs condition did not outperform children in the spaced and simultaneous conditions. Future studies will examine how different concept types effect children's ability to acquire and generalize STEM concepts using the same presentation schedules.

RECONSTRUCTING PAST AND PREDICTING FUTURE SPECIES-CLIMATE RELATIONSHIPS WITH MODERN POLLEN SURFACE SAMPLES FROM EASTERN NORTH AMERICA

Jordan Schutz, Allison Stegner, Jack Williams (Mentor)

Studying past climate change and how taxa responded is essential to predicting future effects of climate change. Paleoecologists use pollen cores constrained by pollen surface samples to create SDMs that reconstruct past and predict future species-climate relationships. As the Earth warms, the pollen surface samples, collected anywhere from 50 years ago to present, offer different pictures of the present climate-vegetation relationship. I explore how the accuracy of those reconstructions changes depending on which ‘modern’ surface sample is used. Accurate models of the effects of species-climate relationships are essential as climate change already affects current species distributions and will further change potential habitat for species. Here, I show how future predictions can change based on different pollen surface sample data from eastern North America.

THE INFLUENCE OF TIMING OF MENOPAUSE ON CEREBROVASCULAR REACTIVITY

Katherine Senese, Jill Barnes (Mentor)

As the population of elderly females increases, it is crucial to promote healthy behaviors in women. Previous literature has established that premature menopause is associated with increased cardiovascular risk factors. However, the specific cerebrovascular outcomes from the timing of this period of hormonal change are poorly understood. The purpose of this study was to investigate how age at onset of menopause influences cerebrovascular reactivity. We evaluated middle cerebral artery velocity and blood pressure at rest and in response to hypercapnia in healthy, postmenopausal women (55–69 y). We hypothesized that women with an earlier onset of menopause will have impaired vascular function, manifesting in lower cerebrovascular reactivity and a greater blood pressure reactivity to hypercapnia, compared with women who underwent menopause at an older age.

RADIOSENSITIZATION OF HEAD AND NECK CANCER USING FGFR-INHIBITOR

Gopika Senthilkumar, Randall Kimple (Mentor)

Fibroblast growth factor receptors are often amplified or overexpressed in numerous head and neck squamous cell carcinomas (HNSCC). We assessed the potential of AZD4547 (selective FGFR-kinase inhibitor) to enhance tumor-response to radiation across a panel of HNSCC cell lines and xenografts. Our findings indicate that AZD4547 can augment the response of FGFR expressing HNSCC to radiation both in vivo and in vitro by increasing apoptosis and senescence. The combination treatment does not lead to changes in cell cycle or DNA-repair mechanisms. Therefore, treatment approaches that integrate molecular targeting of FGFR with radiation in HNSCC tumors that have high FGFR expression could improve therapeutic outcomes.

THE EFFECTS OF IFN-GAMMA AND SGI-110 ON HLA I EXPRESSION IN PROSTATE CANCER CELL LINES

Tahseen Shaik, Tamara Rodems (Mentor)

The destruction of cancer by immune cells requires class I human leukocyte antigen (HLA-I) expression. However, HLA-I is downregulated in prostate cancer. We found that this may be due to epigenetic silencing. If HLA-I is not expressed the body cannot destroy cancer cells and most immunotherapies will not work. We found that HLA-I is under-expressed even when treated with agents that stimulate immune responses such as interferon-gamma (IFN γ). We want to see if co-treatment with IFN γ and the epigenetic modifying drug SGI-110 increases HLA-I expression. This experiment includes cell treatment, RNA extraction, reverse transcription of mRNA and qPCR. We predict that the drug combination will increase HLA-I gene expression to make cancer cells detectable by the immune system and will make immunotherapies more effective.

NATURE BASED SHORELINES ON THE GREAT LAKES

Briana Shea, David Hart (Mentor)

As Great Lakes communities respond to accelerated coastal erosion, the increasing presence of hard coastal infrastructure can further increase erosion of adjacent properties. Nature based shoreline protection can stabilize the shore while limiting down shore damages and providing many environmental benefits. In this project a spectrum of erosion solutions for Great Lakes coastal properties is developed from ‘gray to green’ with criteria for their implementation. The outcome will be a guidebook educating Great Lakes shoreline owners on their erosion control options. The living shoreline options are evaluate based on their cost, environmental benefits, and maintenance requirements as well as the shore slope and wave energy they are suited for. Existing Great Lakes living shorelines projects are assessed based on these categories.

TOWARDS A PAN-GROUP ACTIVATOR OF THE QUORUM SENSING SYSTEM IN THE COMMON PATHOGEN STAPHYLOCOCCUS EPIDERMIDIS

Wenqi Shen, Helen Blackwell (Mentor)

Staphylococcus epidermidis is one of the leading causes of hospital-acquired infections, and these infections are difficult to eradicate via traditional antibiotic therapy due to increasing antibiotic resistance and the formation of robust biofilms. The accessory gene regulator (agr) quorum sensing (QS) system plays a key role in its pathogenesis, and therefore could be an attractive target to attenuate infections. agr activation is achieved by binding the autoinducing peptide (AIP) to its cognate receptor. Chemical modulators targeting the agr system represent valuable tools for better understanding the role of agr QS system during infection. However, only a limited number of compounds currently exist. Herein, we characterized the structure-activity relationships (SARs) of AIP-II/III and discovered the first set of pan-group activators of agr system in *S. epidermidis*.

BEHAVIORAL RESPONSE OF DAIRY COWS AFTER SUBCUTANEOUS INSERTION OF REAL-TIME TEMPERATURE DETECTING BIOSENSOR: A PILOT STUDY

Kehan (Sky) Sheng, Christopher Choi, Younghyun Kim, Sabrina Brounts, Hanwook Chung, Jennifer Van Os (Mentor)

Heat stress in dairy cows negatively affects production and animal welfare. To improve early detection of heat stress, a real-time body-temperature detecting microchip was inserted subcutaneously at the base of the ear of three dairy cows. Although this technology could benefit cattle welfare, their tolerance for this device needs to be established. To evaluate the cows’ reaction towards the microchip, ear flicks, head rubs, and head shakes were assessed from video recordings two days before and three days after biosensor insertion. We predicted that possible negative response from the cows would increase the frequency of those behaviors after the microchip implant. However, no significant difference was detected for focal behaviors between pre- and post-implantation, suggesting little adverse reaction to the biosensors in this pilot study.

CHARACTERIZATION OF 100 EXTENDED MAJOR HISTOCOMPATIBILITY COMPLEX HAPLOTYPES IN INDONESIAN CYNOMOLGUS MACAQUES

Cecilia Shortreed, David O’Connor (Mentor)

Improvements to anti-rejection therapies in transplantation rely on preclinical studies conducted in NHP models. Cynomolgus macaques (*Macaca fascicularis*) are an excellent model because their major histocompatibility complex (MHC) genes are homologous to the human leukocyte antigen complex, which both encode cell-surface proteins involved in cell recognition and rejection of non-host tissues. Characterization of MHC genes is required to control disparity between donor and recipient tissues. During phase 2 of my study with a cohort of 48 macaques, I characterized 49 class II allelic variants by PacBio sequencing. Together with previous work, we have now defined the MHC class I and II alleles that are associated with 100 extended MHC haplotypes. Completion of this study significantly improves investigators’ ability to use these macaques for transplantation research.

THE CORRELATION BETWEEN FLUORESCENCE AND POSITRON-EMISSION TOMOGRAPHY (PET) IMAGING OF H₂S-ACTIVABLE NANOPARTICLE PHOTOSENSITIZER

Cerise Siamof, Weibo Cai (Mentor)

Hydrogen sulfide, a known biological signaling molecule, is found in high amounts in human colon adenocarcinoma tumor sites. This project seeks to determine the correlation of fluorescence and positron-emission tomography (PET) imaging of H₂S activable porphyrin polyethylene glycol nanoparticle (PPN) photosensitizer to confirm potential applications of H₂S responsive systems for cancer therapy. To confirm these applications, nanoparticle photosensitizer will be synthesized by conjugating Tetrakis(4-carboxyphenyl) porphyrin with 8-Armed polyethylene glycol (PEG), which will result in a PPN. Then, the fluorescence of the PPN will be quenched, after which the PPN's H₂S activability will be assessed and used to confirm the time-dependent recovery of fluorescence of the PPN. The system will be tested in vitro to assess potential applications for photodynamic therapy (PDT).

UNDERSTANDING VEHICLE AND BICYCLE INTERACTIONS USING NATURALISTIC OBSERVATIONS

Carlina Sii, Boris Claros (Mentor)

Cycling has seen a significant increase in popularity in recent years. Traffic management, eco-friendly, and public health initiatives have contributed to the rise of cycling enthusiasts. With the switch of transportation modalities and diverse roadway users, bicycle safety has not been properly assessed. In 2016, 840 bicyclists were killed in traffic crashes in the United States. This research seeks to study vehicle-bicycle interactions in naturalist real world environments. A bicycle was equipped with cameras, ultrasonic sensor, and a data logger to measure lateral separation of passing vehicles. Data will be collected during 2019 at predetermined routes with known roadway characteristics. Through the use of the naturalistic data, the risk of vehicle-bicycle crashes will be estimated as a function of driver/cyclist behavior and roadway conditions.

RELATIONSHIP FLAGS (FOR LEADERS, ADVOCATES, AND GREEK STUDENTS)

Lauren Silber, Tracy Schroepfer (Mentor)

National statistics show that 1-in-4 women (ages 16–24) experience violence in their intimate relationships, so it is important that college students are educated on dating violence. To ensure that UW–Madison students received this education, FLAGS was developed to provide peer-led workshops to students on the prevalence of dating violence, strategies for recognizing warning signs, and guidance for supporting friends experiencing dating violence. To test the effectiveness of the workshops, a pre-and-posttest was administered to workshop participants to measure their changed level of understanding about dating violence. Statistical analyses revealed that there was a significant increase in correct answers post-workshop. These findings provide support for developing a standard peer education workshop model for use on university campuses.

NICHE PARTITIONING IN COMMUNITIES FEATURING DIFFERENT AVIAN SCAVENGER RICHNESS

Kate Silverthorne, Jonathan Pauli (Mentor)

My project aims to compare dietary overlap between avian scavengers at two sites in Argentina. The first site features a rich guild of avian scavengers with five species; the second is relatively simple, featuring only two species of avian scavengers. I hypothesized that in areas with more competing species, there will be lower inter-specific dietary overlap, and smaller intra-specific dietary breadth. I compared the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotopic signatures, proxies for animal diets, of molted feathers to quantify niche breadth for individual species and niche overlap between species. Contrary to my hypothesis, the site featuring more species exhibited more dietary overlap than the area with less species. These findings can result from different prey availability between sites shaping competitive interactions, creating functional homogenization among species.

RELATIONSHIP OF STRESS, IMMUNE SYSTEM FUNCTIONING, AND HEALTH IN CAREGIVERS OF CHILDREN WITH AUTISM

Christian Simon, Manish Patankar, Elizabeth Larson (Mentor)

Caregivers of children with autism have been shown to experience increased depression and stress. Increases in inflammatory cytokine levels have been linked to depressed mood in other groups which suggests a potential physiological mechanism whereby stress impacts caregivers' physical and mental health. We will examine the relationship of inflammatory cytokine levels, depression, perceived stress and physical health in caregivers of children with autism. A phlebotomist drew blood from fifteen caregivers of children with autism. 3 1-mL samples of patient plasma were extracted from the centrifuged blood in order to test for identified cytokines. A Milliplex assay system will be used to measure pro- and anti-inflammatory cytokines. Statistical analysis will be used to examine the relationships of cytokine levels to measures of health.

GAME THEORETIC MODEL OF PRE-DISASTER RELOCATION

Andrew Simovic, Yuqun Mark Zhou, Hongru Du, Vicki Bier (Mentor)

This paper uses game theory to explore strategies by which governments might encourage residents living in flood-vulnerable areas to relocate prior to disasters and reduce damage costs for both the government and households. We find that offering a one-time subsidy can be effective at incentivizing relocation if the government has a significantly lower discount rate than residents. We also examine the use of a fixed annual benefit after relocation and explore the impact of assuming hyperbolic discounting instead of standard exponential discounting to model possibly myopic decision making on the part of residents. This game-theoretic model sets the stage for future agent-based modeling research that simulates heterogeneity among residents with differences in housing costs, discount rates, age, and other factors affecting their propensity to relocate.

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IMPACT OF AVAILABLE LEGAL RESOURCES ON OUTCOMES FOR WISCONSIN OPIOID USERS

Rita Simpson, Rebecca Miller (Mentor)

Rates of opioid use disorder (OUD) are on the rise in Wisconsin, leading to an increase in related adverse health outcomes among people who inject drugs (PWID). While effective interventions for managing OUD exist, geographic, social, and economic barriers limit PWIDs access to these lifesaving interventions, especially those living in rural areas. An absence of legal counsel may act as a barrier-to-care by limiting access to and success in drug court and diversion programs, which help PWID to avoid prison and receive the services they need. Understanding that the social-ecological framework guides many public health prevention efforts, this research uses a mixed-methods approach to assess the relative importance of legal counsel availability on the health outcomes of PWID that live in 6 rural Wisconsin counties-of-interest.

BHIKKHUNIS AND MEI CHIS: CONTRASTING, COMPLEX EXPERIENCES WITH WOMEN'S EMPOWERMENT

Rachel Sina, Gudrun Buhnemann (Mentor)

Despite the long-lost original practice of female ordination in Theravada Buddhist traditions, due to its conservative nature, modern Theravada Buddhism has been more reluctant than its Mahayana counterpart to embrace bhikkhunis, or nuns, within religious and social spheres throughout Theravada countries. Resistance to bhikkhuni ordination has contributed to and upheld patriarchal values within these societies. However, mei chis are women recognized as partial-monastics and are accepted in Theravada nations. Bhikkhuni ordination has largely created and is fostered by Buddhist women's empowerment in spiritual, economic, and social spheres, while mei chi practice exists in a world outside of such empowerment. However, some bhikkhuni patriarchal practices, public pushback, and divergent mei chi opinions complicate this picture of contrast of women's empowerment between bhikkhuni and mei chi practices.

IMPROVING ENERGETIC PARTICLE CONFINEMENT IN STELLARATORS

Luquant Singh, Aaron Bader (Mentor)

Stellarators are a leading candidate for a nuclear fusion reactor. Optimization of stellarator magnetic geometry has been demonstrated to improve the confinement of bulk thermal particles in stellarator plasmas, but it remains to be determined how to optimize magnetic geometry to confine higher energy particles. Because stellarator magnetic fields are generated using magnetic coils, determining stellarator coil sets with good confinement properties for energetic particles is an important step in determining desirable magnetic geometries. Recent developments in stellarator coil-generating computational codes have enabled the modeling of a wide variety of coil sets with various engineering parameters, including average distance between coils and the plasma. This distance may play an important role in the confinement of energetic particles in stellarator plasmas.

EXAMINING THE DIVERSITY OF SOCIAL IDENTITIES AMONG US MEDICAL SCHOOL STUDENTS

Haley Sisel, Alaa Abd-Elsayed (Mentor)

In an age of proclaimed progression and inclusivity, the issue of diversity—specifically in academia—has sparked recent controversy. Its significance in medical education is illustrated by the inclusion of diversity standards in 2009 by the Liaison Committee on Medical Education (LCME), the accrediting body for MD programs. Our study will investigate the misrepresentation of identity among medical students through statistical analysis, and identify initiatives promoting diversity. Data, retrieved from the Association of American Medical Colleges, includes gender, race and ethnicity, and state of legal residence. Using this data, we will compare self-reported demographic data for medical school applicants and matriculants. This research will contribute to the contentious, yet necessary, discussion regarding diversity, bias, and representation in medical education.

DYNAMIC CHANGES OF CRUCIAL HMSC TRANSCRIPTION FACTOR GENE EXPRESSION, DIFFERENTIATION POTENTIAL, PROLIFERATION CAPABILITY, AND MORPHOLOGY IN THE IN VITRO AGING PROCESS

Athill Sivapatham, Wan-Ju Li (Mentor)

Human bone-marrow derived mesenchymal stem cells (BM-MSCs) are multipotent stem cells capable of trilineage differentiation to adipocytes, chondroblasts, and osteoblasts. Older patients often develop bone and cartilage defects. Transcription factor studies can provide insight into cellular aging mechanisms. This study looks at how gene expression, differentiation potential, proliferation capability, and cell morphology change through repeated cell passages in vitro through differentiation analyses through staining, gene expression, and histology. Initial findings indicate that osteogenic and chondrogenic differentiation were less successful in older cells while adipogenic differentiation was inconclusive. Proliferation decreased and morphology did not change. Gene expression of ETV4 and FOXJ1 decreased significantly. These results clearly show drastic changes in differentiation as age increases and further emphasize the importance of studying MSC aging through transcription factors.

FREQUENCY AND DISTRIBUTION OF CUTTING MANEUVERS AMONG FEMALE COLLEGE ULTIMATE FRISBEE PLAYERS

Paul Slaughter, Peter Adamczyk (Mentor)

Ultimate frisbee players have a high rate of lower limb injury such as ACL tears. We studied the prevalence of high-risk cutting maneuvers in women's collegiate ultimate players during competition using lower-body wearable motion sensors. Cutting frequency ranged from 0 to 19 cuts per point. Sharp cuts (greater than 120° change of direction) were more prevalent than shallow cuts. Average speed of cutting was greater than 3 m/s. These statistics quantify in-game movement characteristics that can be used to structure laboratory studies of injury risk. These studies should focus on cuts greater than 120° in order to be representative of common directions seen in real games.

CLONING CANINE DLA-88 INTO PCEP4

Morgan Smith, Matt Reynolds (Mentor)

Canines are a useful comparative model for oncology, genetic and autoimmune diseases. There is currently limited information about canine major histocompatibility complex (MHC) class I molecules, which present tumor or infectious disease-derived peptides to CD8 T cells. To address this issue, we will clone three different DLA-88 MHC class I canine alleles into a mammalian expression vector. Cloned alleles will be transfected into mammalian cells, for cell surface expression to characterize peptides involved in cell mediated immune response. Cloning of DLA-88 is the first step in understanding the relationship between MHC class I molecules and antigens found in canines.

APPLICATION OF THE INFORMATION-MOTIVATION-BEHAVIORAL (IMB) MODEL: A COMMUNITY-BASED PEER GROUP FOR AFRICAN AMERICANS WITH TYPE 2 DIABETES

Ariana Song, Olayinka Shiyabola (Mentor)

The information-motivation-behavioral (IMB) model is a social-psychological conceptualization of motivations of health-related behaviors. The IMB model was central to the design of the Peer Ambassador Support Program to Enhance Care (PASPEC), a pilot program implemented in Madison and Milwaukee for improving medication adherence in African Americans (AAs) with type 2 diabetes based on sociobehavioral and health psychology theories. Unique personal, interpersonal, and socioeconomic factors influence beliefs of AAs, and consequently, medication adherence. Additionally, AAs experience higher prevalence of diabetes compared to whites. This program gathered the qualitative feedback of an AA-only, community-based peer support group in an IMB model with "peer ambassadors" educating "peer buddies" about medication adherence.

ARE THERE SEX DIFFERENCES SEEN IN PROLIFERATION AFTER INJURY IN DROSOPHILA

Bailey Spiegelberg, Kassi Crocker (Mentor)

When it comes to neurological diseases, we see disparities in sex and yet these differences are rarely looked at. To do this we are using a novel mutation, Brat cheesehead, that has continued proliferation and progressive neurodegeneration. In a previous study, it was shown that at 29 degrees females flies do worse than males. In this study, we are seeing if sex indeed plays a role in differences between proliferation of neural cells in *Drosophila melanogaster*. In order to induce this proliferation, these flies were injured at 24 hours old using a Penetrating Traumatic Brain Injury model. Brains were assayed 24 hours post-injury to determine levels of proliferation. These results can be helpful in recognizing candidate genes and pathways in neurodevelopment and regeneration.

USING ECHO DOTS TO REDUCE PATIENT DISTRESS DURING THE PERIOPERATIVE PERIOD

Ashley Squires, Megan Draheim, Mary Beth Henry (Mentor)

Distress adversely affects quality of life in patients undergoing major surgery. In our study, donor funded Echo Dots were distributed to patients in the perioperative period. The intent was to improve quality of life by increasing nutrition and exercise and decreasing disrupted circadian rhythm and worry. We measured distress of both participants and a control group at three intervals with the NCCN Distress Thermometer. At patient number 12 we reviewed results to better address patients' needs. Increased technical support and face-to-face visits were requested to improve use. A hospital volunteer position was created to best implement this intervention. Future goals include: creating Amazon Alexa Skills to target individual patient needs that will ultimately enhance the patient experience and quality of life.

HOW WAS YOUR VISIT?: PARENTS' PERCEPTIONS ABOUT ASTHMA CARE IN THE URGENT CARE

Jack Stamer, Caroline Paul (Mentor)

Asthma is among the most common pediatric chronic illnesses and is a frequent reason for urgent care visits. Parent's understanding of their child's asthma is important to the best outcome. Little is known regarding parents' understanding of asthma care in the Urgent Care (UC) setting. We aimed to explore parent's perceptions regarding their child's care. A national online survey of parents (n=468) focused on medication understanding, barriers to following instructions, and factors to improve care. Almost a quarter of parents (22%) reported not understanding the UC provider's medication advice. Many parents lacked understanding of asthma care instructions in the UC. Future studies should explore the needs of parents to help optimize management of their child's asthma care in the UC.

MIDWESTERN INDIGENOUS POPULATIONS AND THEIR RELATIONSHIP TO FOOD: AN ANALYSIS ON THE IMPACTS OF GENERATIONAL TRAUMA

Tarah Stangler, Jennifer Gaddis (Mentor)

This project will be an analysis on the influence of generational trauma experienced by Midwestern Indigenous populations caused by constant removal from their traditional land, attempted racial genocide and reeducation programs and how this continues to impact their relationship to food. The analysis will include an examination of current trends in food related illnesses such as diabetes and obesity in Midwestern Indigenous populations in tandem to the decrease in generational education of traditional practices and knowledge regarding Indigenous food practices and preparation.

EXAMINING THE IMPACT OF FLOW STATES ON SURGEON PERFORMANCE

Brianna Statz, Hee Soo Jung (Mentor)

Medical errors account for a large number of preventable deaths across the world. These errors could potentially be reduced by understanding the experiences that underlie successful surgical operations. Previous studies show that optimal psychological states, called flow states, have been correlated with increased performance. In this study, I investigated the relationship between experiencing flow and surgical performance in the operating room. In order to examine this relationship we used the Short Flow State (SFS) scale to assess flow. Operative performance was measured using both the Operative Performance Rating Scale and Zwisch scale. We found that the SFS scale is likely not an effective tool to use in the operating room. There are several limitations to this study including small sample size and the Hawthorn effect.

UNDERSTANDING PATHOGENIC SUCCESS BY IDENTIFYING RALSTONIA SOLANACEARUM'S NUTRIENT SOURCES IN PLANTA

Olivia Steidl, Corri Hamilton, Caitilyn Allen (Mentor)

The bacterial plant pathogen *Ralstonia solanacearum* (Rs) has adapted to life in the nutrient-poor xylem of its host plant in part because it can grow on the nutrients that are present in plants. These include the sugars sucrose and trehalose. I hypothesize that an Rs double mutant lacking the genes required to metabolize trehalose and sucrose will be less virulent than the wild-type bacterium. I will confirm that this $\Delta treA/\Delta scrA$ double mutant can no longer grow on either sucrose or trehalose as sole carbon source. I will then test this hypothesis by inoculating mutant and wild-type strains on the model host plant tomato and quantifying bacterial growth and disease development.

MODERN YOGA IS BENEFICIAL FOR ATHLETES: A COMPARISON STUDY OF MODERN YOGA PRACTICE AMONG ATHLETES

Logan Steinike, Gudrun Buhnemann (Mentor)

Yoga in the past few decades has transformed from a meditative practice into more intense styles classified as "modern yoga." Recent discoveries suggest modern yoga provides many health benefits for the practitioner. Athletes have turned to styles of modern yoga to be proactive about their recovery and to gain an advantage over their competition. The athletes hope the health benefits that modern yoga provides for the average practitioner will be just as beneficial for athletes. This study is a comparison of multiple studies encompassing a range of modern yoga styles and athletes from various sports. Yoga greatly benefits athletes, but the benefits could be increased if the style of yoga was specialized. Future research is needed for athletes to unlock modern yoga's full potential.

SCD-1, FGF21, AND ADIPONECTIN INTERACTION MAY PREVENT WEIGHT GAIN IN LKO MICE ON HSVLF DIET

Abbey Stoltenburg, Sarah Lewis (Mentor)

Understanding how obesity develops is crucial to improving treatments. Liver-specific Stearoyl CoA Desaturase 1 (SCD1) knockout (LKO) mice fail to gain weight on a high-sucrose very low fat (HSVLF) diet, suggesting SCD1 regulates obesity. We have previously shown that Fibroblast Growth Factor (FGF21) is upregulated in LKO livers and literature implies FGF21 regulates adiponectin secretion in adipose tissue. Increased adiponectin decreases hyperglycemia similar to LKO mice. We hypothesize that increased FGF21 in liver promotes adiponectin expression in adipose tissue in LKO mice on a HSVLF diet. We will test this hypothesis in vitro using 3T3-L (adipose) and HepG2 (liver) cells treated with SCD1 inhibitor. Investigating SCD1's impact on FGF21 and adiponectin is important because this project may identify targets for novel therapies for obesity.

USING CRISPR-CAS9 TO KNOCKOUT ADE2 IN S. CEREVISIAE

Hayley Stoneman, Russell Wrobel (Mentor)

Saccharomyces cerevisiae (Baker's yeast) is a model organism that is ideal for genome engineering research. CRISPR-Cas9 is a recently emerging tool that is of high interest in genetics, due to its simplicity and universality. In this project, the bioinformatics tool CRISpy is used to design guide RNAs for CRISPR-Cas9 knockout experiments. The target gene is ADE2, which has an easily assayable phenotype and turns red when successfully knocked out. This experiment focuses on the design of CRISPR constructs, and the validation of the strain coverage feature of the CRISpy program.

COMPUTATIONAL DESIGN AND DEMONSTRATION OF VOLTAGE CONTROL OF MAGNETIC SKYRMION

Varun Sudhakaran, Jiamian Hu (Mentor)

My project deals with the culmination of physics and computer technology. Skyrmions are the basis of our project and it is essential in computer efficiency and could be a breakthrough in the Computer Engineering world. Furthermore, the main platforms we were using were the Linux terminal with a cooperation with CHTC as well as using the supercomputing system to run simple commands to submit these jobs. The jobs that are submitted go into depth on how stable each skyrmion signal and essentially seeing if the data is viable. I often go into the labs in the Material Sciences building which is where I usually work for my daily reports and my results from my end of the job as a research scholar.

NON-INVASIVE MEASUREMENT OF EARLY-STAGE DIABETIC RETINOPATHY

Andrew Suscha, Nader Sheibani (Mentor)

Diabetic retinopathy (DR) is the leading cause of blindness in middle-aged humans. Studies have found potential metabolic biomarkers for retinal damage after 6 weeks of diabetes. However, non-invasive detection of diabetes mediated early retinal vascular changes has been impossible. My study used Akita mice, a commonly used diabetic model, to investigate early DR progression. I was specifically interested in the efficacy of fundus imaging as a potential non-invasive method for measuring early stages of DR. Initial fundus images were taken on 8-week mice, and again at 16 weeks. Fundus quantitation demonstrated retinal damage at 16 weeks. Findings were supported by trypsin digest preparations which identified significant pericyte loss at 16 weeks. These results support fundus imaging as a potential non-invasive metric of DR.

CELL CYCLE AND APOPTOTIC PATHWAY GENE REGULATION IN GLIOBLASTOMA MULTIFORME (GBM) AND GBM DERIVED STEM CELLS: IMPLICATING PENTRAXIN 3 UPREGULATION.

Ian Sutton, Uma Wesley (Mentor)

Glioblastoma multiforme (GBM) is the most aggressive type of brain cancer and progresses at a rapid rate. GBM derived stem cells (GSC) are resistant to drug induced apoptosis. Pentraxin 3 (PTX3) is an angiogenic and survival factor for GBM. Our lab has identified higher levels of PTX3 in GSCs. We demonstrated that GSCs are mostly in G2 and S-phase (a proliferative state) and express increased levels of GADD45A, which protects GBM cells from apoptosis. Increased PTX3 expression correlated with cell cycle progression and higher CyclinD1 that promotes progression through the cell cycle. Also, PTX3 expression correlated with patient tumor grade. In summary, PTX3 upregulation is associated with cell cycle progression and GBM malignancy. These results indicate that PTX3 may provide growth advantage for brain tumors.

HOW CREATING INTIMACY VERSUS DISCUSSING INFORMATION AFFECTS ABILITY TO REACH CONSENSUS

Maeve Swackhamer, Lyn Van Swol (Mentor)

Researchers believe there is a connection between people receiving information and their ability to reach consensus. Finding ways to encourage consensus in a discussion will lead to more effective problem-solving strategies. In this study, participants discussed climate change in an online chat group and we assess their responses with linguistics software that detects emotional content. The independent variable being manipulated is the initial condition: two conditions were used, and the difference between them was whether or not participants got to discuss hobbies and interests (intimate conversation) before discussing climate change. Afterward, participants try to come to consensus about the issue. In finding the best solution to climate change, the prediction is that those in the intimacy condition will be better able come to consensus.

MODELING OPTIMAL SPINDLE POSITIONING USING FLUORESCENTLY TAGGED EB3 AND CDK1 PROBES

Matthew Swenson, Zac Swider (Mentor)

Optimal spindle positioning of a dividing epithelial cell is necessary to ensure proper chromosomal segregation and the subsequent size of daughter cells. Spindle positioning is thought to be controlled by microtubule interactions with motor proteins at the cell cortex. However, the exact method by which these microtubules and motor proteins achieve optimal spindle positioning is poorly understood. One hypothesis for this mechanism is that tricellular junctions, which have been observed to sequester Cdk1 during M phase, control spindle positioning by destabilizing microtubules in the vicinity of the tricell junctions. By imaging *Xenopus laevis* embryos injected with fluorescently-tagged EB3 and Cdk1 biosensors, I aim to build a model for spindle positioning based on spindle location relative to cellular junctions.

HIGH IONIZATION QUASAR-DRIVEN OUTFLOWS IN A Z~1 POST-STARBURST GALAXY

Cameren Swiggum, Christy Tremonti (Mentor)

We have discovered an unusual post-starburst quasar at a redshift of ~ 0.94 in the Sloan Digital Sky Survey III. Data from the Wide-field Infrared Science Explorer (WISE) reveal a total luminosity output of approximately ten trillion suns. Decade long photometric data show that the source has varied more than two magnitudes. New spectra obtained with the South African Large Telescope (SALT) during a low state reveal the host galaxy and unusually strong emission lines of [OIII], [NeIII], and [Ne V]. The lines are blue shifted with outflow velocities up to ~ 4000 km/s. The [NeV] to [NeIII] ratio is unusually high (~ 3.5). We speculate that the highly ionized emission lines arise in strong shocks generated by powerful quasar-driven winds interacting with gas in the host galaxy.

MEDIA MULTITASKING AND ITS EFFECT ON TASK SWITCHING ABILITIES

Maria Szalkowski, Shawn Green (Mentor)

Previous research indicates that frequent and concurrent use of multiple media forms has a negative impact on various cognitive abilities. However, these findings have not been consistently replicated. In this study I examine how media multitasking impacts task switching directed by external cues and task switching that is internally directed. I originally hypothesized that frequent media multitasking involves becoming better at managing internally determined task switching, but this comes at the cost of a reduced sensitivity to external signals. Here I present my results.

NEOLIBERALISM AGAINST PUBLIC LIBRARIES: THE FIGHT TO KEEP KNOWLEDGE ACCESSIBLE IN ARGENTINA

Isabelle Szerenyi, Professor Ksenija Bilbija (Mentor)

The National Library in Argentina found itself in peril after 240 employees were laid off upon the demand of newly elected President Mauricio Macri in 2016. This investigation sought to discover what effects the new economically competitive shift in government has had on the National Library, and what actions have been taken to preserve access to literature by defenders of free speech. After compiling my research through interviews, personal observation, and current events, I have come to the conclusion that the library system in Argentina remains in danger of drastically losing funding due to persisting economic instability.

MODELING THE DISCUSSION OF CONTROVERSIAL TOPICS USING EPISTEMIC NETWORK ANALYSIS

Sara Tabatabai, Brendan Eagan (Mentor)

In this study, online discussions on social determinants of health were collected from undergraduate students at Tufts University and Kansas State University (KSU). The discussions were coded for concepts that arose from a grounded analysis of the text (Class, Race/Ethnicity, etc.), and we measured the connections between concepts using Epistemic Network Analysis (ENA). A student who believes some concept has an impact on health would receive the same coding and treatment in ENA as a student who believes that concept does not have an impact on health. We addressed this possible issue by adding two codes which illuminate whether a student believes a concept is, or is not, a factor in social determinants of health and compared the discourse models between the two schools.

ASSESSING THE CRYSTAL FABRICS AND MINERALOGY OF SPELEOTHEMS FROM CAVE OF THE MOUNDS, WISCONSIN

Rui Qiong Tan, Shaun Marcott (Mentor)

Caves that form in carbonate terrains record a diverse range of environmental conditions. The characterization of crystal fabrics in cave carbonates (speleothems) is necessary to reach a more complete knowledge of speleothem formation and their evolution through time. Different types of fabric growth result from distinct environmental conditions in and above the cave site. The qualitative petrographic observations complement existing geochemical observations from speleothems. I constructed microstratigraphic logs of speleothem fabrics from 3 stalagmites that grew in Cave of the Mounds, Wisconsin, and compare this data with previously collected quantitative geochemical data. The speleothem from my study grew between 232 to 37 thousand years before present and record fabrics that indicate different drip-rates. This shows that crystal fabric correlates to growth rates of the speleothems.

MACHINE LEARNING APPROACHES TO REDUCE PREVENTABLE EMERGENCY DEPARTMENT RETURN VISITS

Marvin Tan, Brian Patterson (Mentor)

In the U.S., the Emergency Department (ED) is one of the primary outpatient care sources for older adults. Studies show many older adults experience poor health outcomes after being discharged from the ED. One measure of potential opportunities for care improvement is the rate of return visits to the emergency department shortly after discharge. In this project, we use machine learning techniques to analyze existing patient data to find combinations of characteristics that predict the risks of a patient returning to the ED after discharge within a prespecified period and build a model to help ED physicians to identify older adults with such risk. With the implementation of this model, we aim to improve the ED discharge outcome for older adults.

COMPARISON OF TROPOMI NO₂ RETRIEVALS WITH GROUND- BASED MEASUREMENTS IN LOS ANGELES

Madankui Tao, Tracey Holloway (Mentor)

Nitrogen dioxide (NO₂), regulated under the Clean Air Act (CAA), directly harms the human respiratory system and contributes to the formation of other pollutants. Satellite-derived NO₂ data has been widely used to improve the air quality monitoring and forecast in the United States. Beginning in July 2018, data are publicly available from the Tropospheric Monitoring Instrument (TROPOMI), equipped with a high spatial resolution of 7x7 km² to detect concentration variation and emission sources. We examine day-to-day and weekday-weekend variability of TROPOMI NO₂ for summer and fall 2018 over Los Angeles and compare TROPOMI retrievals to in situ NO₂ measurements from the EPA Air Quality System. The objective of our work is supporting the future application of TROPOMI for air quality management and public health applications.

EVENTUALLY, I HAVE TO BREATHE: AN EXAMINATION OF THE PRACTICE OF HIP-HOP DANCE AND THE TRAUMATIZED BLACK BODY

Breanna Taylor, Mary Patterson (Mentor)

This study focuses on how Hip-Hop Dance can be used as an antidotal tool to educate individuals on the retrieval (acknowledgement) and release (healing) of corporeal trauma, or trauma that has been stored away in the Black body. Corporeality serves the purpose of explaining how the Black body is used as a primary site of information, while sifting through its interaction with trauma. Trauma, in this context would be the results of slavery and ill-treatment of Black bodies (i.e., police brutality, low-resourced and underdeveloped communities, restrictions on Black expression, etc.) within a US context. In analyzing the Bangin' dance scene in Milwaukee, Wisconsin, among Black youth in underdeveloped and surveilled communities, the practice of Hip-Hop Dance to retrieve and release embodied trauma can be explored.

EVALUATION OF A NOVEL SURGICAL SYSTEM FOR OSTEOCHONDRAL ALLOGRAFT TRANSPLANTATION

Alexander Teague, Corinne Henak (Mentor)

Osteochondral allograft (OCA) transplantation implants cartilage and subchondral bone to repair debilitating joint defects. Implantation is universally achieved using impaction, which is detrimental to chondrocyte viability—a determinant of clinical success. To mitigate chondral damage, we developed a novel system that avoids impaction by using a screw-in graft. Testing this screw approach revealed dramatic reductions in chondrocyte death compared to impaction. Graft placement accuracy and the resulting surface incongruities were assessed by comparing the native and grafted joint geometries with 3D laser scans. These results guided finite element modeling which showed minimal changes in the post-grafting joint loading paradigm. When considering the modeling with post-implantation chondrocyte viability, these results indicate that the screw-in graft is likely more effective than traditional approaches to OCA transplantation.

THE EFFECTS OF COLLABORATION ON ENGINEERING STUDENTS' TEST SCORES IN WISCEL

Eda Tee, Sally Wu (Mentor)

The university has created multiple learning environments that encourage peer collaborations such as WisCEL (Wisconsin Collaboratory for Enhanced Learning). To determine the impact of collaboration on students' learning outcome, this study examines the correlation between students' collaboration and their test score. We analyzed data from an engineering class where 129 students sat at 29 tables at WisCEL to work on a problem set every week. Students are encouraged but not required to work together with the other students at the table. We determined collaborations among students by comparing the time that students submitted answers to individual problems. The findings provide insights on the significance of peer collaboration on learning outcomes and sheds light on the importance of collaborative learning spaces.

STRUCTURAL COMPARISON OF PALATAL BONES OF CROCODYLUS JOHNSTONI WITH A NEW PHYTOSAUR FROM THE POPO AGIE FM (WYOMING, USA)

Nadiah Tengku Mahmood, Dave Lovelace (Mentor)

Convergent evolution is exemplified between crocodylians and the archosauriform reptiles, the phytosaurs. The anatomy of the palate is functionally important with regard to respiration as well as feeding. Crocodylians and phytosaurs possessed different structures to achieve a similar skull shape which may have bearing on their ecology. In this study, I segmented the palatine and pterygoid bones from CT scans of the freshwater crocodile, *Crocodylus johnstoni*, and of a basal phytosaur, UWGM 1978. The crocodylian palatines join along the midline and form around the nasal passages. The phytosaurian palatines do not join along the midline. This may be connected with the specialization of the phytosaur snout where the nostrils are placed closer to the eyes and nasal passages are shorter than in modern crocodylians.

QUANTITATIVE POLYMERASE CHAIN REACTION ANALYSIS OF GENE EXPRESSION OF IMMUNE MARKERS IN MOUSE MELANOMA

Kevin Thayyil, Mario Otto (Mentor)

The synergistic effects of radiation therapy and immunotherapy have shown promise as an effective cancer treatment strategy; however, a tumor's microenvironment can promote the progression of tumor growth and suppress various immunotherapy treatment strategies. Syngeneic B6 mice bearing murine B78 melanoma xenografts were treated with low and high dose tumor-targeted radionuclide therapy (TRT) using the alkyl-phosphocholine analog ¹³¹I-NM404. Post injection of the TRT agent, cohorts of mice were sacrificed weekly and tumors harvested over a four-week period. Quantitative polymerase chain reaction (qPCR) was used to analyze and compare the relative gene expression of immune markers throughout the four-week time course of tumor growth post-treatment.

IDENTIFICATION OF THE MECHANISM OF MITOTIC CHECKPOINT PROTEIN MAD1 LOCALIZING TO THE GOLGI APPARATUS

Rebecca Thiry, Beth Weaver (Mentor)

Upregulation of Mitotic Arrest Deficient 1 (Mad1) causes chromosome missegregation resulting in aneuploidy, an abnormal chromosome number, which is a common characteristic of tumors. Mad1 assists in activating the major cell cycle checkpoint that regulates chromosome segregation during mitosis by recruiting its binding partner Mad2 in early mitosis. However, Mad1 is expressed throughout the cell cycle, and its functions outside of mitosis which could affect cancer initiation and progression are not well studied. Our laboratory has recently shown a novel localization of Mad1 at the Golgi apparatus that regulates integrin secretion and cell migration. The mechanism by which this occurs is unclear. The purpose of this research is to define which portion of Mad1 is necessary for its Golgi localization.

DEVELOPMENT OF A HUMAN AND AGE-SPECIFIC IN VITRO MODEL FOR STUDYING AXON GROWTH

Elizabeth Thompson, Darcie Moore (Mentor)

The inability of mouse models to identify effective treatments for spinal cord injury patients necessitates the creation of a human model for studying axon regeneration. Here, we developed a novel, human in vitro model for studying axon growth, using direct reprogramming of human fibroblasts into induced neurons, allowing for maintenance of patient age in the resulting neurons. Fibroblasts from humans ranging in age from neonatal to 70 years old were induced into neurons, and reprogramming efficiency and cellular identity were measured throughout the conversion process. Further, the intrinsic neurite growth rates of these purified neurons from different aged individuals were measured and characterized. This novel model will be instrumental for a future screen to identify novel species-specific and age-specific regulators of axon elongation and regeneration.

PROTEIN INTERACTIONS INVOLVED IN POSITIVE-STRAND RNA VIRUS REPLICATION

Jessica Thornton, Johan Den Boon (Mentor)

Positive-strand RNA viruses constitute the largest class of viruses and include important human pathogens, such as poliovirus and Zika virus. Without exception, all positive-strand RNA viruses depend on rearranging host membranes to compartmentalize their RNA genome replication machinery, concentrate replication components, and avoid cellular defense systems. Physical interactions between viral replication proteins drive the formation and function of these compartments. We identified areas likely to participate in these interactions with protein structure prediction software and confirmed their interaction status through photo-crosslinking techniques. Using this method, we have identified multiple viral protein interactions that have an impact on viral RNA replication. Our identification and characterization of molecular interactions should provide an excellent basis to develop broad-spectrum antivirals against positive-strand RNA virus replication.

BUTTON-SNAP LATCHING: A NEW METHOD OF FUNCTIONALIZING GRAPHENE

Isabelle Tigges-Green, Martin Zanni (Mentor)

Since the isolation of graphene was proven feasible, researchers have been exploring the possibilities of building on its unique properties through functionalization. The current methods of functionalization involve developing unique chemical reactions to create new bonds with graphene. We propose a new method of functionalizing 2D materials that utilizes existing chemistry to tether molecules through covalent bonding across patterned holes in graphene sheets. So far, we have constructed a fluorescence microscope and obtained base measurements of fluorescent polystyrene beads. With this instrument in place, we will develop Button-Snap Latching where fluorescent polystyrene beads coated in biotin or streptavidin will be covalently bonded across nanopatterned holes in graphene and the presence of dimers will be detected using fluorescence microscopy.

UTILIZING NK CELLS IN A VACCINE MODEL AGAINST NEUROBLASTOMA TO IMPROVE ANTI-TUMOR EFFECTS

Katharine Tippins, Kirsti Walker, Adeela Ali, Sabrina Kabakov, Christian Capitini (Mentor)

The present research aims to investigate the role of natural killer (NK) cells as an effective immunotherapeutic agent when used in conjunction with neuroblastoma cells modified to express immune costimulatory molecules. Efficacy of the NK cell treatment was assessed using a vaccine model in which mice were given a bone marrow transplant followed by AgN2a cell vaccines, the second coupled with the additional NK cell treatment. After the vaccine course, mice were challenged with 2e6 neuroblastoma cells and monitored for tumor development. In vitro experiments also assessed the ability of NK cells to function when co-cultured with AgN2a. Preliminary data from the immunization model has shown that NK cells improve the anti-tumor effects of the AgN2a vaccine without causing any unintended graft vs. host effects.

EPIDEMIOLOGIC SURVEY OF LEGIONELLA ANTIGEN TESTS AT AURORA HEALTH CARE

Caroline Toberna, Dennis Baumgardner, MD (Mentor)

Legionella pneumophila is an aerobic, pathogenic gram-negative bacterium which infects hosts through contaminated cooling towers and other sources of water. Human infection presents as potentially life-threatening pneumonia otherwise known as Legionnaires' disease. This retrospective study aimed to identify unrecognized Legionella outbreaks in Eastern Wisconsin. We extracted relevant geodemographic information from the charts of 11,652 patients who had undergone Legionella urine antigen (LgAg) testing at Aurora Health Care between January, 2013 to December, 2017. Positive cases were mapped to locate geographic hotspots, and demographics were compared to negative cases. The rate of positive LgAg in Eastern Wisconsin was 0.67%. Predictors for a positive test were being younger, male, non-white, testing in warmer months, and ZIP code of residence (ZIP code relationships being investigated).

FUNCTIONAL STUDIES OF THE BICC1 TRANSLATIONAL REPRESSOR PROTEIN

Tommaso Tonelli, Michael Sheets (Mentor)

Bicaudal-C (Bicc1) is an RNA binding protein that represses the translation of specific mRNAs, and causes them to make less of a certain protein. Its functions are important for several biological process, such as organogenesis, embryonic development, and several human diseases such as: Major Depressive Disorder and Polycystic Kidneys. Past research from the Sheets laboratory has demonstrate that a specific domain of Bicc1 contains the activity responsible for the specificity mRNA binding. My project is to use molecular biology to make specific amino acid changes in this region and analyze the consequences for RNA binding and translational repression.

SCHEMA-BASED PREVIEWS SUPPORT LEARNING IN EDUCATIONAL PROGRAMS

Yi Tong, Heather Kirkorian (Mentor)

The present study examines the effect of previewing on young children's learning and comprehension of educational programs. We recruited 107 preschoolers (52% girls) from the age of 3-5 years old and randomly assigned them into three different conditions: schema-based narrative preview, non-schema-based educational preview, and no preview. After participants watched an educational program in their assigned condition, they took a post-test on their narrative comprehension and educational learning outcomes. We found that children who watched a schema-based narrative preview outperformed children in the other two conditions on both narrative comprehension and educational learning. However, there was little difference between the performance of children who watched a non-schema-based educational review and no preview. These findings will contribute to the improvement of educational programs.

ABSENT FATHER'S PERCEIVED ROLES AS CAREGIVERS TO CHILDREN IN CO-PARENTING RELATIONSHIPS

Isaac Trussoni, Janean Dilworth-Bart (Mentor)

This study will examine how Black fathers outside the traditional nuclear family structure are still present in the lives of their children and how they perceive their role in that presence using thematic analysis (n=10). Research shows how crucial co-parenting is for child development and shows us how absent Black fathers give support from outside of the home. As research on this style of co-parenting increases, what Black fathers view as involvement in their children's lives must be examined too. Past studies have shown that Black father's involvement through co-parenting can affect education outcomes through early development. It is important that Black father's roles be examined as intervention in the perceived role of absent fathers can lead to positive outcomes from strong co-parenting relationships.

THE EFFECTS OF NEGATIVE AND HARSH PARENTING BEHAVIOR ON CHILDHOOD ADHD OVER TIME

Sheyenne Tung, James Li (Mentor)

Attention-deficit/hyperactivity disorder (ADHD) is a childhood psychiatric disorder characterized by developmentally abnormal patterns of inattention, hyperactivity and/or impulsivity. While the causes of ADHD are still unclear, previous research has found that negative and harsh parenting may exacerbate child ADHD symptoms. This study investigates the prospective relationship between negative parental behavior, assayed using self-reports, and childhood ADHD symptoms over the course of two years. We recruited 210 children and their parents at time 1 (T1) and 66 participants have returned for a follow-up assessment thus far (T2). We hypothesize that negative parenting behaviors at T1 will predict greater childhood ADHD symptomatology at T2. Clarifying the longitudinal effects of negative parental behavior on childhood ADHD may improve our temporal understanding about key targets for intervention.

GLOBAL CEREBRAL BLOOD FLOW IN HEALTHY OLDER ADULTS WITH LOW AND HIGH SODIUM DIETS

Makayla Tuomi, Jill Barnes (Mentor)

Recent animal studies indicate that high sodium diets reduce resting cerebral blood flow, leading to cognitive impairment. However, the relationship between dietary sodium intake and global cerebral blood flow (gCBF) is unknown in humans. The purpose of this study was to determine the relationship between sodium intake and gCBF in healthy older adults (61 \pm 5 years). 20 participants (10 male, 10 female) underwent 4D flow MRI to assess gCBF. Dietary sodium intake was assessed with diet logs for 3 days prior to the study visit. Participants were divided into high sodium (HS; >2300 mg daily) and low sodium (LS; <2300 mg daily) groups based on the FDA's recommendation. It was hypothesized that the HS group would have a lower gCBF compared to the LS group

MULTILINGUAL LANGUAGE AWARENESS

Teagan Twombly, Kristin Shutts (Mentor)

With increasing linguistic diversity in U.S. classrooms, it is more important than ever to understand how to promote positive interactions between speakers of different languages. To address this, my thesis evaluates a Multilingual Language Awareness curriculum within the Madison Metropolitan School District. This curriculum aims to use linguistic diversity as a teaching resource, rather than a setback for improving all students' academic and social outcomes. To evaluate the efficacy of the curriculum, students receiving the curriculum were compared to a lab-based control sample on three social cognition tasks. Children identified written and audio clips of speakers in different languages, were asked if they could learn another language, and were asked if they wanted to do an activity in English or another language.

STUDYING THE METABOLISM OF TOXOPLASMA GONDII THROUGH MUTAGENESIS: BPGM/PMFP

Charlotte Urban, Will Olson, Laura Knoll (Mentor)

The glycolytic pathway follows the general conversion of 2x1,3-BPG to 2x2-PG with the production of 2-ATP. When the host cell is infected with *T. gondii* it has been discovered through mass spectrometry based metabolic analysis there is an increase in 2,3-BPG suggesting the host cell/parasite is using the Luebering-Rapoport shunt during glycolysis. This shunt causes a net decrease of 2-ATP molecules per glucose metabolized. While the cause of this metabolic shift is unknown, we hypothesize that the host cell may be activating this shunt to reduce ATP production and slow down parasite replication through decreasing energy production. Through using a genetically optimized version of CRISPR/CAS9 we will knockout the genes, PMFP/BPGM, and determine the importance of these genes to parasite virulence and host cell infection.

"PAROISSES INDOCILES" (UNRULY PARISHES): A RECONSIDERATION OF HABITANT LOYALTIES AND THE HISTORIOGRAPHY OF THE AMERICAN REVOLUTION IN CANADA, 1774-1776

Sebastian Van Bastelaer, Sebastian van Bastelaer, Gloria Whiting (Mentor)

Americans failed to convince Canadians to join their fight for independence from Britain, but it was not for lack of trying; Patriots sent diplomatic and military missions to Quebec in attempts to secure what they called the "Fourteenth Colony." It was all in vain, historians have concluded: A worthless effort. Canadians would have nothing to do with the American experiment. But this narrative, long-told by scholars of the American Revolution, overlooks the sizable number of Quebecois people who cooperated with Americans. This project explores underutilized archives (including French-language repositories located outside of the United States) to explain why these determined inhabitants imperiled their lives and livelihoods by embracing the Patriot cause.

SMALL GESTATIONAL AGE BABIES AND ONE-MONTH IRON STATUS IN NEONATAL INTENSIVE CARE UNIT

Maria Vandenlangenberg, Christine Brichta, Sally Norlin, Pamela Kling (Mentor)

Background: Neonatal Intensive Care Unit (NICU) babies are at-risk for developing iron deficiency anemia (IDA), which can result in long-term cognitive deficits. Being small- vs. appropriate-for-gestational-age (SGA vs AGA) is a risk factor for developing IDA. Limited data is available in NICU babies. Hypothesis: SGA babies exhibit lower ferritins than AGA, indicating IDA. Methods: Our study obtained ferritins at 1 month-of-age. Risks for developing IDA were recorded and low (<70mg/L) 1-month ferritins were identified. Results: Mean ferritin was 158 mcg/L, with 15% measuring low. In all babies, ferritins were higher in SGA vs AGA (197.21 vs 128.9 mcg/dL, p=0.016); however ferritin (n=183) did not differ, p=0.21, in prematurity (<33weeks gestation). Conclusion: SGA babies in the NICU are not more prone to IDA than AGA babies.

TESTING INSECT TEMPERATURE TOLERANCE

Kyle Vandervere, Sean Schoville (Mentor)

For many species, the size and type of habitat are usually dependent on their physiological limits. Grylloblattidae have temperature as their physiological limit, as it constricts the Grylloblattidae to narrow niches. Since Grylloblattidae lives in mountains preferably, their environments experience large fluctuations in temperature that frequently reach below 0 C, although they seek refuge in climatically stable microhabitats under the snowpack. Here we test the critical thermal limits, temperature preference, and desiccation resistance of multiple Grylloblatta populations from across their geographical range. We examine species across ecological gradients ranging from caves to alpine sites, as well as sites that contain multiple sympatric species. We find that southern species have broader thermotolerances which may correlate to more extreme climate variation due to unreliable snow cover.

THE UNDOCUMENTED MIGRATION PROJECT: IN THE PEAK OF SUMMER AT THE U.S.-MEXICO BORDER

Francisco Velazquez, Philip Dennis (Mentor)

As a member of the Undocumented Migration Project, I would like to show a 29-minute looped video. In this triptych, the viewer is guided through the research that the Undocumented Migration Project conducts. In addition, there is a photo series included as we recount the hike on the migrant trail, the team, and the endless Sonoran Desert valleys. I would like to present the video in a gallery or enclosed space. Preferably somewhere with a high wall, a projection and audio system. By bringing this conversation directly from the desert to the viewer, there is no longer a skewed middle-man, but rather a place in which the audience questions and creates the dialogue surrounding the topic of migration and the human experience.

LEARNING VIEW INVARIANT SEMANTIC SEGMENTATION FOR UAV VIDEO SEQUENCES

Abhay Venkatesh, Abhay Venkatesh, Vikas Singh (Mentor)

There are several excellent image datasets with pixel-level annotations available in the computer vision community to enable semantic segmentation of scenes. However, data is scarce for training computer vision models for unmanned aerial vehicles (UAVs), also known as drones. We propose a framework to compensate for this lack of training data and still obtain generalizable models for segmentation of images/videos acquired by drones. We start with pixel-labeled images captured at the street-view level and then we consider images at varying poses. By leveraging good segmentations of the street-view data, we train parameters of a "helper" network that learns to nominally change the internal feature representations of a segmentation neural network to yield good segmentations for viewing angles other than street-view pose, acquired from a drone.

PARTNER2LOSE

Cynthia Villatoro, Corrine Voils (Mentor)

The Partner2Lose project has a focus on obesity. Obesity means being overweight and having excessive body fat. This research will be a two-year process. The research is intended to determine whether losing weight is easier by doing physical activities alone or with a partner. To decide who will be receiving the patient-only intervention or the partner-assisted intervention is randomized. Each individual will attend classes that will track their process and where they will meet with a nutritionist for healthy eating advice. They will have to follow a nutritional plan and a handbook that is given to them. This is important because the percentage of people with obesity is increasing with time and can lead to various health risks that could be prevented in some cases.

MEASURING PARENTAL CONSISTENCY: CONSTRUCT AND PREDICTIVE VALIDITY

Samuel Vincent, James Li (Mentor)

In this study, we will examine the validity of parental consistency as a construct using three disparate assays of parenting behavior: 1) self-reports (via the Alabama Parenting Questionnaire), 2) smartphone-based ecological momentary assessment (Mobile Survey of Parent-Child Dynamics), and 3) direct observations of parent-child interaction (Dyadic Parent Child Interaction Coding System). First, we will conduct confirmatory factor analyses to examine the factor structure of the parenting variables in which we predict the data will best fit a single factor model. Second, we will extract a “factor score” and enter that score into a linear regression model to predict child externalizing behaviors as assessed on the Child Behavior Checklist. We hypothesize that higher levels of inconsistent parenting will predict greater child externalizing problems.

RNA BINDING PROPERTIES OF THE LSM1-7 RING FROM SCHIZOSACCHAROMYCES POMBE

Johanna Virta, Eric Montemayor, Samuel Butcher (Mentor)

The Lsm1-7 ring regulates human gene expression by promoting messenger RNA decay. However, the sequence of RNA that is recognized by Lsm1-7 is unknown. Using *S. pombe* Lsm rings, which closely resemble human rings, we made the first observation of tight RNA binding affinity for Lsm1-7. The ring is capable of binding polyuridine tracts followed by an adenosine residue. Deletion of the C-terminal region of Lsm1 allows Lsm1-7 to bind polyuridine tracts more tightly, with or without an adenosine residue. These data suggest the C-terminal region of Lsm1 is a central regulator of RNA binding activity. Finally, a crystal structure was determined of the truncated Lsm1-7 ring in complex with a polyuridine RNA, showing the uridine nucleotides bind into the same binding pockets as Lsm2-8.

CONCEPTUAL UNDERSTANDING THROUGH SIGNS, SYMBOLS, AND/OR OBJECTS

Samantha Visintainer, John McGinty (Mentor)

Whether in an active learning environment or in a passive-learning setting, learning is all around us and understanding how we learn is fundamental to prosperity. The purpose of this experimental study is to determine under what conditions individuals can best learn basic math concepts, such as Euler’s Theorem, through various combinations in uses of objects, icons, and/or symbols. This research poses an intriguing question: is there a difference in conceptual understanding when the use of symbols is used in conjunction to objects compared to when the use of symbols is used in conjunction with icons? It is hypothesized that the combination of objects and symbols will harvest the greatest understanding of Euler’s Theorem than that of symbols and icons.

PROVIDING AN ACCESSIBLE ART EDUCATION FOR CHILDREN

Masha Vodyanyk, Doug Rosenberg (Mentor)

This community service project is funded by the Morgridge Center’s Wisconsin Idea Fellowship and focuses on bringing art education to children in the Eagle Heights and University Housing community at a time when they are still developing fine motor skills and learning how to express themselves in different ways. Each lesson focuses on a different historic art style, subject and/or medium. Students not only explore different ways of creating art, they also learn the history of different movements and the artists who lead them. An important aspect of these lessons is providing an extracurricular art education to those who would not normally get such an opportunity.

DESIGNING FOR CAREGIVERS: RAPID PROTOTYPING TO ENHANCE APPLICATION DEVELOPMENT

Jacob Volcensek, Siddarth Ponnala, Rachel Zenker, Nicole Werner (Mentor)

HelpCare Connect is a mobile application designed to connect networks of informal caregivers to enhance communication and coordination of care for Persons with Dementia (PwD). HCC has been developed using an iterative human-centered design process. We wanted to implement a design process that would ensure high levels of usability and acceptability for the caregivers using HCC. To accomplish this, we employed a human-centered design method known as rapid prototyping, an iterative process to deliver and evaluate prototypes. We used sketching, paper prototypes, and wire framing to visualize and discuss design requirements with design researchers and software developers. Rapid prototyping allowed our team to quickly identify software development limitations, which forced our design researchers to generate innovative ideas to improve HCC usability and acceptability.

ONLINE LEARNING IN HOLOCLEAN

Jordan Vonderwell, Theodoros Rekatsinas (Mentor)

As data analytics has become an increasingly vital component of research, the need for tools to ensure data quality has become greater than ever. One such tool is HoloClean, a statistical inference engine to impute, clean, and enrich data. Currently, HoloClean works in a closed-world environment where all data must be provided at once. This project aims to use online learning techniques in order to develop an alternative method for HoloClean. Using these techniques, we are able to account for data that is streamed in over time or from multiple sources, both of which commonly occur in large projects. Allowing for continuous updates of the underlying model enables HoloClean to perform improved inference.

HAZE FORMATION IS ASSOCIATED WITH ANTHOCYANIN LOSS IN GRAPE AND CRANBERRY JUICES

Danielle Voss, Bradley Bolling (Mentor)

During the storage of shelf-stable cranberry and grape juices, pigmentation changes to brown concurrently with haze formation and its precipitation. These changes are undesirable and indicate the end of shelf-life. Color change is attributed to monomeric anthocyanin (MA) loss; however, precipitate formation is not well understood. This experiment's purpose was to identify if MA loss contributes to the formation of juice precipitate. Cranberry and grape juices were aged under accelerated conditions (50°C) for 4 days, and the MA content and turbidity were measured daily. In grape juice, MA loss preceded haze formation and occurred at a faster rate. In cranberry juice, these changes occurred concurrently and haze formation occurred at a faster rate. These differences suggest that other juice components contribute to precipitate formation.

A COMPARISON OF THE PARAVERTEBRAL BLOCK VERSUS PECTORALIS BLOCK IN CONTROLLING BILATERAL POST-MASTECTOMY PAIN IN SETTING OF TISSUE EXPANDER PLACEMENT

Christina Vulpitta, Elizabeth Wilson (Mentor)

Post-mastectomy pain affects more than half of patients undergoing the procedure and can last for years. This study aims to assess if acute and chronic post operative pain can be better managed by a novel regional anesthesia nerve block known as the pectoralis block (PECs). While the paravertebral block (PVB) is the current standard of care at UW, PECs is standard at other hospitals. PECs is easier for patients to position for placement and has less risk of harm to nearby structures in comparison to the PVB block. This study will operate as a randomized controlled trial comprised of two study arms which will be assigned randomly. We will assess our outcomes in the post anesthetic care unit (PACU), post-operative day 1, 7 and 30.

BRAIN STRUCTURE AND FUNCTION ALTERATIONS IN CHILDHOOD CHRONIC STRESSORS: IMPLICATIONS FOR FUTURE RESEARCH ON CHILDHOOD CHRONIC HEALTH CONDITIONS

Kara Waier, Anne Ersig (Mentor)

Childhood chronic health conditions (CHC) affect as many as 1 in 4 children and adolescents and can be a source of substantial chronic stress. Other types of stressors influence brain structure and function, yet little is known about the effects of CHC stress. This literature review examined research on the impact of different childhood stressors (PTSD, trauma, abuse and neglect) on brain structure and function in adolescents. We found evidence that alterations in structure and function can be identified within adolescence via neuroimaging. These findings are key to the foundation of future research regarding the effects of CHC stress on brain structure and function within adolescence. We hypothesize that CHC stress in adolescents may result in alterations to brain structure and function.

CHLORIDE TRANSPORTER EXPRESSION IN DEVELOPING RETINAL BIPOLAR NEURONS

Julie Wallin, Mrinalini Hoon (Mentor)

During CNS development, the neurotransmitter GABA switches from exerting excitation to inhibition. This is due to a change in the intracellular chloride equilibrium potential of developing neurons, achieved by downregulation of NKCC1 cotransporter 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. This project aims to develop a developmental profile of chloride transporter expression across distinct mouse retinal bipolar cell types through the use of transgenic lines, immunohistochemistry and gene expression assays. Our data will enable understanding of when GABA switches from an excitatory to an inhibitory neurotransmitter in different types of developing retinal bipolar neurons, which is key towards understanding the mechanisms governing retinal synaptogenesis.

MEDIA, TRUST, AND CITIZENSHIP IN A MULTICULTURAL DIGITAL WORLD

Devon Wanasek, Seline Wiedemer, Sue Robinson (Mentor)

As distrust in the media continues to decline, a host of new, well-funded projects are trying to figure out how to repair that credibility chasm in journalism. Our project analyzes these projects as case studies in order to create a model for newsrooms and journalistic foundations to follow that helps them address this issue. To do this, we are qualitatively coding media trust projects from around the world and interviewing their directors, thinking about challenges, strategies, and other logistics. In addition, we are hoping to re-conceptualize what it means to “trust” journalism and what role citizens might play in learning about the world. By giving newsrooms a reliable model to follow, we hope that this pattern of distrust will diminish.

SEX DIFFERENCES IN SENESCENCE-RELATED GENE EXPRESSION IN A RAT MODEL OF BRONCHOPULMONARY DYSPLASIA

Sarah Wanek, Marlowe Eldridge (Mentor)

Bronchopulmonary dysplasia (BPD), induced by hyperoxia exposure, is the most common preterm birth complication, which may be caused by increased senescence. To test this, newborn rats were exposed to hyperoxia or normoxia for 14 days and analyzed for senescence at 1 year. Cell-cycle blocking proteins (p16 and p21) expressed differently female and male compared to their controls. At one year, sex difference is presented with elevated p21 expression in female rats associated with reduced lung compliance and elevated lung collagen. p16 expression in hyperoxia males is high at day 14 and remains highly expressed at 1 year. These data suggest that lung aging is accelerated in hyperoxia rats. Moreover, there are sex differences in the mechanisms of the accelerated lung aging.

PREDICTING MOLECULAR PROPERTIES FROM MOLECULAR DESCRIPTION WITH MACHINE LEARNING

James Wang, Dane Morgan (Mentor)

Our research focuses on developing a neural network, a type of machine-learning algorithm, in order to predict properties of organosilicones. Organosilicones are a compound which, when used as an electrolyte in batteries, makes them safer and more efficient. However, developing new organosilicon compounds involves a lot of trial and error, because it's difficult to predict the properties of a compound without synthesizing it. This makes it expensive and time consuming. We are currently building off of a preexisting model called Aug-Chemception, which predicts the properties of general molecules. We have narrowed its scope to organosilicones. Currently, we're working on predicting a relatively simple property, flashpoint. Once we achieve this, we will move onto more complex properties like lithium diffusivity.

POTENTIAL ROLE OF SOIL MOISTURE AND GROUP 15 HERBICIDE SELECTION IN THE CONTROL AMARANTHACEAE SPECIES

David Wang Wang, Lina Liu, Rodrigo Werle (Mentor)

Waterhemp (*Amaranthus tuberculatus*) is ranked the most troublesome weed species in Wisconsin Cropping systems whereas Palmer amaranth (*Amaranthus palmeri*) is considered a recent threat. Soil-applied herbicides is recommended for the management of these two species. Soil moisture plays a major role on weed emergence and herbicide activation. Thus, the objective of this study is to investigate the role of soil moisture and Group 15 herbicide selection (i.e., acetochlor, dimethenamid-P, Legionnaires' disease, and s-metolachlor) on control of waterhemp and Palmer amaranth under greenhouse conditions. The study is being conducted in a factorial design arranged in a RCBD with 4 replications. The findings will assist Wisconsin's farmers understand the impact of soil moisture conditions at application and group 15 herbicide selection on control of waterhemp and Palmer amaranth.

INTERGENERATIONAL TRAUMA: INCARCERATED MOTHERS' EARLY EXPERIENCES OF CHILDHOOD VICTIMIZATION

Selesteel Warzewick, Julie Poehlmann-Tynan (Mentor)

An increase in maternal arrest and incarceration has led to various studies about its impact on childhood development. Among individuals who are incarcerated, instances of childhood abuse and neglect are higher than the general population (Wolff & Shii, 2012). Theories of intergenerational trauma demonstrate that early childhood experiences of abuse and neglect can have negative consequences on future outcomes (Jackson & Deye, 2015). This study analyzes data from 165 children who have a parent who is incarcerated within Dane County. The current study will offer insight into how early childhood experiences of abuse and neglect shape incarcerated parents' future encounters with domestic violence and their children as witnesses to domestic violence.

INTERPOLATION SCHEMES THAT DON'T RUIN STARS

Zachary Way, Rich Townsend (Mentor)

Stars are the principal source of light in the universe, so it is important to understand how they work. The light emitted by stars comes only from their outermost layers, and we cannot directly see into their interiors. However, asteroseismology (the study of a star's oscillation modes) allows us to connect observations of waves on a star's surface, to the properties of its hidden interior. Asteroseismology requires good theoretical models, and it is important to be precise in building and manipulating these models so that our conclusions of the nature of stars are equally precise. This work examines schemes used to interpolate stellar models, with a particular focus on ones that respect the physical laws underpinning stellar structure.

CULTIVATION AND METABOLOMIC CHARACTERIZATION OF ANAEROBIC AMMONIUM OXIDIZING BACTERIA

Coty Weathersby, Christopher Lawson (Mentor)

Anaerobic ammonium oxidizing (anammox) bacteria have recently been applied in sustainable wastewater treatment systems for the removal of ammonium from wastewater with minimal oxygen inputs. While the process has received increasing interest as an energy-efficient alternative to conventional wastewater treatment, the physiology of anammox bacteria and regulation of their metabolism under different environmental conditions is poorly understood, preventing further process optimization. Specifically, the availability of organic carbon in wastewater is believed to have a strong impact on anammox bacterial metabolism; however, little is known about the molecular mechanisms by which anammox bacteria utilize organic substrates. This project will investigate how the anammox species *Brocadia. spp.* remodel their metabolism in the presence of acetate versus autotrophic growth using quantitative metabolomics approaches combined with metabolic flux analysis.

TO COMPARE OR SPACE? THE ROLE OF VISUAL ATTENTION IN CHILDREN'S SCIENCE LEARNING

Ellen Weber, Haley Vlach (Mentor)

Children's ability to generalize concepts is a fundamental process in cognitive development. Previous research suggests the timing of learning can affect children's generalization and may be influenced by visual attention abilities. This study examines the link between visual attention and the efficacy of spaced, simultaneous, and massed presentation styles. In this study, preschool-aged children were shown 16 science concepts in simultaneous, massed, or spaced schedules. Each concept consisted of four category exemplars. An eye tracker measured participants' patterns of looking. Analyses are ongoing, however, we expect children in the simultaneous condition will compare exemplars in order to abstract relations. Whereas, we predict children in the spaced condition will look longer at each individual exemplar, relative to massed and simultaneous conditions, to learn relevant category features.

STAYIN' ALIVE: THE EFFECT OF DIFFERENT CARBON SOURCES ON GROWTH IN PSEUDONOCARDIA

Lexis Wedell, Soleil Young (Mentor)

The *Pseudonocardia* bacterial genus contains important species recognized for symbiotic relationships with insects, antibiotic production, and metabolism variance. Across the genus, species vary in their ability to metabolize various sugars. Previously, a graduate student had analyzed *Pseudonocardia* genomes to predict various metabolic phenotypes including growth on different carbon sources such as glucose, rhamnose, and arabinose. We compared growth on these carbon sources to identify patterns in metabolic potential corresponding to differences in clade membership and associations with ants. We also examined phenotypic differences in growth including growth rate and spore formation for these strains.

THE INFLUENCE OF HURRICANE MARIA ON SOIL CARBON DYNAMICS

Lily Weglarek, Elliot Vaughan (Mentor)

Hurricanes are powerful and can strongly influence ecosystem processes. With the frequency and intensity of hurricanes increasing, the purpose of our research is to better understand how tropical soil properties change with hurricanes. Specifically, we are addressing how Puerto Rican soil organic carbon (SOC) and nitrogen levels vary before and after Hurricane Maria. To determine the hurricane's effect, soil samples were collected before and after Hurricane Maria hit Puerto Rico. Soils were collected from sites representing forests of three ages and pastures, at three time intervals. Our analyses will help to determine the short-term effect of Hurricane Maria on SOC and nitrogen storage in different land coverage types and may provide insight on how hurricanes can affect soil fertility and climate change.

POST TAIL DYNAMIC ANALYSIS OF FINANCIAL TIME SERIES

Zeyu Wei, Zhengjun Zhang (Mentor)

Previous literature has made Fréchet model dynamic by introducing autoregressive structure on tail index and scale parameter and created the Autoregressive Conditional Fréchet (AcF) model. This study uses returns of the S&P500 constituents to investigate the tail dynamics captured by the AcF model. The study finds that filtering the original series by AR(1) does not change the tail dynamics of the original series, and the pseudo-residual extracted by GARCH(1,1) model also does not capture information about the tail dynamics of the stock returns. However, the dynamics of the tail index lies in the maximum fitted volatilities by the GARCH(1,1) model.

HEAT TREATMENT OF ALLOY 709

Matthew Weinstein, Uzziel Torres, Adrien Couet (Mentor)

Before use in nuclear power plants, materials must first be qualified by a Nuclear Quality Assurance program to ensure safety and effectiveness. New proposed materials, such as Alloy 709, must be fully characterized and studied before a NQA certification is approved. Alloy 709 and other nickel-based alloys are highly ductile, meaning that the formation of strengthening precipitates such as carbides is important for their viability as a material for nuclear applications. In this project we will be studying how these precipitates form in Alloy 709 after applying heat treatments to find the optimal treatment for material strengthening through precipitate formation.

MALLEABILITY OF CATEGORIZATION IN TYPICALLY DEVELOPING AND PHYSICALLY ABUSED CHILDREN

Emily Weiss, Seth Pollak (Mentor)

Children encounter numerous facial displays of emotion, which help guide their behavior. Individuals perceive emotions as belonging to discrete categories. We tested the degree at which participants switch from categorizing a face as one emotion (calm) versus another (anger). We also tested whether emotions are unique compared to other biological stimuli. Lastly, we examined whether children's exposure to varying degrees of emotion influenced categorization. Sixty children (6–12 years; 30 physically abused, 30 typically developing) completed computerized emotion and animal categorization tasks. In the emotion task, participants categorized faces morphed from neutral to angry. In the animal task, participants categorized morphed images of cows and horses. Our findings will provide insight into whether emotion categorization is unique and influenced by early experience.

WATER VEST

Henry West, Jacob Cohn, Isabel Reams, Nicole Froelich, Molly Snow, Lesley Sager (Mentor)

Each day, women and girls in areas of Kenya embark on strenuous treks covering upwards of 12 kilometers simply to collect water. They carry heavy loads of over 20 liters of water on their heads, which can lead to headaches and severe neck and spine damage, as well as take valuable time out of their days. Because of resource limitations, we needed to design something that can be made inexpensively and with locally-sourced materials. The result of our work is the Water Vest, an over-the-shoulders vest made from rice bags that can carry up to five gallons of water hands-free. It consists of a pocket in the front and back which each hold a locally sourced 10 liter jerrycan full of water.

INFLUENCES OF PATERNAL KIN AND/OR MALE PEER MODELS ON THE WAYS FATHERS RETURNING FROM PRISON APPROACH PARENTING

Layne Wetherbee, Luke Muentner, Pajarita Charles (Mentor)

Approximately half of incarcerated men have minor children, the majority of whom lived with their child before their current sentence. Through intergenerational transmission of parenting practices, fathers reflect parenting approaches of their family of origin onto their family of procreation. Our qualitative research uses 19 interviews from recently released fathers, and evaluates how paternal kin and/or male peer models positively or negatively influence the ways these fathers approach parenting. The interviews present common themes of paternal influences on parenting practices, such as advice on fathering, ideals of fatherhood, different or similar approaches to parenting, or the effects of a broken paternal relationship. Understanding the factors that influence fathers' engagement with their children after paternal incarceration could offer insight into parental interventions during reentry.

GROWTH OF ANTIBIOTIC PRODUCING SOIL BACTERIA SIMILAR ON LURIA BROTH (LB) VS POTATO DEXTROSE AGAR (PDA)

Elizabeth Whelan, Emma Bolduc, Joshua Pultorak (Mentor)

With the recent rise in fatal drug-resistant infections worldwide, antibiotic-resistance has become a global crisis. The discovery of novel antibiotic compounds is critical in solving this crisis—which is the goal of the Tiny Earth Project. This project tested whether soil bacteria produce more antibiotic-compounds on lysogeny broth (LB) agar plates, or potato dextrose agar (PDA) plates. Colonies from the same sample of soil were cultured on both types, transferred to plates with pseudo-pathogenic bacterial spreads, and analyzed for zones of inhibition. Finally, we performed a series of biochemical tests and DNA sequencing on the isolates. A Fisher exact test yielded a p value of 0.81. Thus, we conclude there is no significant difference in the selection of antibiotic-producers between PDA and LB medium.

THE ASSOCIATION BETWEEN HAVING A CHLAMYDIA INFECTION AND DEPRESSION AMONG ADULTS IN THE UNITED STATES, NATIONAL HEALTH AND EXAMINATION SURVEY 2009–2016

Morgan White, Susan Zahner (Mentor)

It is estimated that as many as 20% of the U.S. population has depression. Additionally, chlamydia is the most common sexually transmitted infection (STI) in the United States. Minimal research has been conducted specifically regarding the association between having a chlamydia infection and depression. The objective of this exploratory study is to describe how many U.S. adults are living with a chlamydia infection and depression, and examine the association between having a chlamydia infection and depression. Using the National Health and Nutrition Examination Survey (NHANES), we performed a cross-sectional study of U.S. adults age 18–39 years to describe the prevalence of U.S. adults who have a chlamydia infection and depression. Such findings have implications for nursing and other health professionals' care and practice.

ESTROGEN RECEPTOR ALPHA (ERA) GENE SILENCING IN THE HYPOTHALAMUS REDUCES REWARD SALIENCE IN ADULT FEMALE RHESUS MONKEYS

Molly Willging, David Abbott (Mentor)

We sought to determine the role of hypothalamic ERα in regulating reward motivation in conjunction with an overweight/obese phenotype in adult female rhesus monkeys. We utilized RNAi technology to assess specific neural ERα gene silencing (n=5) compared to age and weight matched controls (n=4). Weekly assessed body weights in ERα silenced female monkeys significantly increased from those of controls after 12 months and this differential remained after 24–30 months. Sucralose preference tests (4 x 30 min; 2 x 60 min) were quantified and digitally recorded at 24–30 months to assess motivation. A trend of decreased sucralose consumption (0.4mg/ml water) by ERα silenced compared to control females may provide insight of a neural target for novel therapeutics enabling improved female body weight regulation and motivation.

IT TAKES A VILLAGE TO SAVE A FAMILY: THE IMPACT OF COMMUNITY AND DOULA SUPPORT ON BLACK INFANT MORTALITY

Malik Williams, Larissa Duncan (Mentor)

Black women are twice as likely to lose an infant within their child's first year of life than non-Hispanic, white women. This racial health disparity is due in part to the stress that comes from the social and environmental implications of poverty and structural racism. Throughout history, Black people have had trust and support issues with white medical providers, which leads to more social stress placed upon Black women during the childbearing years. To help address these disparities, there are community-based organizations that aim to lessen the stress for patients by providing educational resources, more frequent appointments, and doula support for high-risk pregnancies. These interventions have shown promise to be cost efficient and effective at reducing infant mortality.

“THAT’S NOT OFFENSIVE!” THE PERPETUATION OF STEREOTYPES THROUGH INTERNET-BASED MEMES

Imani Wilson, William Cox (Mentor)

We will perform a Media Content Analysis (MCA) in order to assess the content, offensiveness, and popularity of internet joke memes related to stereotypes. Specifically, we will assess whether stereotype-affirming joke images are less popular (spread more) when they possess offensive or derogatory content. With this, we will examine these relationship characteristics across joke images related to different target groups (e.g., race, gender, sexual orientation). This analysis will allow the examination of the extent to which internet meme joke images may be more likely to perpetuate stereotypes when they possess either stereotype opposing, affirming, or derogatory/offensive content. We hypothesize that internet joke images that possess stereotype affirming content will spread further than those that are stereotype affirming or opposing and also comprise offensive/derogatory terms.

HIGH BLACK INFANT MORTALITY RATES IN WISCONSIN: A CRITICAL ISSUE FOR THE PROGRESS TOWARD REPRODUCTION JUSTICE

Janae Winston, Christine Garlough (Mentor)

My research examines the complex relationship between race, history, reproduction, and social justice while examining the current public health crisis of Black infant mortality in the United States and in Wisconsin more specifically. My research first provides a synopsis on the history of reproduction. This in turn offers a foundation and understanding of our current structures of health and its effects on infant mortality, specifically for Black childbearing women in Wisconsin. My research proceeds to propose an understanding of reproductive justice in order to situated infant mortality within a reproductive justice framework. It culminates in an advocacy oriented policy letter that details steps for elected official to implement in community based programs.

DEVELOPMENT OF A NEAR FREQUENCY COMMUNICATIONS FISH TAG

Alex Wolff, Terence Berry (Mentor)

Fish tagging has been used in research throughout history; however, with the digital age, the technologies and methods have been adapting. Near frequency communication (NFC) tags, can be used to advance tagging methods. These tags can be used to track, location, weight, size, and length of fish. This information can be recorded by any person with a smartphone to create a database. The project will develop and test the attributes of two types of NFC tags modeled from external tags in use today. Mechanical tag data, as well as the impact on fish health and performance will be collected and used to select the optimal design. This tag will ideally be used to publicly source data collection.

STRONG SOLUTIONS TO THE FORCED FRACTIONAL EULER ALIGNMENT SYSTEM

Tyler Wolter, Trevor Leslie (Mentor)

The Fractional Euler Alignment model is a system of partial differential equations that exhibits some salient features of the self-organized dynamics of biological systems. Most notably, solutions of this system undergo a process called ‘flocking’, whereby the velocity field converges to a constant in the long-time limit. In this presentation, we will discuss the origins of the Fractional Euler Alignment model and compare this model to others in its class. We will also consider the wellposedness of the system in low regularity function spaces from the point of view of recent work by Leslie, but focusing on the critically dissipative case, where Leslie’s methods fail. We will describe some recent work aimed at treating this case.

CS@MSL: A POSTMORTEM

Skylyn Worzalla, Maxine McKinney de Royston (Mentor)

CS@MSL was a day-long experience for 6th and 7th grade students to learn about sequential code, coping mechanisms, and collaborative software development. Drawing upon Social Cognitive Theory (SCT), which focuses on communal learning to increase underrepresented students' motivation, outcome expectations, and self-efficacy, near peer mentors lead a student-interest driven, activity-based curriculum. Funded by the Wisconsin Idea Foundation and American Family Insurance, this project was hosted at a racially and economically diverse school in a historically segregated city, which also lacks access to computer science curriculum and resources. This intervention was designed as a pilot for developing a programmatic framework that organizations in the Madison area and across Wisconsin can implement locally. In this presentation, pre- and post-survey data will be discussed.

COMPUTATIONAL DESIGN AND DEMONSTRATION OF VOLTAGE CONTROL OF MAGNETIC SKYRMIONS

Dongxia Wu, Varun Kumar Sudhakaran, Jiamian Hu (Mentor)

The objective of this project is to predict experimental conditions where magnetic skyrmions are stable at room temperature (25°C) and to demonstrate a design of creating and deleting the skyrmions by voltage-induced strain. Magnetic skyrmions are localized topological defects with swirling spin texture. Because of the thermal stability, magnetic skyrmions are promising for big data related technology. Recently, nanoscale skyrmions were discovered at room temperature with relatively low magnetic field in Pt/Co/MgO film. Our project focuses on the effect of strain on the thermodynamic stability of the skyrmions in such magnetic multilayers. This project will verify the control of nanoscale skyrmions by voltage-induced strain. We use supercomputer to run simulations. After that, We will construct a phase diagram presenting the type of equilibrium state.

THE GENETIC BASIS OF M. TUBERCULOSIS BIOFILMS USING A GENOME-WIDE ASSOCIATION STUDY

Tongzhen Xie, Caitlin Pepperell (Mentor)

Tuberculosis (TB) is an infectious respiratory disease infecting one-third of the world's population. During pathogenesis, granulomas in the lungs which, after cavitation, allow *Mycobacterium tuberculosis* (M.tb) to form a biofilm. Previous research has found that M.tb biofilms can harbor drug-persistent bacteria cells, but the association between M.tb biofilm phenotype and genetic variance has not been examined. In this study, we investigated the relationship between M.tb biofilm phenotype and genetic variation by using whole genome sequencing and a bacterial genome-wide association study statistical test. We assayed the biofilm phenotypes of clinical M.tb strains from Saskatchewan, Canada. Preliminary results suggest that changes in gene regulation is associated with biofilm production. These findings may provide novel drug targets that could allow us to treat TB patients more effectively.

SENSE OF BELONGING: STUDENTS OF COLOR AT PWI

Mai Chia Xiong, Brad Brown (Mentor)

Previous studies show that developing a sense of belonging fosters success in college but is often difficult to achieve for students of color, especially if they attend predominantly white institutions. Campus involvement has been linked to sense of belonging in some studies. In-depth interviews with 7 students of color explored how involvement in campus organizations fosters a sense of belonging and cultivates attachment to certain aspects of the PWI. Preliminary analyses suggest that locations or groups identified by the students help (1). affirm their identities, interests, and their value as students to the university; (2). develop interpersonal relationships; and (3). create comfortable spaces for students to be themselves. Findings provide insights on what and how specific groups contribute to students of color belonging at PWIs.

ENGINEERING ESCHERICHIA COLI FOR PRODUCTION OF POLY(3-HYDROXYOCTANOIC ACID) FROM SUGARS

Ke Xu, Brian Pflieger (Mentor)

Poly(3-hydroxyalkanoates) (PHA) are a class of renewable and biodegradable polyesters that can be microbially synthesized in large quantity. Demands for sustainable materials have recognized PHA as potential plastic alternatives. Due to the cost of related feedstocks (e.g., fatty acids and lipids), a challenge for large-scale PHA production is to produce polymers from cheaper and renewable feedstocks (e.g., sugars). Here, we demonstrate the production of poly(3-hydroxyoctanoic acid) (PHO) in recombinant *Escherichia coli* from sugars via an engineered metabolic pathway that combines fatty acid biosynthesis and β -oxidation.

COST-EFFICIENCY OF IMPLEMENTING GENETIC SCREENING FOR G6PD-DEFICIENCY FOR PREGNANT WOMEN WITH MALARIA ON THE THAI-MYANMAR BORDER

Diane Xue, Jason Fletcher (Mentor)

This project analyzes the costs and benefits of implementing genetic screening for G6PD deficiency on pregnant women with vivax malaria in Thai refugee camps prior to beginning malaria treatment. Currently, the only antimalarial that prevents recurring malaria episodes is Primaquine. However, Primaquine can cause severe hemolytic anemia in patients who are G6PD deficient. Under the current protocol, pregnant women with vivax malaria are never prescribed Primaquine because of unknown G6PD deficiency risk for mother and fetus, and therefore, are at risk of multiple malaria episodes. To explore the cost-efficiency of implementing G6PD deficiency followed by Primaquine treatment for G6PD-normal patients, this project analyzes the costs related to implementing point-of-care screening and changing malaria treatment protocol compared to the value of lives saved.

QUANTIFICATION OF IMAGES

Catherine Yan, Joseph Szulczewski (Mentor)

Breast cancer affects about 12% of women in the course of their lifetime and the biggest risk factor for breast cancer is increased extracellular matrix. The focus of our research is to determine how extracellular proteins effect breast cancer progression. Using multiphoton microscopy, our lab collects in vivo images of mammary cancer cells, which contain significant amounts of quantifiable data. Utilizing MatLab and FIJI macro, we are able to isolate regions of interests to quantify cancer cell protrusion dynamics and protein expression changes, as well as localization of immune cells to tumor vasculature. By constructing analysis algorithms, we enable batch quantification of data that is faster and reduces subjective error. The ability to quantify spatial information and expedite image processing is an essential asset to research.

BIOBANK-WIDE ASSOCIATION SCAN IDENTIFIES RISK FACTORS FOR LATE-ONSET ALZHEIMER'S DISEASE AND ENDOPHENOTYPES

Donghui Yan, Qiongshi Lu (Mentor)

Dense genotype data and thousands of phenotypes from large biobanks, coupled with increasingly accessible summary association statistics from genome-wide association studies (GWAS), provide great opportunities to dissect the complex relationships among human traits and diseases. We introduce BADGERS, a powerful method to perform polygenic score-based biobank-wide scans for disease-trait associations. We applied BADGERS to two independent datasets for Alzheimer's disease (AD; N=61,212). Among the polygenic risk scores (PRS) for 1,738 traits in the UK Biobank, we identified 48 significant trait PRSs associated with AD after adjusting for multiple testing. Family history, high cholesterol, and numerous traits related to intelligence and education showed strong and independent associations with AD. These results provide novel insights into the distinct biological processes underlying various risk factors for AD.

A HAMILTONIAN MONTE CARLO APPROACH TO CONTINUOUS-VARIABLE PHYLOGENETIC INFERENCE

Yichen Yang, Bret Larget (Mentor)

Phylogenetics is the study of evolutionary relationships across different species. Bayesian phylogenetic inference has been popular since the late 1990s with the development of Markov Chain Monte Carlo (MCMC) algorithms. In recent years, for sampling continuous variables, Hamiltonian Monte Carlo (HMC), an MCMC algorithm that utilizes Hamiltonian dynamics, has been shown to have a higher efficiency than many other MCMC algorithms in many settings. We propose a novel method of HMC for phylogenetics that generates nearly independent samples with a smaller order of time complexity than that of current commonly used software based on MCMC. The algorithm we developed could be further extended to improve the efficiency of these other approaches.

THE COMPLEXITY OF SEEING COMPLEX C WITH THE UW'S SMALL RADIO TELESCOPE

Delano Yoder, Brian Babler, Jacqueline Beran, Cameron Campbell, Kyra Eierman, Matthew Kalscheur, Margaret Klein, Nicholas Schnoor, Bangzheng Sun, Cameren Swiggum, Samuel Sztokowski, Snezana Stanimirovic (Mentor)

We used University of Wisconsin's Small Radio Telescope (SRT) to map the distribution of neutral hydrogen (HI) in a high velocity cloud known as Complex C. Complex C likely originated from outside the Milky Way (MW) since its velocities and metallicities are incompatible with that of the MW disk. We observed 88 spectra across Complex C, each integrated over 20 minutes. After data calibration, we found that SRT's Complex C spectra do not agree well with professional surveys. We've identified the incorrect telescope pointings to be caused by a mechanical problem with the SRT's drive. After accounting for the pointing errors we get a much better agreement with published observations. Further improvements of the SRT's drive are essential for future SRT observations.

QUANTIFYING SILENCING OF ESTROGEN RECEPTOR ALPHA EXPRESSION IN THE HYPOTHALAMUS OF FEMALE MARMOSETS

Hannah Yohnk, Alli Biskowitz, Sarah Novack, David Abbott (Mentor)

This study was designed to quantify estrogen receptor alpha (ERa) gene silencing in the hypothalamus of adult female marmoset monkeys and examine ERa's role in sex behavior and gonadotropin regulation of ovarian function. ERa immunostaining was quantified in a rostral-caudal order of marmoset brain sections obtained postmortem from females that were neurally infused with a virus to silence ERa expression (n=4) or with a control (n=4) in the hypothalamus. Sex behavior was quantified and hormonal ovarian regulation was measured through obtaining chorionic gonadotropin circulating levels. This is the first study examining ERa in female primates and its findings suggest likely ERa-specific neuroregulation in women and promise a novel therapeutic target for infertility disorders and sexual dysfunction.

THE IMPACT OF LARGE-GROUP COLLABORATION ON LEARNING OUTCOMES

Kristen Younan, Sally Wu (Mentor)

In many learning environments, educators encourage students to collaborate when completing homework and studying in an effort to augment their learning. The purpose of this research is to explore the effects of collaboration on learning outcomes by looking at any benefits or hindrances that collaboration may foster. We first analyzed data from problem sets students worked on during three periods of an electrical engineering class using submission time of every problem as a proxy to gauge which individuals were collaborating. Then, we analyzed students' scores on four exams to investigate whether there was a significant trend between group size and performance on exams. This research provides insight into what group size yields maximum benefit to students, and may help guide how instructors set up group-work.

NETWORKING MAPPING TO FORM INTRA-CONNECTIVITY DESIGN

Laura Younan, Nicole Werner (Mentor)

Informal Caregivers for persons with Dementia (PwD) operate in caregiving networks. Currently, these networks are disconnected, resulting in high levels of caregiver isolation as well as communication and coordination breakdowns within networks. Existing caregiver support tools have focused on individuals rather than supporting connection of caregiving networks. We aimed to explore caregiving network composition to inform the design of future support tools. We mapped the networks from 20 interviews with caregivers of PwD. Findings revealed: 1) caregiving network size varies widely (range = 2 to 11), and 2) Caregivers network roles can be characterized based on the relationship and frequency of interaction with the PwD. Our results will inform the design of Help Care Connect (HCC), a web-based application to enhance caregiving network connectivity.

GREENHOUSE GAS EMISSIONS OF OUR PEER INSTITUTIONS: THE GOOD, THE BAD, AND THE UGLY

Benjamin Zacher, Cathy Middlecamp (Mentor)

In order to assist higher education institutions in assessing their sustainability, the Association for the Advancement of Sustainability in Higher Education (AASHE) has created the Sustainability Tracking, Assessment, and Rating System (STARS). The report contains 64 indicators of sustainability, one of them being the Greenhouse Gas (GHG) Emissions Inventory. GHG emissions make up one of the largest components of the report and are a major indicator of institutional sustainability. This project uses statistical methods to analyze the gross emissions and GHG STARS credit rating of our peer institutions, which are determined based on similar metrics unrelated to sustainability such as endowment, full-time student enrollment, location, and area. After establishing which institutions have "good" (low) GHG emissions, this project investigates the characteristics that influence their success.

EXTERNAL BEAM RADIOTHERAPY REQUIRED FOR TUMOR REGRESSION WHEN USING CPG-OLIGODEOXYNUCLEOTIDE AND ANTI-OX40 IN AN IMMUNOLOGICALLY COLD TUMOR MODEL

Luke Zangl, Ravi Patel (Mentor)

Purpose/Objectives: We hypothesize that administering EBRT with CpG/OX40 can enhance tumor regression and survival by promoting innate and adaptive immune cell infiltration into the TME of the "cold" syngeneic B78 murine melanoma model. Materials/Methods: Mice were engrafted B78 cells in the right flank. Mice bearing tumors were randomized to placebo, EBRT, CpG/OX40, or EBRT + CpG/OX40 groups. Flow cytometry was used to analyze cell populations in the TME. Results: Minimal response was observed in mice treated with CpG/OX40 or EBRT alone. Mice treated with EBRT + CpG/OX40 exhibited tumor regression. EBRT + CpG/OX40 significantly increased survival. Conclusions: Increased innate immune cell populations and adaptive effector/suppressor cell ratios demonstrate EBRT + CpG/OX40 is a potent in situ vaccine that can turn an immunologically "cold" tumor "hot".

QUANTIFICATION OF EOSINOPHIL MOTILITY

Samantha Zaug, Deane Mosher (Mentor)

When activated by certain cytokines, eosinophils change shape and move in predictable patterns. Quantifying such movement may contribute to a greater understanding of the role eosinophils play in biological processes. For my research contributions, this is accomplished primarily through video microscopy by which cells are activated and recorded under high magnification. The resulting videos are observed for visual differences between test groups as well as processed to obtain quantitative results such as velocity, persistence, roundness, and area. These results can be compared across different cytokines, primarily IL-5 and IL-33, at varying concentrations. Consistent differences were observed between eosinophils activated by IL-5 and those activated by IL-33, with the most notable difference being velocity. Analysis was conducted using Leica image processing, Microsoft Excel, and Fiji software.

THE AMERICANIZATION OF FRENCH LANGUAGE AND CULTURE

Samantha Zeid, Jan Miernowski (Mentor)

In this research project, I explore the different aspects of how France has been influenced by American culture in terms of both internal and external aspects. By this I mean how France's position in the world has changed over the years due to the increasing levels of American influence, how Americanization has culturally converted France into the state it is today, the sphere of French vs English as the international language, as well as the impact that Americanization has linguistically had on the French language. I must add that this abstract is subject to change, as I am in the midst of specifying my subject. I may cut out the linguistics and focus heavily on the Cold War period, which is the prime of Americanization.

INVESTIGATING THE MECHANICS OF THE LYTIC CYCLE OF PROLIFERATION OF THE EPSTEIN-BARR VIRUS

Lily Zemelko, Adityarup Chakravorty (Mentor)

Epstein-Barr virus is one of the most common herpesviruses affecting humans, infecting over 90% of the population. Increasing evidence demonstrates that EBV causes Burkitt's lymphoma, nasopharyngeal carcinoma and other cancers worldwide. Our research investigates EBV's lytic cycle, which has three distinct stages: early gene expression, viral DNA amplification and late gene expression. This project visualizes viral DNA and an early and late mRNA as it goes through the lytic cycle. As a result, we will be able to gain crucial insight into the mechanics of the lytic cycle, and ultimately unravel EBV biology as a whole.

SYSTEMATIC STUDY OF GENUS LUCANUS SCOPOLI FROM CHINA

Zhihong Zhan, Craig Brabant (Mentor)

Lucanus Scopoli (1763) (Coleoptera: Lucanidae) comprises approximately 120 valid species worldwide. Nearly 70 percent of these are distributed in China and adjacent countries. Previous studies on the Chinese lucanid fauna have consisted primarily of new species descriptions; no holistic studies to examine the relationships within the genus have been undertaken. In this project, we examined specimens representing 52 *Lucanus* species from China and proposed provisional species groups. The validity of subspecies is addressed. A new species record for China is reported.

SCHOOL RULES ABOUT SOCIAL MEDIA—DO TEENS REALLY FOLLOW THEM?

Amanda Zhang, Bradford Brown (Mentor)

Adolescents' ability to keep current with social media events can be stymied by schools' restrictive policies about cell phone/social media use at school. Based on qualitative analyses of interviews with a diverse sample of 29 students, this study charted perceptions of and responses to school rules about cell phone use during school. Students agreed about their school's policies but pointed to sharp differences in how teachers enforced them. Although most said they complied with school guidelines, many students still sneak underhanded looks for fear of missing out. Social media sites are blocked on school wifi, but students bypass this by using a VPN. Findings may help schools derive effective policies for guiding students to healthy use of social media.

TECHNOLOGY ADOPTION IN SOLAR ENERGY

Yipei Zhang, Sarah Johnston (Mentor)

Solar energy is a source of clean energy and will be important for addressing climate change. The use of solar panels that track the sun (axis-tracking technology) has increased steadily in recent years. Axis-tracking increases production, but it costs more up front and is less durable. The goal of this project is to estimate a model of the adoption of this technology. We use Arcmap, Stata, and other statistical software to estimate the relationship between technology choice and other factors, including electricity market structure. One goal of restructuring electricity markets was to give firms an incentive to innovate and adopt cost-cutting technologies, so we are particularly interested in whether restructured markets are associated with increased adoption of technology.

RESCUE OF NEUROGENIC AND COGNITIVE DEFICITS OF FRAGILE X MICE THROUGH GENETIC REDUCTION OF MDM2

Lucy Zhao, Xinyu Zhao (Mentor)

Fragile X Syndrome is an inherited intellectual disability commonly caused by absence of FMRP, encoded by FMR1 on the X chromosome and essential for neuronal development and cognitive functions. Our lab previously published FMRP loss increased MDM2 levels, over-activated NSCs, and reduced neurogenesis, causing learning deficits in mature adult Fmr1-KO mice. We found that intraperitoneal injections of Nutlin-3 effectively rescues these deficits. However, whether systemic Nutlin-3 treatment rescues the symptoms by targeting only MDM2 and via correcting adult neurogenesis is unknown yet directly concerns effective therapeutic development. I aim to induce conditional MDM2 genetic reduction specifically in NESTIN-expressing NSCs and their differentiated neurons and I hypothesize NSC and adult new neurons-specific MDM2 genetic reduction can rescue neurogenic and cognitive deficits in mature adult Fmr1-KO mice.

STRENGTHENING LOCAL FOOD SYSTEMS: IMPROVING INTERDISCIPLINARY RELATIONS

Linda Zhao, Alfonso Morales (Mentor)

The objective of this research is to explore the ways that computer science can be leveraged to benefit farmers markets, which have proven to be a fundamental part of communities for various reasons. The Kaufman Lab works to enable these organizations to make better internal and external decisions. Professor Morales won grant awards to advance a toolkit for decision-making that markets around the country could use. Those awards have produced Farm2Facts, an online toolkit used by farmers market managers to collect and analyze data about their markets. By analyzing and improving both the appearance and the functionality of this site through a combination of front-end and back-end web development, we hope to reach a wider audience and empower more market managers in the United States.

INTERNATIONAL STUDENTS IN THE WRITING CENTER: WHAT SUPPORT DO STUDENTS WANT?

Zhiyun Zhao, Calley Marotta (Mentor)

The purpose of this research is to understand what kind of support international students want from the Writing Center. Current research on international students and Writing Centers constructs international students as inexperienced writers, and examines the support tutors think international students need (Cross, Holten, Picciotto, & Ruble, 2015). In this project, I use semi-structured interviews to examine international students' academic writing experience and their perspectives on the Writing Center. The results of this research provide Writing Center tutors with suggestions on how to work with international students of different academic writing backgrounds.

DIGITAL TOOLS FOR CYTOLOGY EDUCATION

Jenny Zheng, Kaitlin Sundling (Mentor)

The objective of this project is to create a learning tool which will help new cytotechnologists improve their skills in locating and diagnosing abnormal cells. Cytotechnologists aid physicians in the diagnosis of diseases through cell analysis. Prior education research has shown that active learning is beneficial and helps with recalling information. Simulation and other virtual training may improve cytotechnologists education and aid performance in their daily work. We aim to improve cytotechnology education through digital tools including the use of flashcards and the creation of a digital game that simulates lab work through Game Maker Studio. Example educational tools will be presented along with preliminary results.

STRENGTHENING LOCAL FOOD SYSTEMS: IMPROVING HOSPITALS AND FARMERS MARKET PARTNERSHIP

Judy Zheng, Alfonso Morales (Mentor)

Kaufman Lab strives to bridge a connection between local foods and hospital food systems to create a healthier food environment. The methodology includes looking at point of sales data from The Four Lakes Cafeteria at UWMC to analyze strategies that have been proven to be effective. Hospitals aspire to become a community leader in guiding people towards healthier food options. Eventually, the findings will enable an established, sustainable, and efficient partnership and build a robust and stable market between hospitals and local food producers, improve food environment at hospitals, and increase the flexibility in large food supplies in local food sourcing in broad-line distributors. So far, there has been a positive response to the marketing on sales, but the data is still being analyzed.

THE SIGNIFICANCE OF OBJECTS, ICONS, AND SYMBOLS IN MATHEMATICS LEARNING

Miaoya Zhong, John McGinty (Mentor)

The purpose of this quantitative study is to understand the mechanism for grounding while learning Euler's theorem for undergraduate students at UW-Madison. At this stage in the research, grounding will be generally defined as the process that humans use to form a relationship between a mental structure and an external object. The research question is: what advantages do learning with objects, icons, and symbols have compared to learning with icons and symbols, compared to learning with only symbols? The hypothesis is that the combination of objects, icons, and symbols will facilitate the best learning outcome in teaching Euler's theorem, which is measured by the largest difference in participants' performance on pre-test and post-test.

MISTUDIO—A WEB APPLICATION FOR MICROBIOME SEQUENCING DATA ANALYSIS

Weipeng Zhou, Zhengzheng Tang (Mentor)

A web application which provides a graphical interface to perform advanced covariate analyses and visualizations.

MEASURING THE BEHAVIOR OUTCOMES OF DAUGHTERS AND SONS WITH INCARCERATED FATHERS

Lulu Zhou, Kerrie Ann Fanning, Lulu Zhou, Julie Poehlmann-Tynan (Mentor)

Over five million American children have a parent who is incarcerated. Most studies examining the effects of parental incarceration on children focus on fathers and sons, which leads to a limited understanding about the impact of parental incarceration on daughters. The current study aims to fill the gap by exploring whether the incarceration of a father relates to sons' and daughters' behavioral outcomes differently. Participant data on 140 incarcerated fathers with 73 sons and 64 daughters who are 2–6 years of age are analyzed. Demographics and behavior outcomes such as aggression were collected for each of the children with the parent's reported closeness with the child as a mediator. This study can provide insight into designing gender-sensitive intervention programs for children with incarcerated parents.

FAMILIAL HISTORY OF ALZHEIMER'S DISEASE AND THE CEREBROVASCULAR RESPONSE TO A METABOLIC STIMULUS

Alyson Zimmerman, Jill Barnes (Mentor)

Diminished blood flow to the brain may play a significant role in cognitive decline. Adults with a family history of dementia and Alzheimer's disease (AD) may demonstrate lower blood flow compared with adults with no family history of AD. The purpose of this study was to determine whether brain blood flow during a cognitive test differs between adults with or without a family history of AD. Adults 55–69 years old, completed a three-minute N-back working memory and Stroop Color Word test. Throughout the test, mean arterial pressure (MAP) and middle cerebral arterial velocity (MCAv) were continuously measured. We hypothesized that individuals with a family history of AD may have impaired responses to the cognitive test, resulting in irregular MCAv and MAP responses.

