Undergraduate SYMPOSIUM

ABSTRACT 2022

Celebrating research, creative endeavor, and service learning

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We are very pleased you are joining us for the 24th 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 24th year is an extraordinary milestone demonstrating our steadfast commitment the Wisconsin Experience where students display their relentless curiosity, intellectual confidence, empathy and humility, and purposeful action.

John Zumbrunnen, Vice Provost for Teaching and Learning
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CONGRATULATIONS 2022 MENTORING AWARD WINNERS

Sue Robinson, Professor, Journalism and Mass Communication

Sue Robinson holds the Helen Firstbrook Franklin Professor of Journalism endowed research chair in the School of Journalism and Mass Communication. Dr. Robinson has mentored over 75 students as the faculty advisor and mentor to the Black Voice publication as well as the National Association of Black Journalists. Further, she has mentored eight students who participated in the Undergraduate Research Scholars program or the McNair Scholars program. Sue works to be an ally and her mentorship is long lasting. One student said, "With Professor Robinson, I found a mentor and teacher who was actively working on how to provide a space for Black students to learn, vent and develop as people." Another student said, "Sue is not the type of mentor to accept mediocrity or disappear once the tassel is flipped."

Nicole Werner, Associate Professor, Industrial and Systems Engineering

Nicole Werner has mentored nearly 30 undergraduate students in industrial and systems engineering approaches for improving health and wellbeing. Professor Werner's research is in care transitions across health care systems. Her undergraduate mentees have received more than 40 awards including the NSF Graduate Research Fellowship, the Baldwin Wisconsin Idea grant, the Harvey Meyerhoff Undergraduate Excellence Award, and the Discovery to Product (D2P) Commercialization Award. She uses a team-based approach in her lab, where a small group of students from all levels work together to conduct a research project and disseminate the results as conference presentations and papers. The success of this approach is demonstrated by her students' writing productivity. A recent undergraduate she mentored who went on to do their MS and graduated two years ago and now works in a hospital system wrote, "I wouldn't be in this position if it wasn't for what I learned while in your lab."

Pajarita Charles, Assistant Professor, Social Work

Dr. Charles has mentored undergraduate students in her Lab for Family Wellbeing & Justice since 2018. She has mentored 19 undergraduate students from social work, legal studies, public policy, and human development and family studies. She has weekly lab meetings with thoughtful agendas that include opportunities for all lab members to report progress, plan new goals, and discuss hot topics in the field. Beyond the weekly lab meeting, she also has a separate weekly meeting with each undergraduate student to focus on their specific goals and growth One student said, " During my time in the lab, Paja has gone above and beyond her mentoring role: she has supported my individual curiosity and questioning, provided me with learning opportunities that cater to my interests, and taught me invaluable lessons regarding professional development."

Ksenija Bilbija, Professor, Spanish & Portuguese

Ksenija has mentored undergraduates throughout her career where she specializes in cultural studies, gender criticism, and post-traumatic memory, with interest in Spanish American Literatures. Professor Bilbija has guided more than thirty students through the Hilldale collaborative grant since 1996. She has also mentored several students through the Sophomore Research Fellowship grant, supported the research of Undergraduate Research Scholars, and has served as director for one senior honors thesis. In the fall of 2018, five of her students received prizes in the essay competition held by the Human Rights Program. A student described their experience, "Ksenija's influence on my academic and personal growth extended beyond the Hilldale Grant's experience both performing boots-on-the-ground research in Santiago, Chile and our final 25-page thesis. Ksenija fostered my intellectual curiosity, the same drive that helps me approach complex patient care as a medical student at the University of Michigan."

Patricia Tran, PhD Candidate, L&S Freshwater & Marine Sciences

Patricia is a PhD student in the Freshwater and Marine Sciences program focusing on microbial ecology in freshwater, marine, and human environments. One of Patricia's mentee's summarized Patricia's impact saying, "When I first came to the lab, I had never taken a college-level biology course nor ever worked in a lab, but Patricia immediately began working with me to increase my scientific literacy, proficiency in computational and experimental lab work, and scientific writing ability. Having that support was instrumental to not only my experience in undergraduate research but also in shaping my desire to have a career in research." Patricia also employed high-impact and evidence-based practices when recruiting a new undergraduate student. Her advertisement, candidate review rubrics, and interview questions were crafted to minimize implicit bias and to highlight multiple dimensions of diversity. Practices that will have a lasting impact.

INCREASED ADIPOSITY IS RELATED TO REDUCED NEURITE COMPLEXITY IN MEMORY-RELATED REGIONS OF COGNITIVELY UNIMPAIRED ADULTS

Hanna Noughani, Barbara Bendlin (Mentor)

In cognitively healthy adults (mean age=63.5 years, SD=8.5) enrolled in the Wisconsin ADRC Clinical Core (N=383), we used the neurite orientation dispersion and density (NODDI) model to examine if obesity was related to the microstructure of memory-related brain regions: hippocampus, parahippocampal gyrus, hippocampal cingulum, uncinate fasciculus, and fornix. Microstructure was assessed using neurite density (NDI) and orientation dispersion (ODI) indices from NODDI. Obesity was measured using body mass index (BMI) and waist circumference (WC). Multiple linear regression revealed that individuals with higher BMI and higher-risk WC had significantly lower hippocampal ODI and fornix NDI. Higher BMI was related to higher uncinate fasciculus ODI. Results suggest that increased adiposity may be related to less complex neurite microstructure in memory-related regions of cognitively unimpaired adults.

HYPOTHALAMIC ESR1 KNOCKDOWN CORRELATION WITH METABOLIC MEASURES IN ADULT FEMALE RHESUS MONKEYS

Siti Hydara, Molly Willging (Mentor)

During the menopause transition, reduced serum estradiol levels heighten the risk for metabolic dysfunction. Estrogenic effects on female rodent metabolism are primarily mediated by estrogen receptor alpha (ESR1) activation within the medio-basal hypothalamus (MBH). The role of MBH ESR1 in female primate metabolic homeostasis is unknown. We utilized RNAi technology to assess ESR1 gene knockdown (ESR1KD) in the MBH of adult, female rhesus macaques. ESR1KD presented with increased body weight % change, reduced post-prandial energy expenditure, intermittent reduced morning activity, and reduced caloric intake. Thus far in correlation analyses, the extent of individual animal ESR1 knockdown and these metabolic measures are nonsignificant. Overall, these findings highlight MBH ESR1 role in regulating energy homeostasis but do not yet show a range of knockdown inducing such effects

ARGUMENTATIVE BELIEF COMPLETION NETWORK

Steven Zhang, Emaad Manzoor (Mentor)

Belief prediction using machine learning currently applies to wide arrays of online services, including basket completion and personal recommendations, while expanding exponentially both in applications and capabilities. This research explores the use and implementation of belief network data from Kialo and Twitter in training belief prediction models on AWS. The use of structured belief networks enables models to convert two-dimensional prediction data into three-dimensional graphs and networks, drastically improving the effectiveness of the model. The paper further analyzes the process and results of this research by contrasting belief network models with classically trained models and finding improvements. With greater efficiency and accuracy, the model makes predictions for more randomized use cases or smaller datasets with significantly more efficiency and accuracy.

ISOLATION OF A SUBPOPULATION OF HEMATOPOIETIC CELLS (NON-HUMAN PRIMATE MODEL) FOR ALLOGENEIC TRANSPLANT (MURIEL MODEL)

Dennis Kobuzi, Christopher Little, MD (Mentor)

Currently, the prospects of establishing mixed chimerism with respect to immunosuppression minimization and allograft engraftment is being investigated. Prior to transplant, the recipient undergoes a conditioning regimen that "creates space" in the existing bone marrow via immunosuppression for subsequent allogeneic hematopoietic cell transplant. In theory, this is how mixed chimerism is achieved: a state in which the recipient begins to undergo hematopoiesis that is a mixture of recipient and donor DNA. We specifically are creating a protocol that purifies the hematopoietic cells harvested from the donor (Non-Human Primate Model) via a lineage depletion kit and flow cytometry sorting that is increasing the probability of establishing mixed chimerism. Our subpopulation of hematopoietic cells were transfused into mice (Muriel Model) with promising levels of mixed chimerism monitored.

THEMES IN STREAM OF CONSCIOUSNESS WRITING AND THEIR RELATIONSHIP WITH MENTAL HEALTH

Kinjal Mehta, Christine Wilson-Mendenhall (Mentor)

Evidence suggests that hidden patterns in language can reveal aspects of our inner emotional life. In an online study (n = 255), participants engaged in free-form "stream of consciousness" (SOC) writing for 7–10 minutes and completed several questionnaires measuring mental health. We used a bottom-up approach to extract themes in the SOC texts. In short, the Meaning Extraction Helper software was used to generate a document term matrix that then was submitted to principal component analysis. Of the components identified, scores on a component or "theme" involving words oriented to the environment (e.g., "outside") and sensory experience (e.g., "look," "move") was consistently, positively related to mental health. These findings suggest that patterns in free-form SOC writing may be a useful, indirect indicator of mental health.

UTILIZING BEMPEGALDESLEUKIN, A CD122 PREFERENTIAL IL-2 AGONIST, AND RADIATION TO PROMOTE AN ANTI-TUMOR IMMUNE RESPONSE AGAINST B78 MELANOMA BRAIN METASTASES.

Alejandro Onate, Zachary Morris (Mentor)

In situ vaccine (ISV) immunotherapeutic strategies aim to stimulate an anti-tumor effect by harnessing a patient's own immune system. The Morris Laboratory at UW–Madison has pre-clinically demonstrated ISV when optimally combining radiotherapy (RT), immune checkpoint inhibitors, and intratumoral administration of interleukin-2 (IL2). This regimen results in complete responses against flank and even distant melanoma tumors; however, it only modestly improves survival of mice harboring brain melanoma metastases. Bempegaldesleukin (BEMPEG), a PEGylated derivative of IL2, potentially provides a safer and more effective alternative to IL2 due to its longer systemic circulation half-life, lower toxicity, and preferential activation of T and Natural Killer cells, which altogether may improve both IL2 accumulation in brain metastases and stimulate greater anti-tumor immune response. I propose to test BEMPEG in combination with ISV treatment against melanoma brain metastases. Using a murine model co-harboring melanoma flank and brain tumors, I hypothesize that groups treated with BEMPEG + ISV will display significantly improved survival due to greater numbers and activation of NK and T-cells (in both intra- and extracranial metastases). Results showing improved efficacy of BEMPEG compared to intratumoral IL2 against brain metastases would support future clinical applications for BEMPEG in combination with ISV.

ADVANCING SEPARATIONS OF OLIGONUCLEOTIDES WITH HIGH-THROUGHPUT NANO-FLOW HILIC AND FAIMS PLATFORM FOR CONFIDENT SEQUENCE AND MODIFICATION CHARACTERIZATION

Qiuwen Quan, Joshua Coon (Mentor)

RNA has several important functions in the cell which are greatly influenced by its post-transcriptional modifications. As the RNA therapeutic market has reached an inflection point and researchers aim to understand the underlying mechanism of these modifications, novel analytical techniques must be developed. Utilizing mass spectrometry for oligonucleotides is hindered by the use of non-volatile ion-pairing reagents. Since separation of complex RNAs prior to electrospray is critical for depth of coverage, we explored the use of HILIC separations, that function without ion-pairing reagents, and ion mobility with FAIMS. We show that RNA can be separated by modification status and length with both separation methods, displaying the capacity of nano-flow HILIC and ion mobility with FAIMS to allow for more rapid, high-throughput analyses of complex mixtures.

NEURAL CORRELATES ASSOCIATED WITH PERSUASION DIFFER BASED ON HEALTH AND SCIENCE MISPERCEPTIONS

Emma Goshin, Christopher Cascio (Mentor)

Science/health misperceptions are beliefs that are contrary to the epistemic consensus of the scientific community regarding a phenomenona. Individuals who hold these beliefs show resistance towards corrective information. We examined whether individual differences in beliefs in health and science misperception influence how persuasive messages are processed by recruiting 45 healthy U.S. adults from UW–Madison and surrounding community to take part in an fMRI study measuring neural activity during exposure to persuasive messages and collected self-report data on health and science misperceptions. There was a positive relationship between beliefs in science/health misperceptions and neural activity in positive valuation and self-processing regions during messages perceived as effective versus ineffective. Thus, people who hold greater health and science misperceptions put less value on message content for their goals.

IMPACT OF AIR CONTENT ON MICROWAVE ABLATION IN LUNG TISSUE

Silvia Iordache, Audrey Evans (Mentor)

Lung cancer is among the most common and deadliest cancers. Microwave ablation is a minimally invasive procedure that uses an antenna to radiate microwave energy locally to kill diseased tissue. However, the air in lung tissue impacts the ablation zone's size. We used a simulation software coupled with temperature-dependent lung dielectric properties and a dielectric mixing model to simulate. Additionally, we used an air compressor, manometer, and pressure regulator to experimentally inflate porcine lung. Simulation results show that as air content increases, the lung tissue's permittivity decreases, and the ablation zone's size decreases. Results will help guide radiologists in determining how lung inflation levels impact the microwave ablation zone size and illustrate a need to consider lung inflation for future lung microwave ablation system parameters.

SELECTION OF CHEMICALLY MODIFIED DNA APTAMERS DERIVED FROM A SEMI-RANDOMIZED G-QUADRUPLEX SCAFFOLD

Christian Gomez, Eric Kohn (Mentor)

DNA aptamers are short oligonucleotides that bind to specific target molecules. Aptamers' ability to bind protein targets makes them promising for therapeutic, diagnostic, and drug delivery applications, where they have shown great promise compared to other methods, such as antibodies. We generate libraries by randomizing key positions in an aptamer of known structure with the standard based adenine, cytosine, and guanine as well as the synthetic thymine analogue 5-ethynyl-uracil which bears a terminal alkyne. Further functionalization through click chemistry followed by selection through competitive binding assays has shown promise as a novel strategy for discovering new aptamers. This work will cover our use of the reported thrombin binding aptamer, HD22, as a scaffold for generating modified variants.

POTATO TUBER COLONIZATION BY ANDEAN AND MADAGASCAR STRAINS OF RALSTONIA

Kaylee Sorrells, Caitilyn Allen (Mentor)

The bacterial plant pathogen *Ralstonia solanacearum* (Rs) is part of a diverse species complex that causes potato brown rot which threatens food security in the tropics. Human interference has created a larger epidemic in Madagascar due to the introduction of a highly aggressive Rs strain from the Andes. To elucidate specific differences in potato plant colonization between the introduced Andean strain and the native Madagascar strain, I created genetically marked strains with antibiotic resistance and fluorescent tags analyzed their colonization patterns using microscopy and bacterial quantification. My results demonstrate that Andean strains are more successful at getting into potato tubers than native strains, which could contribute to the rapid spread of Andean strains in Madagascar.

PHASEOLUS VULGARIS CV. MEDALIST (NAVY BEAN) SHOWS INCREASED APHANOMYCES EUTEICHES DISEASE SEVERITY WHEN INTERCROPPED WITH RAPID-CYCLING BRASSICA RAPA (FAST PLANTS)

Elliot Braun, Douglas Rouse (Mentor)

Aphanomyces euteiches is an oomycete plant pathogen that causes root rot of many leguminous crops. Many Brassica species produce glucosinolate products which have been shown to suppress *Aphanomyces euteiches* infection of legumes, but the effects of Rapid-Cycling *Brassica rapa* (Fast Plants) on disease suppression remains unknown. In this study, Phaseolus vulgaris cv. Medalist (navy bean) was intercropped with Rapid-Cycling *Brassica rapa* (Wisconsin Fast Plants) and the disease severity of the navy beans was measured after infection by *Aphanomyces euteiches*. Disease symptoms of the navy beans were worse in the intercropped group when compared to the control and did not support the glucosinolate hypothesis. This leaves many questions with regard to Wisconsin Fast Plant exudates, and future research could address mechanisms underlying this phenomenon.

DEVELOPING EPIGENETIC APPROACHES TO UNDERSTAND THE INVASION SUCCESS OF BARRED OWLS IN THE PACIFIC NORTHWEST

Perla Larios Ramos, Emily Fountain (Mentor)

Barrel Owls (*Strix varia*) have expanded their territory into the Pacific Northwest, endangering Northern and California Spotted Owl (*Strix occidentalis caurina* and *S. o. occidentalis*) populations. Previous ecological data shows an increase of aggressiveness and adaptability in Barrel Owls in the Pacific Northwest; however, the evolutionary mechanisms behind these changes are currently unknown. Our objective is to develop a detection method for epigenetic changes that help invasive species thrive, such as variants responsible behavior and reproduction. We performed dissections of Barrel Owls, DNA extractions, Polymerase chain reaction (PCR) and will conduct next-generation sequencing. Our results will help prevent disturbances caused by Barred Owls and assist management with conservation of Spotted Owls. By conclusion, we hope to conduct a genome-wide association (GWAS) for Barrel Owl populations.

GENOMIC EDITING BY CRISPR/CAS9 AS A THERAPEUTIC NEURAL-NETWORK STRATEGY FOR PARKINSON'S DISEASE

Samuel Neuman, Marina Emborg (Mentor)

The neurons in the substantia nigra pars compacta (SNpc) project into the striatum, while the striatum projects into the substantia nigra pars reticulata (SNpr). Retrograde and anterograde transport between these structures can be exploited as a therapy for Parkinson's Disease. In this project, we evaluated whether genomic editing in the striatum affected protein expression in the SNpr and SNpc. Ai14 reporter mice received intrastriatal injections of NC-containing RNPs targeting the stop codon to permit expression of TdTomato. TdTomato+ fibers were detected in the SNpr when the edited striatal area was >5 mm2 but not <2 mm2. These results suggest that a biological threshold of expression is required for substantial axonal transport of the protein to be used as a neural-network therapy.

DIFFERENCES IN LIFETIME AND RECENT SUBSTANCE USE PATTERNS ON MEASURES OF WELLBEING IN EARLY SUBSTANCE USE RECOVERY

Jordan Edwards, Alejandra Colmenares (Mentor)

Substance use disorders remain a major issue facing United States, resulting in negative consequences for patients, their loved ones, and communities at large. While several factors possess clear associations with recovery outcomes, the effects of polysubstance use remain up for debate. This analysis looked at two longitudinal samples of participants in early recovery from substance use, 20 in opioid recovery and 140 in alcohol recovery. Polysubstance use and scores of psychological distresses were captured at study intake and monthly over study participation, 1–10 months. Preliminary results show that approximately 60% of the sample reported polysubstance use. Trends in anxiety and depression scores over the length of study participation are predicted to co-vary with polysubstance use, with higher psychological distress in those who use multiple substances.

LONGITUDINAL RESTING-STATE FMRI ON PARKINSON'S DISEASE: COGNITION AND PERSONALIZED FUNCTIONAL CONNECTIVITY

Renxi Li, Catherine Gallagher (Mentor)

Parkinson's disease (PD) is a prevalent neurodegenerative disease characterized by motor symptoms of tremor and rigidity, and non-motor impairments such as cognitive decline. In this study, (f)MRI and clinical data from 30 PD and 41 control recruited through a VA Clinical Science Research & Development-sponsored project were used. The cerebral cortex and subcortical regions were registered using hybrid surface/volume-based alignments. On the cortical surface, eighty regions of interest (ROIs) derived from six functional networks were spatially optimized using Personalized Intrinsic Network Topography (PINT) to account for subject-specific variations in locations of maximal correlations. ROIs for deep structures and cerebellum were derived from established functional atlases. The longitudinal resting-state functional connectivity differences of the cerebral, cerebellar, and striatal ROIs were compared between cognitively stable/declined PD and controls.

CO-CULTURE SYSTEM OF PANCREATIC CANCER ORGANOIDS WITH DORSAL ROOT GANGLION

Austin Yeung, Jeremy Kratz (Mentor)

Perineural invasion represents a common aggressive feature of advanced cancer through infiltration of nearby innervation which is suggested as a high-risk feature for early metastases and worsened survival. Prior work in two dimensional cultures has suggested peripheral axons can release serine to support the growth of exogenous serine-dependent pancreatic ductal adenocarcinoma (PDAC). Here, we examine the relevance to this dependency in three-dimensional patient-derived cancer organoid models (PDCOs). We investigate neuronal-PDAC crosstalk in response to metabolic inhibitors of PHGDH and TCA cycle inhibition. The hypothesis is that neuronal co-culture will mediate metabolic compensation in PDCOs with unique serine metabolic dependency. We report organotypic growth under the selective pressure of these agents as monotherapy and in co-culture to evaluate extrinsic contributions to cancer resistance.

INSULIN RESISTANCE MEDIATES THE RELATIONSHIP BETWEEN CARDIORESPIRATORY FITNESS AND COGNITIVE SPEED

Clayton McIntyre, Ozioma Okonkwo (Mentor)

Cardiorespiratory fitness (CRF) and insulin resistance are both thought to affect cognition in aging adults. We investigated whether insulin resistance mediates the relationship between CRF and several cognitive abilities in n=1,157 aging adults at heightened risk for Alzheimer's disease. We used a validated equation to estimate CRF, HOMA-IR to quantify insulin resistance, and cognitive composite scores calculated from performance on neuropsychological tests to measure cognitive abilities. We used linear regression models to show that CRF is associated with executive function (B=0.015, SE=0.005, p=.003) and cognitive speed/flexibility (B=0.013, SE=0.006, p=.034). Further mediation analyses revealed that insulin resistance acts as a mediator in the relationship between CRF and cognitive speed/flexibility, but not executive function. CRF was not associated with global cognition, delayed recall, or immediate learning.

USING SHEAR WAVE TENSIOMETRY IN MECHANICAL PHANTOMS WITH VARYING FIBER ALIGNMENT

Ruby Salbego, Stephanie G Cone (Mentor)

Anterior Cruciate Ligament (ACL) injuries affect hundreds of thousands of athletes every year. To treat the ligament, an autograft is taken from a healthy tendon, eventually reforming with scar tissue exhibiting unaligned collagen fibers. This alters tendon behavior, so it is important the tendon has recovered before clearing the athlete. However, there are no direct methods for measuring healing tendon behavior within humans. In this study, we use shear wave tensiometry to track loading patterns in mechanical constructs that mimic tendons with three different levels of fiber malalignment. We expect that higher degrees of malalignment will correspond to slower shear wave speeds. These results will be our first step toward creating a tensiometry based system to quantitatively track rehabilitation following surgery.

OPTIMIZING OUT PLANTING SURVIVAL AND GROWTH OF NURSERY-RAISED NORTHERN RED OAKS

Devin Mulrooney, Nick Balster (Mentor)

Northern red oak (NRO), *Quercus rubra*, provide Wisconsin with critical environmental services, as well as economic benefits in forest industries. Because NRO are difficult to regenerate naturally, afforestation efforts require nursery grown saplings. To ensure survival and growth after being out planted, nurseries provide saplings with nitrogen (N). Improper management of N fertilizer however can result in detrimental environmental consequences. Despite these tradeoffs, little long-term study has been done on the growth and survival of NRO following outplanting. We tested the hypothesis that the growth and physiological differences between seedlings raised under different nitrogen regimes would be evident in early years (2–3 years after outplanting) but not persist long term (17 years after outplanting) due to nutrient dilution and acclimation to the local environment.

GENES, NEONATAL NURSERY AND BIOBEHAVIORAL DEVELOPMENT

Mili Meredith, YuFan Ye, Allyson Bennett (Mentor)

Early life stress (ELS) has significant impacts on biobehavioral development and health. In human and nonhuman primates (NHP), neonatal intensive care unit (NICU) placement may present ELS. Understanding of the consequences and risk factors for adverse NICU-associated outcomes can help refine neonatal care practices. We used hair cortisol, clinical health data, and pedigree-based sibling relationships to identify the long-term physiological and health effects of ELS and evaluate potential genetic influences associated with vulnerability to persistent NICU-NR effects. Subjects were mother-reared (MR) and NICU nursery-reared (NICU-NR) adolescent-adult rhesus macaques born at the Wisconsin National Primate Research Center (WNPRC) from 2012-2019. I predict that NICU-NR animals will have higher cortisol and more health issues than the MR group and that adverse NICU-associated outcomes will be heritable.

IMPROVING CROSS-POPULATION POLYGENIC PREDICTION WITH LOCAL GENETIC CORRELATION

Gefei Song, Qiongshi Lu (Mentor)

Polygenic risk score (PRS) is a powerful measurement used to assess the genetic risk of specific traits and diseases. However, current methods have poor portability across trans-ethnic groups, and none of them have applied functional annotations into the models. In this study, we introduced a novel statistical framework TRIPLANE (TRans-ethnIc polygenic Prediction with LocAl geNEtic correlations), which incorporated portable informed annotation using local trans-ethnic local genetic correlations, to improve the PRS prediction. The results from both simulation and real data showed our method robustly improved the predictive power for trans-ethnic PRS, which provided a potential of the clinical utility of PRS and application into future precise medicine.

AN ARSENAL OF PROGRESSIVISM: HOW FAMILIAL BONDS BUILT AND BROKE THE LA FOLLETTE DYNASTY OF WISCONSIN (1924–1953)

Julia Derzay, Alfred W McCoy (Mentor)

Historians have separated the public and personal spheres of the La Follette political dynasty of Wisconsin. I argue that the La Follette political dynasty follows a three-generation business model. Once one understands the family business structure of the La Follettes, it becomes clear that the family is defined by their familial bonds. When unified, they established a stronghold in Wisconsin with the governorship, possessed a Senate seat, and managed their Progressive Party. But the reliance on family labor also made the dynasty vulnerable. For as the relationships began to fray, the enterprise collapsed. This breakdown left Wisconsin politics an open arena for radical Republicans. Just as the strong bonds defined the La Follette ascendancy, the breakdown of these same bonds also led to their downfall.

REDUCING DISCRIMINATION AGAINST HEALTH CARE PROVIDERS: AN EMPIRICAL TEST OF THE EFFECTIVENESS OF A SHORT INDIVIDUATION

Sai Nagisetty, Markus Brauer (Mentor)

Doctors of color are frequently treated in an offensive or disrespectful manner by their patients. This discrimination leads to low job satisfaction, burnout, decreased productivity and lower quality of care. The present research project aims to investigate whether patients' perceptions of their doctor as a competent individual influence their behavior during patient-doctor interactions. In the planned study, patients will receive (or not) a short description of their doctor with their pre-visit materials. The description will highlight the doctors extensive training and provide personal information about them. After the interaction, doctors will rate the patient's behavior toward them during the interaction whereas patients will report their satisfaction with and their trust in the doctor.

STRESSFUL LIFE EVENTS, CORTISOL AND BRAIN HEALTH IN A DIVERSE POPULATION OF OLDER ADULTS

Julianne Logan, Megan Zuelsdorff, (Mentor)

Alzheimer's Disease and Related Dementias (ADRD) disproportionately impacts historically marginalized populations including socioeconomically disadvantaged persons, rural communities, and minoritized racial groups. My undergraduate project aims to assess the relationships between lifetime acute and chronic stressors, cortisol dysregulation, and cognitive function among a sample of Native, Black, and White older adults from the Wisconsin Alzheimer's Disease Research Center. Data was compiled from a sample of 238 adults enrolled in Dr Megan Zuelsdorff's Stress and Resilience in Dementia (STRIDE) Study with complete salivary cortisol, lifetime stressful events, and demographic data. Our results supported that accumulated stressors across the life course are related to blunted cortisol awakening response, a marker of cortisol dysregulation and a risk factor for poor health outcomes.

DESIGN OF EXPERIMENTS MODEL FOR ASSESSING MICROPLASTIC IMPACT ON CYANOBACTERIAL GROWTH RATE AND TOXICITY PRODUCTION

Azul Kothari, Erica Majumder (Mentor)

To study the impact of microplastic pollution on two freshwater cyanobacterial species responsible for harmful algal blooms, batch cultures are grown with polyethylene, polypropylene and cellulose fibers of various sizes, concentrations, and states of UV-degradation. Weekly, growth rates are measured by spectroscopically quantifying chlorophyll concentration and counting cells with a hemocytometer, while toxin production is quantified through HPLC. Statistical design of experiments will generate a model for how microplastic characteristics impact growth rate and toxin production. We are also designing a filtration-based microplastic sampling device to observe microbe-plastic interactions on the St. Lawrence River. Ongoing experiments aim to quantify and improve microplastic recovery and volumetric flow rate. Our results will guide future inquiry into any association between microplastic pollution and the cyanobacterial community.

EFFICACY OF BRAIN-COMPUTER INTERFACES AND FUNCTIONAL ELECTRICAL STIMULATION INTERVENTION ON OUTCOME MEASURES OF HAND MOTOR FUNCTION IN STROKE SURVIVORS

Thomas Hosseini, Vivek Prabhakaran (Mentor)

Stroke motor impairment can be treated by non-invasive electroencephalographic (EEG)-based brain-computer interfaces (BCI). We sought to determine whether BCI+functional electrical stimulation (FES) improves motor function.21 stroke survivors (f = 16, age = 61.69±13.07, chronicity at baseline = 33.15±41.84 months) with motor impairment completed 4–32 hours of BCI-FES intervention. Group averages of hand grip strength (HGS) and Nine Hole Pegboard Test (NHPT) were compared at baseline and completion. Participants showed adaptive change from pre-intervention to post-intervention (HGS: PRE 16.07±19.67 lbs, POST 19.31±21.47 lbs, $p = 0.01$) (NHPT: PRE 184.65±128.91 seconds, POST 183.66±129.51 seconds, $p = 0.92$). Results indicate that BCI-FES intervention can improve post-stroke hand function.

EDDY COVARIANCE METHANE AND CARBON DIOXIDE FLUX TO AND FROM NORTH-TEMPERATE BOG LAKES: CAN THE MACHINE LEARN THE PROCESSES THAT CONTROL SPRING AND FALL PULSES?

Hannah Koch, Paul Stoy (Mentor)

Methane is a critical greenhouse gas that can be emitted by anoxic soils, like those associated with the thousands of lake and wetland ecosystems of Wisconsin. It is difficult to measure methane efflux during seasonal transitions like ice melt, which can release methane stored under ice. To address this we measured methane flux in northern Wisconsin bog lakes using buoy-mounted eddy covariance. There was enhanced methane efflux for nearly three weeks after lake melt, but only 20% of the variability in fluxes was captured by simple ecosystem models. We are investigating if machine learning methods can better model methane flux, and if models developed from one lake can predict methane flux from the other, to improve our ability to understand methane flux from Wisconsin ecosystems.

THE NEW LEXICON: RIGHTS ARGUMENTS IN PRE-REVOLUTIONARY FRANCE AND MODERN APPLICATIONS

Anastasia Bruss, Professor Suzanne Desan (Mentor)

How do we talk about things for which the language does not yet exist? The modern lexicon of human rights largely developed in the French Revolution and the years that followed, and has since been refined by the League of Nations and the UN Human Rights Council. I have conducted original research on early Jewish rights discourse in the years before the French Revolution, focusing on what strategies proponents of Jewish rights used to argue for equality in a world without codified human rights. My talk will cover both my historical findings and how they can be applied to modern human rights concerns.

ESTROGEN-RECEPTOR ALPHA NEURONS IN THE ARCUATE NUCLEUS MEDIATE FEMALE NEURAL INHIBITION OF NEUROENDOCRINE PUBERTY

Lukas Henjum, David Abbott (Mentor)

Puberty's onset is characterized by gonadotropin-releasing hormone (GnRH) release from the hypothalamus, and its stimulation of gonadotropin release from the anterior pituitary, initiating menstrual cycles. Non-primate GnRH release is restrained through an ovarian estradiol (E2)-mediated negative feedback mechanism regulating neurons expressing estrogen receptor alpha (ESR1) within the hypothalamus arcuate nucleus (ARC) and preventing ovarian function until adolescence. In prepubertal girls and nonhuman primates, however, absence of ovarian E2 does not trigger puberty prematurely, indicating ovarian independent restraint. We hypothesize that prepubertal restraint in female primates involves neuro-E2 synthesized in the ARC. Following bilateral ovariectomy of prepubertal female monkeys, we anticipate that infusion into the ARC of viral vector containing silencing RNA (shRNA) targeting ESR1 will eliminate GnRH restraint, implicating neuro-E2 in female primate prepubertal restraint.

THE HOMEOWNER CLASS IN METROPOLITAN PLANNING AND POLITICAL STRUGGLE

Zachary Farmer, David Canon (Mentor)

The 21st century American housing crisis manifests in a lack of affordable homes, excessive suburban sprawl, and runaway housing prices. This thesis asserts that the seeds of this current crisis have been planted throughout the postwar era, as America built a strong middle-class of suburban homeowners. The interests of homeowners are often contrary to the solutions being proposed to the 21st century housing squeeze, leading to a remarkable contestation over the location, type, and price of housing, as well as the downstream benefits of homeownership. Using a quantitative and case study analysis of Minneapolis, Houston, and Phoenix, this project theorizes on the ways that homeowners have dominated the urban political struggle and how this influence will variably determine the future of metropolitan planning and politics.

THE EFFECT OF HISTONE DEACETYLASES INHIBITORS ON THE SEXUAL DEVELOPMENT OF TOXOPLASMA GONDII

Marty Kelty, Nicole Davis (Mentor)

Toxoplasma gondii is a pathogen that infects up to 70% of people globally. Its complex lifecycle has an asexual and sexual stage. Although the asexual cycle is well studied, the sexual cycle remains relatively uncharacterized because it occurs only in the feline gut. The cat gut has uniquely high levels of linoleic acid. Previous studies demonstrated that *T. gondii* sexual reproduction is promoted by high levels of linoleic acid in the intestine, but the mechanism of this stimulation is unknown. At the concentrations found in the cat gut, linoleic acid inhibits histone deacetylases (HDACs), promoting cell differentiation. We propose that the mechanism through which linoleic acid promotes sexual development in *T. gondii* is as an HDAC inhibitor, therefore other HDAC inhibitors will promote sexual development.

CHILDREN'S PERSPECTIVES ABOUT ENHANCED VISITS WITH INCARCERATED PARENTS

Madison Berger, Julie Poehlmann- Tynan (Mentor)

Mass incarceration is a huge issue in the United States, making up more than 20% of the prison population. Children with incarcerated parents are understood to be at greater risk for behavioral and mental issues, as well as decreased school performance. The Enhanced Visits Project is a short-term innovation designed to improve family visits between children and a parent who has been incarcerated in the Dane County Jail in Wisconsin. In this analysis, I examined interviews with children and their caregivers which was conducted 3 months after the intervention ended. These interviews helped us to understand both the child and caregiver's perspectives on how the remote visits went and to learn of ways we can improve interventions with incarcerated parents for the future.

AMPLIFYING BLACK VOICES ON CAMPUS: BLACK STUDENTS' REACTIONS TO THE BIAS HABIT-BREAKING TRAINING

Shaniya Auxier, William T. L. Cox (Mentor)

Across several randomized-controlled experiments, the Bias Habit-Breaking Training (BHBT) has been proven highly effective in producing long-term reduction in racial biases among UW–Madison students. Because BHBT has been primarily tested at a predominantly White university, questions remain about the generalizability of its efficacy to students of color, especially Black students. Using a mixed-methods approach involving qualitative interviews, the present work expands assessment to specifically focus on and amplify the experiences of Black students in response to the training. In interviews, Black participants shared overall positive reactions to the training, affirmed BHBTs content was respectful to and representative of Black people's experiences of bias, and explained the perceived utility of the content for themselves and for their perceptions of others.

MOLTEN SALT STRESS CORROSION CRACKING

Alex Nelson, Adrien Couet (Mentor)

Molten salt reactors are a promising new design of nuclear reactor which are safer and more efficient than water-moderated reactors. Before they become a feasible large scale energy source, efforts are needed to better understand how structural materials corrode in molten salt environments. Currently, there has been significant research dedicated towards developing materials resistant to molten salt corrosion, but the coupled effect of mechanical stresses on corrosion has not been investigated. I have developed a unique pressurized capsule which provides tensile stress in-situ during molten salt exposure to study the effects of mechanical stress coupled with corrosion on steels. This research will fill a critical knowledge gap by providing a novel understanding of material degradation leading to an entirely new area of MSR material research.

ROLE OF HYPOTHALAMIC ESR1 IN ADULT FEMALE RHESUS MONKEY ENERGY HOMEOSTASIS

Alexis Woida, Molly Willging (Mentor)

Declining serum estradiol levels during menopause are associated with heightened risk for metabolic disease. Estrogenic effects on female rodent metabolism are primarily mediated by estrogen receptor alpha (ESR1) activation within the medio-basal hypothalamus (MBH). The role of MBH ESR1 in female primate metabolic regulation, however, remains unclear. We therefore employed RNAi technology to assess ESR1 gene knockdown (ESR1KD) in the MBH of adult, female rhesus macaques. ESR1KD females exhibited a ~22% increase in body weight after ~16 months, versus ~12% increase in controls. Via metabolic cage analysis, postprandial energy expenditure (EE) was inconsistently diminished in ESR1KD versus controls. Overall, these findings highlight MBH ESR1 role in regulating body weight and energy expenditure, and suggest a discrete MBH location for therapeutic development to combat female obesity.

EFFECTS OF GAIN-LOSS FRAMING OF PERSUASIVE MESSAGES ON MEDIAL PREFRONTAL CORTEX ACTIVATION.

Sam Pieper, Christopher Cascio (Mentor)

Research suggests that activation of the medial prefrontal cortex (MPFC) in response to persuasive messages can be used to predict message-consistent behaviors and other desired outcomes above and beyond self-report measures of message effectiveness. However, little is known about how message-level features elicit this activation, making it difficult to incorporate knowledge gained from neuroimaging studies on persuasion into persuasive message construction. With this study, we sought to build upon and partially replicate recent research into the role of message frames on the processing of persuasive messages, particularly in the MPFC. To answer this question, we recruited 45 participants from surrounding community to take part in an fMRI study that measured neural activity during exposure to persuasive messages that contained gain versus loss frames.

INVESTIGATING THE IMPACT OF PATHOGENIC TRK-FUSED GENE MUTATION ON THE EARLY SECRETORY PATHWAY IN NEURONAL CELLS

Erin Sharkey, Iryna Pustova (Mentor)

Trk-fused gene (TFG) plays an important role in trafficking secretory proteins from the endoplasmic reticulum (ER) in carriers called COPII. The R106C TFG mutation in humans causes neurodegeneration. To better understand the function of TFG in neuronal cells, we performed immunofluorescence and found that TFG is equally abundant in all parts of neurons. We quantified COPII carriers and found they were also present in all parts of neurons. Their ability to localize at ER exit sites (ERES) was not disrupted due to mutation. We quantified colocalization of TFG at ERES in wild-type and mutant neurons and found significant differences. The R106C mutation in TFG impacts its colocalization with ERES but does not affect the number of COPII carriers observed or ability to localize at ERES.

INVESTIGATING THE LINK BETWEEN SARS-COV-2 INFECTION AND COVID-TOES VIA ACTIVATION INDUCTION MARKER (AIM) ASSAY ANALYSIS OF SPIKE-SPECIFIC CD4+ AND CD8+ T-CELLS

Alexandra Alberts, Hailey Bussan (Mentor)

Increased incidence of pernio diagnoses (swelling, reddening, and abnormal tissue on the toes and fingers) during the COVID-19 pandemic suggests a potential virus-linked pernio now commonly referred to as COVID-Toes. Whether this increase is a physical manifestation of SARS-CoV-2 or an epiphenomenon is under investigation. Therefore, we sought to identify and quantify SARS-CoV-2 spike-specific CD4+ and CD8+ T-cells via Activation Induction Marker (AIM) assay. If memory T-cells are present in patients with COVID-Toes, there will be increased activation of CD4+ and CD8+ T-cells in the presence of SARS-CoV-2 antigens. Therefore, upon analyzing the T-cells of COVID-19 positive patients, patients with COVID-Toes, and a healthy control population, we expect higher numbers of SARS-CoV-2 spike-specific T-cells in COVID-19 and COVID-Toes patients than in the healthy control population.

THE EFFECTS OF INCREASING BRAIN ENDOCANNABINOIDS ON ANXIETY-LIKE BEHAVIORS IN RATS

Jessica Gottlieb, Vaishali Bakshi (Mentor)

Cannabinoids have been widely studied for potential anti-anxiety effects. We used an elevated plus-maze (EPM) to assess effects of increasing endogenous cannabinoid levels in the brain. In EPM, decreased time in closed arms, increased time in center or open arms, and increased exploratory actions, such as stretch-attends, indicate a reduction in anxiety-like state. We administered JZL184, an inhibitor of the endocannabinoid 2-AG breakdown enzyme, monoacylglycerol lipase, which results in elevated levels of 2-AG. While there was no overall effect of JZL184, we saw significant sex differences between male and female rats. Females explored open arms more. Males groomed more and JZL184 blocked this effect. From this, we conclude females were in a less anxious-like state than males, and JZL184 may have behavioral effects in males.

ROLE OF HYPOTHALAMIC ESR1 IN ADULT FEMALE RHESUS MONKEY WHITE ADIPOSE MORPHOLOGY

Andrew Neilson, Molly Willging (Mentor)

During the menopause transition, serum estradiol levels decrease and are associated with heightened risk for obesity and increased abdominal fat mass. Estrogenic effects on female rodent metabolism are primarily mediated by estrogen receptor alpha (ESR1) activation within the mediobasal hypothalamus (MBH). However, the role of MBH ESR1 in female primate metabolic homeostasis and fat morphology is unknown. We employed RNAi technology to assess ESR1 gene knockdown (ESR1KD) in the MBH of adult, female rhesus macaques. ESR1KD females exhibited a ~22% increase in body weight after ~16 months, versus ~12% increase in controls. Via microscopy, so far, there have been no differences in subcutaneous or visceral white adipocyte size or number. Overall, these findings highlight MBH ESR1 role in regulating body weight without adipose morphological changes.

EVALUATION OF AUDIENCE ENGAGEMENT WITH ASSOCIATION OF ZOOS AND AQUARIUMS ZOO SOCIAL MEDIA POSTS ABOUT CONSERVATION

Cassandra Gauthier, Allyson J Bennett (Mentor)

Zoos' mission statements center on conservation goals, including public education about conservation issues and behaviors that promote endangered species conservation. The safest way for zoos to provide public education during the 2020-21 pandemic was through online social media venues. This study identified and analyzed posts from the Facebook pages of 242 accredited zoos during January 2021, examining both post content and multiple measures of follower engagement. Compared to other kinds of posts (e.g., about animal facts, zoo events, etc.) conservation posts appeared less often and received fewer audience likes and shares. These results will help to build a more complete understanding of how social media can be used effectively for zoo-based online conservation education.

INVESTIGATING CORRELATIONS BETWEEN AIR POLLUTION PM10 AND PRO-INFLAMMATORY CYTOKINE TNF-Î±

Sommer Ray, Tyler Gavinski, Alana Sterkel (Mentor)

Air pollution is a concern of the industrialized world. The health effects of emissions are just starting to be understood. Studies have found that exposure to air pollutants causes lung damage and can increase the rate of viral infections. This study aims to investigate the impact of air pollution on the immune response to bacterial respiratory infections. Alveolar macrophages were exposed to particulate matter 10 (PM10), a common component of industrial air pollution, at a 10x serial dilution scheme. Immune response was measured via an enzyme-linked immunosorbent assay (ELISA) to detect levels of pro-inflammatory cytokine TNF-Î±. Preliminary results of the ELISA showed a strong positive correlation between concentration of PM10 and levels of TNF-Î±. Further investigation will examine the macrophages' ability to kill streptococcus pneumoniae.

HEALTHY AND ATRETIC OVARIAN FOLLICLE POPULATION IN RELATION TO ENDOCRINE PARAMETERS IN NONHUMAN PRIMATE MODEL OF POLYCYSTIC OVARY SYNDROME

Justine Hill, David Abbott (Mentor)

This study hypothesized that knockdown of estrogen receptor alpha (ERa) in the mediobasal hypothalamus (MBH) of adult female rhesus macaque monkeys will induce a polycystic ovary syndrome (PCOS) like phenotype, including an abnormal abundance of growing ovarian follicles. The knockdown and control were achieved by infusion of viral vector shRNA against ERa and scrambled shRNA, respectively. We quantified and classified ovarian follicle population density of knockdown (n=6) control (n=5) and normal (n=7) animals. To shed light on the neuroendocrine mechanisms at play in ovarian pathophysiology, we analyzed relationships between ovarian follicle populations and endocrine parameters.

THE IMPACT OF APP C-TERMINAL EDITING ON ENDOSOMAL/LYSOSOMAL PATHWAY DYSFUNCTION IN DOWN SYNDROME FIBROBLASTS

Hailey Feinzig, Mackenzie Beam, Krishanu Saha (Mentor)

Individuals with Down syndrome (DS) exhibit a high risk of developing Alzheimer's disease (AD) due to triplication of the APP gene. Elevated levels of APP-Î²-C terminal fragments (APP-Î²CTFs) in individuals with AD and DS, formed through cleavage of APP by Î²-secretase, play a key role in the development of endosomal/lysosomal pathway dysfunction. A CRISPR/Cas9 mediated knockout of the APP C-terminal region has been shown to reduce Î²-secretase cleavage, down-regulating APP-Î²CTF production in endosomes. We used this genome editing strategy to investigate endosomal/lysosomal pathway dysfunction in DS fibroblasts, evaluating early endosome size/number, lysosomal acidification, and Cathepsin-B enzyme activation in genome-edited DS, untreated DS, and age-matched control fibroblasts. Our results will help elucidate early pathological mechanisms of DS/AD which may aid in the development of potential therapeutics.

OVARIAN FOLLICLE POPULATION IN A NON-HUMAN PRIMATE MODEL OF POLYCYSTIC OVARY SYNDROME IN RELATION TO SOMATIC PARAMETERS

Danielle Bellino, David Abbott (Mentor)

In this study, we hypothesized that diminished expression of estrogen receptor alpha (ERalpha) in the mediobasal hypothalamus (MBH) in adult female rhesus macaques would produce an ovarian phenotype similar to that in polycystic ovary syndrome (PCOS). We characterized ovarian morphology with respect to follicular development and atresia in order to provide insight into ovarian changes after ERalpha knockdown. We aim to determine how the ovarian follicle population was impacted by ERalpha knockdown (n=6) by comparing the proportion and density of healthy and atretic follicles with a control group (n=5) and a normal group (n=7) that under-went no neural manipulation. To shed further light on the ovarian changes, the ovarian follicle populations were analyzed with respect to somatic parameters such as weight and body mass index.

THE POTENTIAL APOPTOTIC REGULATORY ROLE OF CPEB1 IN PANCREATIC BETA-CELLS

Hariharan Jayaraaman, Barak Blum (Mentor)

The transcriptomic identities of pancreatic beta-cells undergo unique changes depending on the diabetogenic stress they encounter. One such change is the lowered expression of the translation regulator, CPEB1, in beta-cells affected by type 1 or type 2 diabetes. However, it is unknown what purpose CPEB1 has within beta-cells. Based on current literature, I hypothesize that the downregulation of CPEB1 in beta-cells would result in higher levels of apoptosis when stressed. Here I show that in the presence of cytokines, cells of the beta-cell line INS1 exhibit a higher apoptotic index when CPEB1 is knocked down, supporting the initial hypothesis. This knowledge would contribute towards understanding the beta-cell transcriptional changes occurring when facing diabetogenic stress and potentially providing a new genetic target for treating diabetes.

THE IMPACT OF TELEVISION ON CHILDREN'S PLAY IN A NATURALISTIC SETTING

Alexandra Nunez, Raiya Lewis, Abby Zuckerman, Kathryn Illis, Heather Kirkorian (Mentor)

While there is substantial research regarding children's attention to media, most research overlooks children's attentional patterns in naturalistic settings and repeated viewings of episodes. We believe that repeated exposure to the same television episodes will facilitate a shift in media attention and attention allotted to participants' surroundings. Over a four-week period, children at a childcare center watched four *Daniel Tiger's Neighborhood* episodes five times each, while we recorded their attention to each episode. We are coding children's attention to the episodes and behaviors during attention off-sets. We hypothesize that children's media attention will decrease with repeated exposure, while social interactions and play will increase due to lowered episode novelty. Findings will help shed light on how television affects children's play in a naturalistic setting.

DEVELOPING A PEER COACH DELIVERED FALL PREVENTION PROGRAM

Hailey Reeves, Alyssa Lenius, Susan Andreae (Mentor)

Falls and fear of falling have significant public health costs, leading to injuries, loss of independence, social isolation, and decreased quality of life in older adults. While there are evidence-based programs to reduce fall risks, successful implementation of these programs can be challenging in communities with diverse cultures and languages. Peer coaches, who reside in the same community and therefore understand the unique challenges residents face, have the potential to overcome implementation barriers and develop trusting relationships with program participants. We present the process of stakeholder engagement and program development of a peer coach delivered fall prevention program in partnership with a community-based affordable housing organization.

ELUCIDATING STRUCTURE-FUNCTION RELATIONSHIPS OF ACYL-ACP DESATURASES USING COMPUTATIONAL TECHNIQUES

Ryan Kong, Michael Jindra (Mentor)

Acyl-ACP (acyl carrier protein) desaturases, which are necessary for unsaturated fatty acid biosynthesis, are ideal enzyme engineering targets for understanding mechanisms of selectivity in oleochemical biosynthesis. Our goal is to manipulate their regiospecificity to control where desaturation occurs in type II fatty acid biosynthesis, thus providing a site for further modification in platform molecules. However, the mechanisms that dictate regiospecificity are not fully understood, and prior mutagenesis studies have relatively low throughput due to barriers in analytical techniques. Here we apply computational tools like homology modeling, protein-protein docking, and molecular dynamics simulations to investigate regiospecificity of a novel desaturase from *Thunbergia laurifolia*. This pipeline is expected to expedite the discovery process as well as inform engineering efforts to design novel desaturase function.

SCREENING PROFILES OF ORAL AND PHYSICAL FRAILTY IN OLDER ADULTS WITH COMMUNITY-ACQUIRED PNEUOMIA

Nandini Suryavanshi, Raele Donetha Robison (Mentor)

Background: Oral and physical frailty are common in community-acquired pneumonia (CAP), however, not routinely screened. Aims: (1) examine oral/physical frailty profiles in patients with CAP, (2) examine if these profiles differ across CAP severity. **Methods:** Older adults (≥65) with CAP were included. Oral (XI; ≥34 = oral frailty) and physical frailty (FSQ; ≥3 = frailty) screeners were administered. Thirty days post-enrollment, CAP severity (mild, moderate-severe) was documented. **Results:** The cohort included 21 participants (Mean age: 73, SD: 7.3). No oral/physical frailty and oral/physical frailty profiles occurred at the same frequency (33%). No oral/ physical frailty was common in mild CAP (42%) whereas both frailty subtypes were common in moderate-severe CAP (36%). Conclusion: Potential, underlying impairments in oral and physical function should be considered in CAP.

THE IMPORTANCE OF INCLUSIVE LANGUAGE IN THE DISCUSSION OF POPULATION HEALTH

Natalie Meath, Claudia Delgado, Christine Muganda (Mentor)

The language we use every day has the ability to shape our thoughts, feelings, and actions. When discussing social, economic, or political issues, these implications are even greater. When vocabulary is not chosen carefully, it can be dehumanizing or belittling. Our research project aims to promote inclusive language, specifically while discussing population health and statistics. We have worked with County Health Rankings and Roadmaps to develop a website that identifies examples of problematic language and provides useful alternatives. Our goal is to encourage the use of deliberate, thoughtful language when characterizing populations using health measures.

EVALUATION OF ERÎ± KNOCKDOWN IN HYPOTHALAMUS INVESTIGATES IMPACT ON METABOLIC HOMEOSTASIS IN FEMALE NONHUMAN PRIMATES

Andi Pieczynski, Lauren Allegretti, Lillian Marrah, David Abbott (Mentor)

This study aimed to evaluate the arcuate nucleus (ARC) and ventromedial nucleus (VMN) of female adult rhesus macaques and the presence of estrogen receptor alpha (ERÎ±) gene knockdown. Viral vector administration was monitored via MRI for ERÎ± nuclei targeting. Control monkeys (n=4) were injected with scrambled RNA (shRNA), with no known gene targets, while the experimental monkeys (n=4) received shRNA encapsulated in adeno-associated virus 8 (AAV8). Retrospective expression quantification was approximately 11 months after silencing. This is one of the first studies examining ERÎ± in female primates and our findings suggest it is important for metabolic homeostasis. ERÎ±-specific neuroregulation in women is a promising therapeutic target for infertility disorders.

REGIONAL ENGLISH ACCENT AUDIO AND VIDEO ARCHIVE

Nyame Imani, Colleen Conroy (Mentor)

The goal of this project is to create an audio and visual archive of regional English accents. It will be a database of diverse speakers including spoken element samples essential to accent acquisition. As accents are evolving continuously, it is important to have access to current samples from varied speakers to be able to coach and learn them accurately and effectively. This data will be collected for use in research to determine key features of a particular accent and will serve as a database for use by vocal coaches and actors to streamline teaching and learning accents for performance. In addition, it will serve as a source for anyone wishing to appreciate the regionally diverse sounds of speakers.

DATA-DRIVEN VEGETATION PHENOLOGY FORECASTING

Supradipta Khanal, Min Chen (Mentor)

Throughout the decades, the climate has been changing rapidly and has greatly impacted the globe. The seasonal changes of vegetation, known as phenology, are a key indicator for climate change, while an important ecological question is how phenology will change with climate. Many numerical models have been developed to predict vegetation phenology, but the predictions remain highly uncertain. With the continuous observation of vegetation from a webcam network (PhenoCam), a data-driven approach can be another powerful way to forecast vegetation phenology. We implemented a deep learning algorithm to forecast phenology at several representative PhenoCam sites. While this is a small step towards combating the existing challenges associated with climate change, we identify that the use of deep learning is helpful due to its high accuracy.

UNSUPERVISED CLUSTERING TO IDENTIFY PATIENT SUBGROUPS IN A DOG MODEL OF CALCIUM OXALATE KIDNEY STONE DISEASE

Alicia Tee, Lauren Baker (Mentor)

Kidney stones are a common condition, especially in dog breeds like the miniature schnauzer (MS), that are genetically predisposed. We hypothesize that unsupervised machine learning algorithms can be used to identify unique subsets of patients that may develop stones for similar genetic reasons. 180 MS dogs were measured with multiple clinical variables. A high proportion of missing values in the dataset needed to be addressed before clustering. We attempted data imputation using multiple imputation by chained equations (MICE), but its effectiveness was limited by multi-collinearity. Cluster analysis with k-means is being performed by k-POD, which does not require imputation before clustering. By studying patient similarities that led to these clusters, we hope to better understand the complex biological processes that lead to kidney stones.

ANTIMICROBIAL POTENTIAL OF MAGGOT ASSOCIATED BACTERIA

OLIVIA Bryan, Shukria Akbar (Mentor)

Natural products (NPs) are organic compounds synthesized by living organisms. They are structurally diverse and have antimicrobial and antitumor properties. Medicinal maggots are used to combat bacterial infection and wound healing, but not much is known about the antimicrobial potential of the symbiotic bacteria associated with the maggots. This study sought to investigate the potential of maggot associated bacterial symbionts as a source of antibiotics. With growing antimicrobial resistance, discovery of antimicrobial active NPs will assist in the fight against multi-drug-resistant human bacterial pathogens. We obtained maggots from a pig cadaver, isolated their bacterial symbionts and investigated antimicrobial potential of organic crude extracts obtained from these bacteria. Our results demonstrate the crude metabolic secretions of maggot associated bacteria are active against bacterial and fungal pathogens.

BOTANY GARDEN AND GREENHOUSE CURATION PROJECT

Jack Siebert, Ingrid Jordon-Thaden (Mentor)

In order to establish preserved, pressed vouchers for each specimen within the UW–Madison Botany Garden & Greenhouse living collection, samples of interest will be collected be they flowering, fruiting, changing colors, etc. These samples will be pressed to remove moisture. After pressing, they are frozen to eliminate insects. They are then mounted and labeled to be placed into the herbarium. By keeping a preserved voucher for each living specimen, important qualitative information such as reproductive structure, fruit development, and seasonal changes may be referenced and observed indefinitely even if the living counterpart may not be in possession of the same characteristics any longer. Around 350 specimens have already been collected, pressed, frozen, and sorted in 2019, but not mounted nor labeled.

POLLEN QUALITY AS A POTENTIAL DRIVER FOR BUMBLE BEE DIVERSITY AND ABUNDANCE IN RESTORED PRAIRIES

Michelle Chung, Stephanie Mcfarlane (Mentor)

Many bee populations are declining globally, in large part due to habitat loss and resulting nutritional shortages. Restored prairies have a greater abundance of bumble bees than non-restored agricultural fields. The nutritional quality of the floral resources in prairie restorations is a potential driver of local bumble bee abundance. Pollen from herbaceous species found in restored prairies across southern Wisconsin was collected in the summer of 2021. I am completing protein and lipid assays on the pollen to determine its nutritional content. I expect to find a positive correlation between the pollen quality of the floral resources and their bumble bee abundance. This research will help determine optimal plant species to be used in future restoration efforts, ensuring healthy bumble bee populations in Wisconsin.

LARGE-SCALE REMOVAL OF BLUEGILL RESULTS IN A COMPENSATORY RECRUITMENT RESPONSE IN SUBSEQUENT POPULATIONS

Kailee Berge, Holly Embke (Mentor)

Bluegill (*Lepomis macrochirus*) experiencing high predation rely on multiple reproductive strategies. These reproductive strategies affect the energy allocation of individual bluegills, changing growth patterns. We assessed the influence of shifting bluegill densities on reproductive strategies in two northern Wisconsin lakes. From 2018 to 2021, ~285,000 centrarchids were removed from an experimental lake while a reference population was monitored. We observed alternating increases and decreases in abundances, indicating a compensatory recruitment response. Mean length decreased 2017–19, increased in 2020, then decreased in 2021. These fluctuations in body length indicate at lower population densities, bluegills may allocate more energy to reproduction and thus result in an increased abundance of small individuals. Understanding the effects of shifting populations on bluegill growth and reproduction has important fisheries management implications.

REVIEW ON NEW STAR FORMATION AND IT'S RELATION WITH THE ENVIRONMENT

Lewin Shen, Brooke Kotten, Ralf Kotulla (Mentor)

Star formation is a critical aspect of a galaxy. Newborn stars generally possess relatively strong UV radiation. This creates a so-called "extended UV disk" when inspecting a galaxy from it's UV images. However, the state of new star formation varies a lot among different galaxies and the causation is unclear. It is imperative to find out where and how those new stars are formed. In this project, we identify a list of galaxies with extended UV disk and probe into different parameters such as galaxy type and number of nearby galaxies to search the common properties of those galaxies. It is observed that the existence of extended UV disk is related to the morphology type and other environmental factors around the galaxy.

OVARIAN AND EXTRA-OVARIAN ESTRADIOL REGULATION OF CALORIC INTAKE AND LOCOMOTION IN ADULT FEMALE RHESUS MONKEYS

Samantha Williams, Molly Willging (Mentor)

Declining serum estradiol (E2) levels during the menopausal transition are associated with heightened risk for metabolic disease. Ovarian estradiol, E2, supports female metabolic function. While ovariectomy (OVX) in rodents enables obesity, OVX in nonhuman primates (NHPs) inconsistently alters weight gain. We therefore hypothesized that in female NHPs, extra-ovarian E2 provides key support for metabolic homeostasis, such as caloric intake and locomotion. To test this, we employed aromatase inhibition to eliminate extra-ovarian E2 biosynthesis. Twenty adult female rhesus monkeys were OVX and received: (1) E2-containing capsules and letrozole treatment (n=6); empty capsules and either (2) vehicle (n=6), or (3) letrozole (n=7) treatment. Six months into the study, no differences in caloric intake or locomotion were observed, suggesting estradiol-mediated energy imbalance may manifest after more prolonged estradiol depletion.

KINETIC AND SEQUENCE-RELATED DETERMINANTS OF PROTEIN SOLUBILITY

Lucas Bartel, Siyu Li, Kevin England, Silvia Cavagnero (Mentor)

Protein aggregation is responsible for many challenges in biotechnology and medicine, including formation of insoluble inclusion bodies during recombinant protein production and generation of aggregates in neurodegenerative and systemic diseases known as proteinopathies. A better understanding of aggregation modalities is needed to combat the above problems. In this work, we employed anaerobic heating-and-cooling to show that approximately 80% of the native *E. coli* proteome is kinetically trapped relative to insoluble aggregates. In addition, we discovered that protein sequences contain easily-measurable predictive indicators of solubility. Specific combinations of hydrophobicity and net charge per residue determine foldability and intrinsic disorder, yet they are not sufficient to predict solubility. However, the presence of alternating disordered and foldable regions along the sequence promotes solubility.

EXPLORING THE TYROSINE METABOLIC NETWORK IN TALINUM PANICULATUM

Megan Gundrum, Hiroshi Maeda (Mentor)

This project focuses on the aromatic amino acid tyrosine (Tyr) and its metabolic network in the plant *Talinum paniculatum*, which have been found to produce many diverse Tyr-derived compounds. Tyr-derived compounds are important phytochemicals for both plants and humans: for example, they can be used to treat neurological disorders. To understand how the Tyr metabolic network changes during growth and development of *T. paniculatum*, we performed metabolite analysis of tissue from seed to mature plants. During a second experiment, we induced various stresses on *T. paniculatum* plants to investigate metabolic changes involved in the plant's stress response. The findings of these experiments could one day be used to help maximize the amount of tyrosine produced by a plant, possibly through genetic engineering or growth conditions.

EXPERIENCES ACCESSING THE MONTHLY CHILD TAX CREDIT AMONG MOTHERS WITH LOWER INCOMES

Kaitlyn Israngkun Na Ayuthia, Sarah Miller, Sarah Halpern-Meekin (Mentor)

The Baby's First Years (BFY) study examines the impact of mothers' receipt of unconditional cash transfers on early childhood development. One thousand mothers with incomes below the federal poverty threshold agreed to participate and be randomly assigned to receive large ($333) or small ($20) monthly cash gifts. Baby's First Years: Mothers' Voices is a BFY substudy with 80 BFY mothers participating in qualitative interviews about their lives. In this study, we examine mothers' experiences with the Child Tax Credit that was expanded in 2021 through the American Rescue Plan. Specifically, we uncover what proportion of mothers did not receive this benefit, whether their receipt varied by them receiving the large or small gift, and the role of administrative burdens in their access to this resource.

NON-CANONICAL FUNCTION OF INTERLEUKIN-10 IN NEUTROPHIL HOMEOSTASIS

Landon Zimmerman, Anna Huttenlocher (Mentor)

Interleukin-10 (IL-10) is a potent anti-inflammatory cytokine. In its classical roles, it is known to mediate its effects by suppressing macrophage and T cell responses. In some of its non-classical roles, it regulates neuronal and adipose tissue homeostasis and epithelial wound repair. Proper neutrophil mobilization from hematopoietic tissues is fundamental for human health and disease. We found that IL-10-deficient zebrafish larvae have reduced number of neutrophils in the caudal hematopoietic tissue and the larvae display overall inflammatory phenotype, indicating neutrophilia. These observations suggest that IL-10 may play a non-canonical role in neutrophil homeostasis.

MILITARY MENSTRUATION: INTERPRETING GENDER AND CITIZENSHIP IN THE U.S. MILITARY

Maia McKeon, Shreya Bandyopadhyay, Stella Douglas, Kristen Halfmann, Sarah (Frankie) Frank (Mentor)

There is little research on how the U.S. Armed Forces handle menstruation. The present research seeks to better understand the female body as regulated via menstruation and citizenship in the military. Using virtual ethnography and discourse analysis, we have collected and organized over 70 items from Reddit, Quora, YouTube, TikTok, the U.S. Army Public Health Center, and online editorials/blogs. Using Atlas.ti, the research team is currently coding collected data via thematic content analysis. Preliminary findings show that many of the discussions on menstruation in the military are focused on bootcamp/training and the U.S. Army, as well as birth control access, cycle changes, and the use of birth control to suppress period bleeding.

MICROBIAL INTERACTIONS BETWEEN SKIN COMMENSALS AND CANDIDA ALBICANS

Heaven Kim, Uyen Thy Nguyen (Mentor)

The human skin microbiome consists of distinct microbial communities which produce diverse molecules including microbial volatiles, which could act as a defense barrier for the skin. Volatiles are unique in that they can interact with microbes through gaseous forms and at greater distances than typical microbial interactions. This research project focuses on the possibility of commensal skin microbes' role in inhibiting *Candida albicans*, a fungal pathogen, through volatile production. *Candida albicans* causes Candidiasis (a prevalent infection in hospitals, chronic wounds, HIV patients). In this project, commensal skin bacteria is tested against *Candida albicans* in search of inhibitory volatile producers; with the successful capture and identification of inhibiting volatiles, antibiotics targeting the severity and effects of HIV, chronic wounds, and hospital-acquired infections could be produced.

PARENTING PROGRAM: EXAMINING FATHER-CHILD AND CO-PARENTING RELATIONSHIPS

Jasmyne Short, Pajarita Charles (Mentor)

As of 2016, over half of the prison population in the U.S. includes parents. The parents are predominantly fathers, many of whom will eventually experience reentry. During incarceration, parent-child and co-parenting relationships are significantly changed. Pathways for Parents after Incarceration is a community-based program designed to help fathers strengthen child and family relationships and improve reentry outcomes through parenting and relationship skill building, therapeutic peer support, and family engagement. This study will compare child-parent relationship and parenting alliance outcomes between pre- and post-test time points to assess for changes in the fathers' relationships. The findings of this study have implications for future practice and research that encourages favorable development and testing of programs for criminal-justice-involved parents and their families.

USING OPTICAL CHARACTER RECOGNITION TO QUANTIFY CODE-SWITCHING IN BILINGUAL STORYBOOKS

Randy Jerez, Melina Knabe (Mentor)

Bilingual storybooks for children can span various formats: sentences might be displayed in a single language (e.g., Lisa has a little llama. Lisa tiene una llamita.) or the two languages might be mixed, or code-switched (e.g., Lisa tiene a little llama. Lisa has una llamita.). As part of a content analysis of Spanish-English bilingual children's books, our aim was to develop a tool that can quantify the number, direction, and type of code-switching found in bilingual books. For this purpose, we developed an Optical Character Recognition program, which uses an algorithm to scan visual media (i.e., book PDFs) and extract text relevant for data analysis. Our next step is to use this tool to understand the textual characteristics of the sampled storybooks.

NARROWING THE SOIL CONDITIONS LEADING TO INCREASED RATE OF FUSARIUM SPP. IN DISEASED TWO-YEAR-OLD PINUS RESINOSA SEEDLINGS IN WISCONSIN

Jaya Suneja, Nick Balster (Mentor)

Wilson State Nursery (WSN) supplies millions of red pine seedlings supporting annual reforestation efforts in Wisconsin. In spring 2021, WSN managers observed fungal (*Fusarium spp.*) infection in its two-year-old red pine seedlings, threatening current and future production. As cultural practices failed to control the disease, abiotic factors were suggested to drive its spread. An observational study, conducted in summer 2021, identified lower volumetric moisture content in areas of diseased seedlings compared to healthy locations. I will present the findings of this study and the development of an upcoming experiment to test hypotheses resulting from these observations. This experiment will help fill important gaps in our understanding of the environmental conditions driving the disease and identify management practices to limit the disease's impact in forest nurseries.

MAPPING THE UNIVERSE WITH RADIO WAVES: SIMULATING EFFECTS OF THE LOCAL ENVIRONMENT ON A RADIO TELESCOPE

Haotian Cao, Peter Timbie (Mentor)

Employing the new experimental technique, line intensity mapping, the Tianlai Pathfinder Array aims to investigate the large-scale structure of the universe by capturing the radio signal from the 21-cm line of hydrogen gas. This project uses computer simulation technology (CST) electromagnetic simulation software to fully understand the ground-coupling effect of the radio signal: ground conductivity, terrain roughness, and the frequency-dependent dielectric constant all affect the radio signal emitted by the ground and coupled into the telescope. We calculated the beam pattern for various elevation angles of the Tianlai antennas; the simulations for single dishes and pairs of dishes with the ground are compared with previous simulations with no ground present. We conclude that the local environment of a radio telescope can create significant systematic effects.

THE RISE OF CHINA: THE EFFECT OF THREAT INFLATION ON AMERICAN PUBLIC OPINION

Katherine Morgan, Jon Pevehouse (Mentor)

This project examines the effect of elite threat inflation on American public opinion toward the economic, political, and military rise of China. First, the project investigates the inflammatory rhetoric of public speeches by U.S. presidents regarding the threat of China. The project then analyzes public opinion polls over the last two decades in order to gauge the change that this rhetoric has on public attitudes toward the rise of China. As various presidents have inflated the threat of China's rise, the American public has formed increasingly negative attitudes toward China. The paper concludes that the past three American presidential administrations have inflated the threat of the rise of China as a power ploy to gain global hegemony in a time of great power conflict.

NEW GENETIC MARKERS FOR HUMAN B CELL FUNCTIONAL MATURATION

Anna Mikat, Sara D Sackett (Mentor)

Diabetes is a metabolic disorder in which the β cells of the pancreas produce minimal to no insulin, preventing the body from performing glycolysis. Advancements in stem cell technology enable the development of insulin-producing stem cell-derived Î² cells (SCβCs), but these cells do not exhibit the same level of insulin secretion as mature β cells. Characteristic genetic markers at each developmental stage help to model pancreas development during SCβCs differentiation, yet few markers have been validated to reflect human islet functional maturation. Utilizing qPCR on SCβCs, human fetal pancreas, and adult human islets, we screened potential β cell maturation markers, which can be utilized to assess the maturity of SCβCs and potentially improve the differentiation of these cells to have better function.

PANDEMIC ENTERTAINMENT

Anaya Frazier, Darshana Mini (Mentor)

The COVID-19 pandemic has impacted many sectors of life: the economy, the health care system, and even the entertainment sector. This project aims to examine how the pandemic has impacted the entertainment sector, and the aesthetic changes it has given way to in the world of television and film, specifically on OTT platforms. Everyone consumes entertainment, and the consumption of it affects our mental state. Additionally, OTT platforms are some of the only places for people to find joy during the pandemic.To improve our understanding of how media was consumed during the pandemic and to help measure how the pandemic changed the entertainment industry we plan to create an archive of sources focused on media produced slightly before and during the pandemic.

EVALUATION OF VARIOUS CORRECTION METHODS ON COVID MISINFORMATION

Yilin Du, Sijia Yang (Mentor)

During the pandemic, misleading information about COVID-19 spreads on social media. The misleading information might result in severe health risks due to the potential exposure to the COVID virus. Since previous research reveals correction methods' efficiency varies, this project aims to further evaluate the methods of coherence narrative, emotional appeal, and visual content on Twitter and Facebook through a randomized experiment. Machine learning will be used to evaluate the subjects' stance and engagement after the treatments. My responsibility is human coding for machine learning training and providing peer fact-checker examples. Findings in the coding process are reported to adjust the experiment. For instance, anti-vaxxers concerned about severe side effects, so we could respond to that misinformation. I participate in experiment implementation and data interpretation.

ANALYSIS OF SIZE, SOLUBILITY AND NUMBER OF HSP70 BINDING SITES ACROSS THE E. COLI PROTEOME

Xi Che, Silvia Cavagnero (Mentor)

Correct protein folding is crucial for the health of living organisms. The Hsp70 chaperone system promotes folding through multiple mechanisms, but which mechanisms are used for specific client proteins are not clear. We address this question by examining the relation between protein size, solubility, and the number of Hsp70 binding sites for 2260 *E. coli* cytoplasmic proteins. We show that the number of Hsp70 binding sites is directly proportional to protein size. Additionally, in the absence of chaperones, 92% of proteins with one Hsp70 binding site are soluble, but only 45% of proteins with multiple binding sites are soluble. We propose that multiple binding sites may promote folding of large aggregation-prone client proteins by enabling these proteins to bind multiple Hsp70 chaperones simultaneously.

EXAMINING THE FEASIBILITY AND ACCEPTABILITY OF THE PATHWAYS PROGRAM

Genevieve Grade, Pajarita Charles (Mentor)

Pathways for Parents after Incarceration is an intervention designed for fathers recently released from prison or jail that focuses on parenting and familial skills over an eight-week class and peer support group. It was adapted from the Parenting Inside Out (PIO) curriculum and implemented in a feasibility and acceptability study with the goal of improving family and reentry outcomes. This analysis focuses on questions of feasibility (recruitment, retention) and acceptability (satisfaction, helpfulness). To better understand the potential usefulness of parenthood programming for individuals in reentry, father and caregiver participants were interviewed before and after the intervention. Initial findings about enrollment and retention rates suggest challenges that accompany post-incarceration intervention work, while participant and facilitator interview data suggest a high degree of acceptability.

HAVE FINANCIAL FEDERAL AGENCIES BECOME MORE INDEPENDENT OVER TIME?

MIA Bhushan, Devin Judge-Lord (Mentor)

Outcomes of federal rule-making proposals in response to congressional lobbying is integral towards understanding how government institutions work. However, federal agencies vary in level of independence as measured by how responsive they are to public demands. Previous studies have shown that federal agency rule making, especially within the financial divisions, has become more independent over time, with agencies becoming less responsive to public comments. Using data from prior studies conducted by Dr. Jennifer Selin and Dr. Devin Judge-Lord, I seek to study whether this pattern can be seen within the congressional sphere (i.e., if financial federal agencies are responsive to congress members). I also attempt to see if there may be any change of influence for those within the same or opposing party of the President.

MICE HARBORING MBD1 MUTATION FOUND IN HUMAN AUTISM PATIENTS EXHIBIT BEHAVIORAL DEFICITS

Sebastian Krebsbach, Xinyu Zhao (Mentor)

Methyl-CpG binding proteins (MBDs) play a crucial role in regulating mammalian epigenetic gene expression. Several studies have shown that knock-out of methyl-CpG binding protein 1 (MBD1-/-) leads to reduced adult neurogenesis and autism-like behaviors. In humans, MBD1 mutations have been found in a small number of patients. However, whether MBD1 mutations lead to behavioral deficits in humans remains unclear. We have generated a transgenic mouse line with the mouse-equivalent human mutation found in autism patients, MBD1-E339K. We found that MBD1-E339K mice exhibited autism-like behaviors. Further investigating the mechanism in which human MBD1 mutation leads to autism-like behaviors is required to expand our knowledge of transcriptional gene repression and provide meaningful information for potential treatments to restore MBD1 functions in autism patients.

LATINX LEADERSHIP

Adrian Cruz-Perez, Alfonso Morales (Mentor)

Leadership is an important element to an organization's success and ultimately creates organizational culture, for success or failure. Through the recollections of current and previous leaders in recorded interviews sharing their memories of how they grew The Resurrection Project, an organization focused on creating social change within the Pilsen, Chicago, neighborhood by creating affordable housing for Latinos. I explore interactions between leaders such as Joe Nehri and Raul Ramundo, who see the growth of other organizational members, like Alma Silva, as very important. I've analyzed how their actions reciprocate resilience, passion, and growth across the organization. A great leader is not born but instead is forged through experience and the relationships that are fostered through challenging another.

THE CONSTRUCTION OF LANGUAGE LEARNERS' MULTILINGUAL-PROFESSIONAL IDENTITIES AND TRAJECTORIES IN CAREER ADVISING APPOINTMENTS: A SOCIAL NETWORK ANALYSIS

Zachary Lesmeister, Ryan Goble (Mentor)

How do language learners' social networks shape how bi/multilingual-professional lives are narrated in career advising appointments? Data for the study on the affordances of career advising for helping collegiate language learners to develop multilingually in professional life includes 50 audio-recorded career-advising appointments and interviews among learners of nine different languages. The analysis showed how select participants have already expanded their social networks to use an additional language outside of class in innovative ways. They also aimed to use their non-English language professionally, and advisors taught them how professional networking would be key for maintaining engagement with the language after graduation. Yet, the connection between the two perspectives toward social networks often went unrealized. These findings show how student affairs might better support bi/multilingual students.

ASSESSMENT OF THE INTERACTION BETWEEN SOIL PHYSIOCHEMISTRY AND MICROBIAL PLASTIC-DEGRADING ABILITY IN WISCONSIN LANDFILLS

Wanjing Chen, Erica Majumder (Mentor)

In this study, microbial community composition, microplastic concentrations, soil physiochemical parameters and their relationship were analyzed for soil samples collected from landfills. By using R studio, we created line plots and correlation matrices to explore the correlations between soil physiochemical parameters. For assessment of microbial community interactions with environmental factors, regression models for Shannon diversity and soil physiochemical parameters were built to see how microbial diversities are affected by different environmental factors. We also generated Bray-Curtis dissimilarity plot to view the differences of microbial community composition across different sites and ages. We observed that soil physiochemical properties varied by different depths and different ages, and the microbial community composition and functions were altered by these environmental conditions.

IMPACT OF SIBLINGS AND ELECTRONIC NOISE ON A CHILD'S LANGUAGE ENVIRONMENT AND LANGUAGE DEVELOPMENT

Grace Arendell, Kaylee Geier, Grace Cano, Sarah Short (Mentor)

Early childhood language development is impacted by the linguistic environment children are exposed to. This linguistic environment is formed by a variety of inputs including siblings, adults, and electronic devices. Previous research suggests that increased television exposure and the presence of older siblings negatively impact children's language development. We will research the impact of these factors on parent-child linguistic interactions by analyzing adult and child vocalization count, conversation turn count, and electronic noise exposure using the Language ENvironment Analysis (LENA) program. We predict that children with siblings will have increased electronic noise exposure leading to decreased child vocalizations when compared to children without siblings. This research is intended to create awareness for families about factors impacting a child's language development.

WHAT ANTI-RACIST PARENTING CAN DO

Ian Burton, Inés Botto (Mentor)

As racial diversity in the United States continues to grow, being aware of each other's cultural and historical differences that relate to race will only continue to grow in importance. Race-conscious approaches to racial socialization bring about a common understanding. To assist white parents in implementing race-conscious practices, the study aims to develop a new, pro-social, anti-racist parenting program. The curriculum was developed based on racial socialization centered around social-cognitive theory and mindfulness. The program will be tested through a pilot program administered to 20 families within Dane County who are interested in racial socialization and bias awareness. Eventually, the goal will be to show its validity along with highlighting a color conscious approach (as opposed to color blind) in discussions on race.

SENSOR DESIGN USING LIQUID CRYSTALS AND TOPICAL DATA ANALYSIS

Mushtaq Ali, Shengli Jiang (Mentor)

We utilize liquid crystals to explore the topological characterization of micrographs. Micrographs use LC's thin glass films to capture their responses to different reactive gaseous environments that have high concentrations of nitrogen gas. We focus on the data that was collected within the LC's first thirty seconds of response. The data is analyzed through chemical and linear algebraic equations and is finally turned into machine learning models otherwise known as binary classifications. This data reveals just how much harmful gases are formulating in DMMP (humid air). Topical data analysis allows us to make predictions using previously input optical responses to support neural networks. In future years the goal is to design and construct portable contaminant sensors to detect harmful components in the atmosphere and water.

THE NATIONAL STUDENT SPEECH LANGUAGE HEARING ASSOCIATION DIVERSITY, EQUITY, AND INCLUSION RESEARCH INTERNSHIP PROJECT

Sanjana Kumar, Julia Zacher, Kim Mueller (Mentor)

The purpose of the National Student Speech Language Hearing Association (NSSLHA) Diversity, Equity, and Inclusion Research Internship was to bring justice and equality, and to stand up against biases toward marginalized populations in Communication Sciences and Disorders (CS&D). The goal of this project was to address the disparity in provider representation of CS&D by extending outreach to high-schoolers in Madison, Wisconsin. Accomplishments include establishing an enduring partnership with Dane County Boys & Girls Club, creation of informational presentations and a website, and the provision of practical experiences to students (clinician-shadowing, NSSLHA involvement). The project will culminate in a paid summer research internship for two students; pre- and post-internship data will be collected to assess impact and students' perceptions of CS&D.

LANGUAGE-DEPENDENT LONG-TERM MEMORY IN MANDARIN-ENGLISH BILINGUAL LEARNING

Jiaxin Wang, Zechun Zhao, Haley Vlach (Mentor)

The encoding-specificity principle suggests that performance is enhanced when the learning and testing contexts are the same (Tulving & Thompson, 1973). Previous research has examined the language context-dependency in memory retrieval in bilingual adults. The current study aims to investigate whether bilingual children demonstrate language-dependent long-term memory. Fifty Mandarin-English bilinguals age of 5–7 will be randomly assigned to two conditions: language matched and language unmatched. Participants will first read a prerecorded e-book in either Mandarin or in English. Then, they will be tested on the novel object-word pairings in the storybook, either in Mandarin or in English, both immediately and at a 10-min delay. We are currently piloting the storybook to test the level of difficulty and to determine the appropriate age group.

RAPID EVOLUTION PERSISTS DUE TO VARIATION IN SELECTION THROUGH TIME AND SPACE

Nathan Ernst, Hamze Boulaleh, Lucas Nell (Mentor)

Increasing evidence shows that evolution can occur fast enough to interact with ecological factors such as population dynamics, but exactly how diversity is maintained hasn't been heavily studied. To discover if diversity could be maintained despite rapid evolution, we conducted experiments using dispersal among aphid cages using parasitoid wasps and pea aphids that can quickly evolve parasitoid resistance. We used two clonal lines of aphids: one resistant to wasps but a bad competitor, and another with no resistance but a good competitor. We also had two treatments: one where aphids could disperse between wasp and no-wasp cages, and another where cages were isolated. We find that dispersal maintained diversity, allowing evolution to continue interacting with ecology, while isolation did not.

ARTIFICIAL PHILOSOPHY: A QUALITATIVE ANALYSIS OF A.I'S POTENTIAL IN PERFORMING PHILOSOPHICAL DIALOGUE

Zach Olbrantz, Jan Miernowski (Mentor)

Research into the philosophy of artificial intelligence has been a mainstay of modern research since the mid 19th century, with many searching for insight into the field's implications for our understanding of knowledge, free-will, and epistemology. This research will incorporate the design and usage of experimental philosophical dialogues between the researcher and natural-language artificial intelligence bots(made possible through OpenAI's GPT-3 API research program), in an effort to gain insight into the potential of AI in performing philosophical dialogue in conversation. In doing so, this study serves both to determine the artificial intelligence's potential for meaningful philosophical conversation, as well as to examine what philosophical conclusions can be made in regards to the determination.

SURVEILLANCE THROUGH TECHNOLOGY: UNDERSTANDING UNDERREPRESENTED STUDENTS' EXPERIENCES WITH SURVEILLANCE TECHNOLOGIES DURING THE COVID-19 PANDEMIC

Sofia Garcia, Matthew Hora (Mentor)

In its early stages, this project will examine the different ways in which students are monitored or surveilled through technology and software while completing schoolwork in school and/or during extracurricular activities during the COVID-19 pandemic. This is to better understand the attitudes of students and their schooling experiences navigating their identities in schooling through different technologies and programs. I argue that students with marginalized identities are surveilled more heavily through technology when completing schoolwork assignments than their counterparts and peers in class. The data collection will consist of semi-structured interviews with recent college and high school students to understand their experiences with surveillance technologies and to compare their experiences across different identities, such as race, gender identity, sexuality, socioeconomic status, etc.

WAVELET TRANSFORM METHODS IN CHEMICAL SPACE APPLIED TO MILKY WAY STARS

Vincent Lu, Elena D'Ongia (Mentor)

The ESA-Gaia mission has been releasing unprecedentedly large sets of precise data on the positions and velocities of stars in the Milky Way. That data set allows for the analysis of moving stellar groups, which are associations of stars with similar velocities discovered in the solar neighborhood that provide for an in-depth study on the dynamics of the Milky Way. We are developing a method that improves upon past works by implementing a more accurate statistical analysis on the releases of Gaia data and will include, for the first time, chemical information obtained from Sloan Digital Sky Survey (SDSS-IV) data. The chemical information will give insight on the origin of the moving groups by associating stars born together from the ones with a dynamic origin.

SOCIAL NETWORKING SITE USE AND DISORDERED EATING SYMPTOMS AMONG YOUNG ADULTS: TESTING CONTENT AND ACTIVITY AS MODERATORS

Annalisa Chu, Heather Kirkorian (Mentor)

The present study examines the extent to which social networking site (SNS) content (i.e., thinspiration and fitspiration) and activity (i.e., active and passive use) moderate the association between SNS use and disordered eating (DE) symptoms among young adults. Participants (n = 107) reported active and passive use of SNSs, exposure to thinspiration and fitspiration, and DE symptoms (i.e., cognition and behavior) via an online survey. Results showed a significant, positive association between SNS use and DE symptoms. This association was moderated by the amount of active (but not passive) use of SNSs; the relation between SNS use and DE symptoms was stronger for participants with greater active use. Our findings suggest that health prevention efforts to address DE symptoms should focus on active SNS use.

CONCEPTUALIZING DEMENTIA CAREGIVING AS A JOB: A LITERATURE REVIEW

Emily Snyder, Nicole Werner (Mentor)

Informal dementia caregiving has not historically been conceptualized as a job. Yet, in recent years, research has begun to refer to caregiving using work-related concepts. To understand current conceptualizations of dementia caregiving as a job, we conducted a scoping review of the dementia caregiving and job design literature. Included papers were analyzed in terms of their characterization of caregiving work as a job. We found that the dementia caregiving literature is limited in its scope, leaving gaps in the attribution of dementia caregiving as a job. By conceptualizing caregiving as a job there are opportunities to improve caregiving outcomes by leveraging the decades of job and organization design literature that have been proven effective in optimizing job related outcomes.

CONTRIBUTION OF HISTONE DEMETHYLASES TO RNA PROCESSING IN PLURIPOTENCY

Hailey Thurston, Rupa Sridharan (Mentor)

Pluripotent stem cells (PSCs) can self-renew indefinitely. PSCs have less compacted chromatin with low levels of repressive histone modifications such as methylation at histone 3 lysine 9 (H3K9me), which the demethylases KDM3A/KDM3B remove. The mechanism of these enzymes' roles in pluripotency maintenance is unknown. Large steady state transcriptional changes are not seen upon KDM3A/3B loss. To study the function of these proteins in PSCs, we first used immunoprecipitation and mass spectrometry to identify the KDM3A/3B interactome and surprisingly found many RNA splicing proteins. We developed a cell line where KDM3A/3B can be rapidly removed using an inducible "degron." We performed diagnostic PCR, western blots and Sanger sequencing to validate the degron cell lines for future studies.

CELL-BASED DRUG DELIVERY SYSTEMS TO REDUCE AND ELIMINATE CANCERS

Afton LaMere, Samira Pal, Aryan Saini, Quanyin Hu (Mentor)

The limitations of current antitumor therapeutics in treating deep and immune-excluded tumor tissue make cancer a leading cause of death and call for an approach that combines cell therapy, immunotherapy, and personalized therapy by engineering bacteria and platelets to deliver nanoparticles to the desired site. Preparing a chemical linker to react with protein drugs to form nanoparticles, and then conjugating them to the surface of bacteria, makes the bacteria-based delivery system a promising technique through its interactions with the human immune system. Platelets serve as carriers of artificial antibodies for immunotherapy through their tumor-targeting and stimulus-triggered release properties when giving mice a subcutaneous tumor, removing some of the tumors, and then using in vivo imaging system to demonstrate the distribution of platelets after intravenous injection.

A DEEP LEARNING APPROACH TO UNCOVER EPIGENETIC MARKERS USING ATAC-SEQ IN SCHIZOPHRENIA PATIENTS

Matthew Chang, Pramod Chandrashekar (Mentor)

ATAC-seq is a very efficient technique for determining chromatin accessibility across the genome which helps in cataloging epigenetic markers (transcription factors, chromatin accessibility, etc) that affect gene regulation. The disease we are working with is schizophrenia (SCZ), and cases of SCZ are shown to express epigenetic mutations in these sites. Analyzing these sites using ATAC-seq with a deep learning model will help us understand the mechanisms underlying the disease and subsequently aid in the intervention and prevention of this disease. We present a deep learning approach that takes in ATAC-seq data as input to classify SCZ and control. The deep learning model can further be used to discover the genomic regions that are most useful in determining if a subject has SCZ or not.

DEFINING THE LIMIT OF A LIQUID BIOPSY MRNA EXTRACTION TECHNOLOGY ON BLOOD SAMPLES WITH A RANGE OF CELL CONCENTRATIONS

Jacob Caceres, Jennifer Schehr (Mentor)

Many treatments are available for patients with cancer, however, some patients are unable to respond quickly to treatment or develop resistance. Solid tumor biopsy testing can predict resistance, but is invasive and not always accurate. Consequently, liquid biopsy technologies are being developed. Due to the wide range of cellularity between patient blood samples, different technologies must be robust to a range of cell numbers encountered. To characterize the performance of the method across this variable, we extracted mRNA from varying numbers of cells. Cell numbers of over 50,00 exhibited loss of material to the plastic consumables. Liquid biopsies may provide a less invasive and more effective method for predicting resistance. Current methods must be refined to ensure compatibility with all sample types.

FUNCTION OF NITROGENASE MUTANTS IN VARYING ENVIRONMENTAL CONDITIONS

Annie Purisch, Alex Rivier (Mentor)

Nitrogen is atmospherically abundant and essential for life, but must be reduced to ammonia for use by cells. This nitrogen fixation process depends on function of nitrogenase enzymes which can be studied in nitrogen fixing bacteria, namely *Azotobacter vinelandii*. This project aims to understand how mutations in nitrogenase enzymes will affect growth of *A. vinelandii* in conditions where nitrogen fixation is essential. Strains of *A. vinelandii* containing different nitrogenase mutants are cultured in varying concentrations of atmospheric gasses and monitored through optical density measurements to determine growth rates. This study serves as an experimental basis to learn how nitrogenase functions in vivo and how environmental conditions affect its function. Understanding nitrogenase function in these parameters also enables greater understanding of nitrogen fixation on early Earth.

ANALYZING VEIN OPTIMIZATION OF DIOON CYCADS ALONG AN ARIDITY GRADIENT

Ellie Coppock, Christopher Krieg (Mentor)

When plants perform photosynthesis, stomata open to gain CO_2 but also lose water vapor. In leaves, water is pulled through conduits called veins, and changes in vein-traits impact the rate that water is transpired. Studies show vein traits are correlated with aridity, suggesting they are key traits under selection. The genus, Dioon (Zamiaceae), survives along an aridity gradient in Mexico, yet nothing is known about how they might modulate vein traits to cope. We proposed vein traits covary with climate, and compared traits measured in a common garden with species' native climate. We found that vein density and leaf thickness are correlated with aridity. These data can be used to understand how species will respond to our changing climate.

PODCAST PRODUCTION AS PEDAGOGY: BEHIND THE ETHICS & EDUCATION PODCAST

Dineo Lyle, Carrie Welsh (Mentor)

One of the main projects of the Center for Ethics and Education is creating curriculum surrounding philosophy of education. This project is educational for both its creators and audience. The curriculum team is made up of faculty, staff, and students. The team produces both the Ethics & Education podcast and related study guides for use in philosophy, sociology, and education undergraduate and graduate classrooms. As a URS Scholar, my work is focused on the podcast. The podcast features conversations with philosophers and education researchers about the philosophy of education, from K–12 to higher education. The podcast is educational in two ways: one, the content is directly related to ethical issues in education; and two, it offers listeners a chance to learn something about education informally.

EXTRA- OVARIAN ESTRADIOL REGULATION OF BROWN FAT THERMOGENESIS IN ADULT FEMALE RHESUS MONKEYS

Sindhu Shankar, Molly Willging (Mentor)

During menopause, decreasing levels of estradiol are associated with elevated risk for metabolic dysfunction, like obesity and reduced energy expenditure. Rodent studies identify ovarian sources of estradiol as the major regulator of female metabolism. In nonhuman primates (NHPs) ovarian estradiol depletion via ovariectomy (OVX) does not induce metabolic dysfunction. We therefore hypothesized extra-ovarian E2 regulates metabolic homeostasis, specifically, brown fat thermogenesis in female NHPs. To test this, we employed aromatase inhibition to eliminate extra-ovarian E2 biosynthesis. Twenty adult female rhesus monkeys were OVX and received: E2-containing capsules and letrozole treatment (n=6) or empty capsules and either vehicle (n=6), or letrozole (n=7.) Our findings highlight the location of estradiol synthesis regulating brown fat thermogenesis and suggest novel therapeutic approaches to combat menopause-associated metabolic disease.

THE ROLE OF ATTENTION IN COMPENSATION AND ADAPTATION TO ALTERED AUDITORY FEEDBACK

Jenna Krakauer, Benjamin Parrell (Mentor)

Speech production relies on auditory feedback to correct for potential errors as they occur (compensation) and to maintain accurate speech over time (adaptation). These feedback-based corrections can be studied by perturbing auditory feedback in either pitch or vowel formants (the resonant frequencies of the vocal tract). In response, speakers oppose these perturbations. However, the magnitude of compensation and adaptation varies both within and between participants, and the source of this variability is currently unknown. Previous studies have shown that divided attention modulates feedback responses for vocal pitch control, and modulates the ability to adapt in reaching tasks. Here, we examine the role of attention in speech motor control through formant alterations. We hypothesize that divided attention reduces compensation and adaptation, therefore contributing to this variability.

PHOSPHORYLATION OF MOUSE DOT1L METHYLTRANSFERASE LEADS TO CHANGES IN ITS CELLULAR LOCALIZATION IN MOUSE EMBRYONIC STEM CELLS, AFFECTING IPSC REPROGRAMMING EFFICIENCY

Amulya Suresh, Rupa Sridharan (Mentor)

Pluripotent stem cells (PSCs) are the basis for regenerative medicine because of their indefinite self-renewal and ability to differentiate into any tissue. Induced pluripotent stem cells (iPSCs) can be produced through reprogramming of somatic cells, avoiding the ethical issues of embryo harvest. Chromatin state has a large influence on reprogramming efficiency. Specifically, depletion of DOT1L, a histone H3K79 methyltransferase, promotes reprogramming while PSCs maintain low DOT1L levels by phosphorylation-mediated nuclear export. To investigate the effect of DOT1L localization on PSC pluripotency maintenance/acquisition, we have constructed two plasmids containing phosphomimetic or phosphoinactivated mDOT1L. We will reprogram mDOT1L knockout fibroblasts in the presence of the mDOT1L phosphomimetic mutants to assess the effect on efficiency. This will allow us to infer whether cellular localization of mDOT1L affects reprogramming.

EXAMINING THE IMPACT OF SKIN PIGMENTATION ON THE ACCURACY AND CERTAINTY OF CELLULITIS DIAGNOSIS

Helena Ikenberry, Michael Pulia (Mentor)

With little representation of darker skin pigmentations in textbooks, it can be easy for doctors to overlook skin diseases that present themselves differently depending on pigment. Cellulitis is a specific example of a skin infection where 30% of cases are already misdiagnosed. Thermal imaging provides a potential definite way to separate cellulitis from pseudocellulitis by examining the temperature of the infected area. The purpose of this study is to use data already collected in Thermal-Imaging 1.0 to determine whether or not skin pigmentation impacts the diagnostic accuracy/certainty of cellulitis diagnosis. Skin pigmentation values will be assigned to each participant and R coding will be used to analyze the data. Lastly, we will examine if thermal imaging could be used to negate these challenges.

PORTABLE LIBRARY BOX PROJECT

Lennox Ochieng, Nancy Kendall (Mentor)

Lack of access to teaching and learning materials poses a major barrier to children's learning. The Portable Library Box Project aims to assist in improving English and Kiswahili literacy skills in young primary school pupils in Kenya. The project will provide literacy materials, such as English and Swahili storybooks, and Portable Library Boxes that are used to store and transport the respective literacy books. By increasing access to literacy materials through the books and Portable Library Boxes, the project intends to grant young pupils the ability to gain comprehension in two key languages used in teaching and learning in Kenya, thus laying the foundation for them to be able to grasp concepts in other key subjects such as mathematics, social studies and science.

LIFEWAYS THROUGH A MICROSCOPE: LOOKING FOR PLANT REMAINS IN ARCHAEOLOGY

Isabelle Paulsen, Jason Miszaniec (Mentor)

Ethnographic accounts reveal that plant resources figure prominently in the lifeways of Indigenous people of coastal western Alaska. These resources are used for subsistence, as fuel, and as a construction material. However, plant use remains largely undocumented from the archaeological record due to inadequate sample recovery. This study identifies macrobotanics (wood and seeds) recovered from the Nukleet site (NOB-001; 1150-1570CE), northwest Alaska. The macrobotanics come from seven 1-litre sediment samples taken from a stratified midden deposit (refuse-pit). Samples were floated, sorted, and passed through a series of nested screens (2mm, 6.35mm, and 12.7mm). Findings reveal that salmonberries (*Rubus chamaemorus*) and crowberries (*Empetrum nigrum*) were critical late-winter resources, and that larger screens (>2mm) obscure the archeological indicators for women and children's foraging contributions.

IMPROVING THE GENETIC TOOLBOX OF CUPRIAVIDUS NECATOR FOR SUSTAINABLE PRODUCTION OF OLEOCHEMICALS

Qianna Loomis, Paul Perkovich (Mentor)

Oleochemicals are found in many industrial products and are traditionally derived from vegetable oils or animal fats. Microbial production is a relatively sustainable method of deriving these products; however current feedstocks are primarily glucose, which is often extracted from food competitive crops and motivates deforestation to clear arable land. One method of improving microbial fermentation is to use *Cupriavidus necator*, a bacterium that can produce high amounts of oleochemicals from sustainable carbon courses. Rudimentary genome editing tools are available, but our goal is to improve the genetic toolbox to enable efficient metabolic engineering of this bacterium for sustainable production of oleochemicals.

THE GENETIC MECHANISMS IMPLICATED IN ALZHEIMER'S DISEASE, BIPOLAR DISORDER, AND SCHIZOPHRENIA: A COMPREHENSIVE REVIEW

Isabella Escalante, Chirag Gupta (Mentor)

Alzheimer's disease, bipolar disorder, and schizophrenia are all neurological diseases that rid individuals of their personal autonomy. Although there are treatments available to slow the progression of the diseases or soothe surface-level symptoms, there are ultimately no definite cures. Therefore, to contribute towards the elucidation of a cure, further characterization of the genetic mechanisms implicated in the diseases are needed. Furthermore, exploring other diseases with similar genetic expressions is another approach to understand more about the genetic mechanisms underlying each disease and to establish a common pattern among them. This review will compile the most recent discoveries in genetic research of AD, BPD, and schizophrenia, as well as identify areas worth additional investigation.

THE FITNESS OF TRICHODERMA KONINGIOPSIS IN THE CONTEXT OF NITROGEN POLLUTION

Hannah Vanderscheuren, Anne Pringle (Mentor)

Nitrogen (N) pollution may alter the decomposer fungal community of temperate forest ecosystems, indirectly influencing plant litter decomposition (Morrison et al., 2016). Researchers speculate that *Ascomycetes* are uniquely tolerant to high N environments because they are fast growing, but little is known about fungal growth in contexts of N pollution (Morrison et al., 2016; Camenzind et al., 2020). I tested whether isolates of Trichoderma koningiopsis exposed to N pollution had different growth dynamics as compared to isolates from an unpolluted environment. I measured mycelial growth and sporulation, two fungal fitness parameters (Pringle & Taylor, 2002). Differences in growth dynamics may reveal that isolates from polluted environments have altered fitness, with possible implications for the earth's N cycle.

COVID-19 AND CHANGES IN YOUNG ADULT'S WEIGHT CONCERNS

Megan Haas, Lauren M. Papp (Mentor)

COVID-19 caused fundamental life changes for young-adult college students. Emerging research suggests increases in mental health and substance use problems, yet potential changes in many other aspects of young-adult adjustment, including weight concerns, remain unexamined. The current study takes advantage of a recent longitudinal project that assessed 355 college students (oversampled for recent substance use) 5 to 7 times over 2 years (M age = 19.5 years, 69% female). Firstly, we predict direct increases in weight concerns (both level of and change over time) following COVID-19. Secondly, we expect more problematic weight concerns following COVID-19 among females and individuals with higher levels of negative affect at the pandemic onset. Results will inform future research and applied efforts intending to support healthy young adult adjustment.

EFFECTS OF DAIRY CATTLE URINE PRESERVATION METHODS ON UREA, CREATININE, AND NITROGEN LEVELS AND EXCRETION

Haden Hartwig, Michel Wattiaux (Mentor)

Proper acidification methods are important to correctly measure the environmental impact of urine excreted by dairy cattle. Our objective was to analyze acidification methods of dairy cattle urine for: urea, creatinine, and nitrogen (N). Each sample was subjected to 3 treatments (No-Preservative, 0.072N H2SO4, and 0.144N H2SO4). The samples were analyzed either within 6 hours of excretion (baseline) or frozen at -20C, thawed, and re-analyzed 42 days later. We concluded that 42-d storage increased urine urea nitrogen (UUN), reduced creatinine, and had no effect on N concentrations relative to the baseline analysis. Additionally, increasing H2SO4 concentration reduced N losses during storage. Level of acidification did not influence storage-related changes in creatinine and UUN concentration.

IMPORTANCE OF PLANT DENSITY AND ARCHITECTURE ON BAST FIBER PRODUCTION IN HEMP

Maria Soutor, Shelby Ellison (Mentor)

Hemp (*Cannabis sativa* L.) is a versatile crop known for its strong bast fibers. Bast fiber can be used for a variety of products, such as fabric, insulation, and cordage. Plants that produce high quality bast fiber are tall, thin, and have reduced branching. High quality bast fibers have a high tensile strength and are very fine. Few studies have explored the parameters to grow hemp optimized for bast yield and quality but plant density has been shown to affect plant architecture traits. We aim to find the optimal planting density for bast fiber yield, using 4 density treatment groups in triplicate. Understanding the effects of planting density on plant architecture can guide farmers decisions to maximize hemp bast fiber quality and yield.

ASSESSING RADIOLABELED PSMA-C18 AS A THERANOSTIC TOOL AGAINST PROSTATE CANCER IN MURINE MODELS

Nathan Clemons, Carolina Ferreira (Mentor)

Radiolabeled PSMA-617 has been widely studied, and proven relatively successful, in both human and murine models to treat and image metastatic castration-resistant prostate cancer (mCRPC). The newly proposed molecule, PSMA-C18, aims to improve the standard of care analog by adding carbons to the molecule, changing excretion pathways and extending clearance rates. ~11 MBq of 86Y radiolabeled PSMA-C18 was introduced in nude mice implanted with 22Rv1 tumors subcutaneously and assessed through PET/CT image analysis and biodistribution studies. PSMA-C18 had a higher injected dose per gram (%ID/g) in the 22Rv1 tumors than PSMA-617. Furthermore, it is hypothesized that PSMA-C18 will have significantly less salivary gland uptake than PSMA-617. Further study of therapeutic isotopes, including 177Lu and 225Ac, will conclude upon therapeutic efficacy of radiolabeled PSMA-C18.

INVESTIGATION OF THE PHYSIOLOGICAL CHANGES BEHIND THE RANGE EXPANSION OF THE POLYPLOID HYBRID, POLYSTICHUM SCOPULINUM

Lucas Lin, Christopher Krieg (Mentor)

In plants, polyploidy has been thought to play a key role in evolution as it can generate more genetic variation. However, we do not have a strong understanding of how polyploidy affects physiology, which limits our understanding of trait evolution and species ecology. To investigate this, we focused on an allopolyploid hybrid, *Polystichum scopulinum*, to understand how polyploidy may have enabled its range expansion in relation to its progenitors, *P. imbricans* and *P. lemmonii*. We show that the leaf thickness (LT) of the polyploid hybrid is significantly higher than *P. lemmoniis* LT, and that the hybrids leaf hydraulic conductance (K_leaf) is significantly lower than both progenitors. These results suggest that *P. scopulinums* physiological differences may be linked to differences in its ecology.

IMPACT OF ASSESSMENT EMPHASIS ON ORGANIC CHEMISTRY STUDENTS EXPLANATIONS FOR AN ALKENE ADDITION REACTION

Niall Ellias, Ryan Stowe (Mentor)

In organic chemistry courses, students should be given opportunities to construct causal accounts for phenomena using structure- and energy-related ideas. We examined three organic chemistry sections that emphasized explaining phenomena on exams to varying extents and asked students to justify the outcome of a chemical reaction. We described student responses by noting the connections made between the structure of molecules and energy, with most students describing how charge or electron delocalization impacted the relative energies of the possible intermediates or transition states. We observed an association between learning environment enrollment and the explanations students constructed. These findings suggest that changing what is assessed to better align with doing organic chemistry may be a promising avenue for reform.

THREE-DIMENSIONAL PERMEABILITY INVERSION USING CONVOLUTIONAL NEURAL NETWORKS AND POSITRON EMISSION TOMOGRAPHY

Zitong Huang, Christopher Zahasky (Mentor)

Quantification of heterogeneous multiscale permeability in geologic porous media is key for understanding and predicting flow and transport processes in the subsurface. Recent utilization of medical imaging techniques in hydrogeology allows the measurement of solute concentrations in spatial and temporal dimensions. Establishing the relationship between concentration distributions and the underlying permeability fields will improve the modeling of transport processes in complex geologic systems. This study presents an inversion method utilizing a convolutional neural network that can efficiently approximate the 3-D permeability maps of geologic samples using imaging-derived concentration measurements. The results indicate that a single trained network can generate robust 3-D permeability inversion maps in seconds. This work provides an unprecedented approach for efficiently characterizing multiscale permeability heterogeneity in complex geologic samples.

NEGATIVE ELECTRON TRANSFER DISSOCIATION TANDEM MASS SPECTROMETRY REVEALS NON-RHIZOBIAL BACTERIA PRODUCE LIPO-CHITOOLIGOSACCHARIDE SIGNALING MOLECULES

Emily Lohr, Joshua Coon (Mentor)

Within the symbiotic milieu of plant root nodules, lipo-chitooligosaccharides (LCOs) function as key signaling molecules, produced and secreted by rhizobium, a nitrogen-fixing bacteria that residues within root nodules. While LCOs have already been characterized to some extent in rhizobia bacteria, their presence within non-rhizobia bacteria is unknown. We investigate non-rhizobium samples *Streptomyces bottropensis* and *Shimazuella kribbensis* to characterize the presence and relative abundance of LCOs using novel mass spectrometry dissociation methods. Further, we compare LCO fragmentation patterns produced via complementary forms of tandem mass spectrometry, Higher-energy Collisional Dissociation (HCD) and Negative Electron Transfer Dissociation (NETD). Since *Streptomyces bottropensis* and *Shimazuella kribbensis* are gram-positive bacteria containing highly-abundant galactose and mannose glycans, initial purification of LCOs from each bacterial extract is essential for LCO characterization.

THE INFLUENCE OF CONTEXT ON THE PERCEPTION OF MASKED FACIAL EXPRESSIONS

Sarah Popowski, Paula Niedenthal (Mentor)

Face masks mitigate the spread of SARS-CoV-2; however, they pose a challenge for communicating emotion through facial expression. By design, face masks conceal the mouth, lips and chin subsequently blocking emotional cues in the lower half of the face. The loss of emotional information causes masked expressions to appear more ambiguous, and they may be more influenced by context than unmasked expressions. The present research aims to examine the influence of context on the perception of masked expressions. Approximately 150 participants will view videos of actors performing masked and unmasked facial expressions of happiness, anger, surprise and disgust accompanied by a positive or negative context sentence. Participants will rate the extent to which the expressions convey each of the four emotions.

ASSESSING THE RAMIFICATIONS OF LIMITED DIVERSITY IN ALLIED HEALTH AND HELPING PROFESSIONS

Katie Sullivan, Kimber Wilkerson (Mentor)

Allied health and helping professions, such as speech-language pathology and special education, rely upon a predominantly white workforce, in juxtaposition to the broad demographic diversity of clientele utilizing such services. This systematic literature review aims to assess reported ethical quandaries and ramifications of limited representation and diversity in allied health and helping professions—including among pre-professionals pursuing academic programs in these fields. Thematic analysis of published literature gestures towards the perpetuation of white saviorism, inequitable practices in medical and educational contexts, and notably high attrition rates of people of color who join these fields. Suggestions for developing cultural-competence and encouraging diversification in the helping professions workforces are provided in response to data regarding the current lack of diversity in such fields.

EVALUATION OF THE CELLULAR DEFENSE AGAINST HEAT LOSS THROUGH MOUSE SKINS

Kalina Larsen, Caroline Alexander (Mentor)

As the largest organ in the body, skin is overlooked for its potential to regulate metabolism. Our preliminary data has shown functional changes in mouse skin associated with cold exposure, but the underlying mechanisms remain unknown. I am examining molecular changes in skins of mice exposed to cool temperatures to understand how skin is naturally regulated to resist heat loss. Specifically, I observe the regulation of sebaceous glands because they make several lipids implicated in skin function. To reveal sebaceous glands response to cold, I track mTOR activation, glucose transport and immune cell recruitment in skin from mice exposed to 15 minutes, 5 hours, or no cold stress. I implement immunohistochemistry to stain the tissue samples and capture images using confocal and light microscopy.

THE SOCIAL AND CULTURAL DETERMINANTS OF HEALTH THROUGH A LATINX INDIGENOUS HEALTH NARRATIVE

Sandy Cortez, Jocelyn Salazar, Alyssa Ramirez Stege (Mentor)

This study focuses on understanding the health-related beliefs and cultural practices of the Saraguro community, a Kitchwa-speaking Indigenous group from Ecuador living in rural Wisconsin. Specifically, how culturally based Saraguro health beliefs and practices are implemented in a diasporic experience in the context of cultural assimilation and changes based on geography, social connection, and access to traditional health and healing practices. We conducted a qualitative study where we interviewed Saraguro community leaders in rural Wisconsin and used thematic analysis to explore potential strengths and challenges that the Saraguro community encounter in the transmission and conservation of health knowledge and practice across generations.

WATER QUALITY AND SAFETY

Chris Lopez-Henriquez, Wendy Bedale (Mentor)

Water is essential to humans. If it contains certain pathogenic bacteria, parasites, viruses, or chemicals, water can cause serious illness or death. This project will provide up-to-date information to food manufacturers on potential chemical hazards associated with water used in food processing operations. A qualitative literature review will be conducted with "Web of Science" and other scientific literature databases. It is imperative that the products we eat are safe since water is a major component of foods (and is used in washing raw food products, cleaning equipment, etc.). This project will help the food industry determine what controls are needed to manage those risks and keep food products safe.

INDIVIDUAL LEARNING RATE AS A PREDICTOR OF ADAPTABILITY IN BOMBUS IMPATIENS

Julia Prouse, Matthew Smith (Mentor)

Division of labor serves as a mechanism for overcoming ecological stressors in social insects. Often in the presence of such a stressor, individuals can adapt their roles to better fit colony needs. We hypothesize that differences in learning ability in *Bombus impatiens* may predict the behavioral plasticity of an individual in the presence of an ecological stressor. To assess individual learning, an automated assay has been designed. Bees are returned to their colonies after testing where their ability to adapt in response to a stressor is assessed. A positive correlation between a bee's learning rate and adaptability is predicted. Through this study, we aim to better understand how natural cognitive variation within a colony can mitigate the effects of ecological stressors on colony fitness.

CLINICALLY RELEVANT SCREENING PATIENT-DERIVED ORGANOID CULTURES OF PANCREATIC DUCTAL ADENOCARCINOMA

Ethan Lin, Jeremy Kratz (Mentor)

Pancreatic Ductal Adenocarcinoma (PDAC) is an aggressive malignancy with 5-year survival of <10%. We have established 3D organoid cultures from clinical speciments of PDAC, providing an improved model of primary tumor biology. Combination therapy, a treatment modality that utilizes two or more therapeutics, may provide improved activity through therapeutic synergy. Initial data indicates that selectively inhibition of cyclin-dependent kinase 7 (CDK7), has broad activity in inhibiting the growth of established PDAC organoid cultures. We report the therapeutic screen of agents in combination with CDK7 inhibitors to evaluate for potential synergistic activity using half physiologic values (Cmax) with agents in clinical development. These lead combinations will be generated towards further mechanistic studies for on target therapeutic action.

VALIDATION OF ACCELEROMETERS TO RECORD LYING BEHAVIOR OF DOMESTIC SHEEP

Sam Wudi, Sarah Adcock (Mentor)

Technology is becoming increasingly popular to assess animal health and welfare to inform farm management. This project examines the accuracy of accelerometers in tracking sheep lying behavior. Eight ewes were fitted with accelerometers and observed for three hours via video camera. The video footage was used to record each ewes lying behavior over the three hours. The data collected from video coding will be matched with the accelerometer data to train a predictive model for lying behavior using the R Studio package RABC. This model will be fed new accelerometer data, which will be tested against corresponding video footage to determine the model's accuracy. The analysis for this project is ongoing. This research could provide a new tool for quantifying ovine welfare in agricultural contexts.

YOUTH ICE HOCKEY PARENT/GUARDIAN PERCEPTION OF SPORT SPECIALIZATION

Madeline Winans, Kevin Biese (Mentor)

The purpose of my study is to determine if there is an association of ice hockey positions and receiving a collegiate scholarship with sports specializations according to the beliefs of parents/guardians. We asked parents/guardians to answer three questions about their child's specialization classification (low, moderate, and high). Participants included 138 parents of youth ice hockey players. There was not an association between ice hockey position and sport specialization, but goalies had the highest proportion of participants that specialized (n=9/14, 64.3%). Parents/guardians who perceive their child as highly specialized believed sports specialization increased the likelihood to receive college scholarships. Parents believe sports specialization helps their child obtain a college scholarship, but this is in contrast with previous research findings.

WHY ARE SOME COURTS SLOW WHILE OTHERS ARE FAST? EVIDENCE FROM INDIA

Grace Deis, Narayani Meghna Varanasi, Rikhil Bhavnani (Mentor)

The Indian judicial system currently has over 28 million cases that are classified as pending, leading to overcrowding of jails, millions spent on legal assistance, and lasting impacts on the economy of one of the most populated countries. The project's goal is to explore which factors have the greatest impact on the speed of the court, such as judge backgrounds, language differences, political fluctuations, transfers, and court frequency and locations. To do this, we are looking at data from the official court websites, holiday schedules and previous studies about the judicial system and court pendency rates. Data from Uttar Pradesh suggests an increase in judgments three to six months before elections.

2022 DUNN COUNTY COMMUNITY HEALTH NEEDS ASSESSMENT REPORT

Odin Schaepkens, Stephanie Hintz (Mentor)

The 2022 Community Health Needs Assessment (CHNA) was conducted by the Community Health Needs Assessment Steering Committee. The purpose of this assessment is to identify what the community of Dunn County believes to be the most prevalent health issues facing their populace today. To obtain data on the thoughts and opinions of the county, surveys were sent to major players in the community such as non-profit organizations, local governments, and public institutions. After our analysis of the data, it was found that the problems most mentioned were related to mental health and wellness; chronic disease prevention; having a healthy environment; prevention of alcohol, nicotine, and drug addiction; and lastly, safe and quality housing. Results will be used to inform the 2022 Community Health Improvement Plan.

CD4/CD8 DOUBLE POSITIVE T CELLS: PERPETRATORS OF GRAFT-VS-HOST DISEASE OR WARRIORS IN THE FIGHT AGAINST CANCER?

David Turicek, Christian Capitini (Mentor)

Allogeneic hematopoietic stem cell transplantation (allo-HSCT) is a potentially curative procedure for patients with B-cell malignancies. Unfortunately, most allo-HSCT patients will relapse or develop graft-vs-host disease (GVHD). Donor T cells mediate detrimental GVHD pathology but also beneficial graft-vs-leukemia (GVL) activity that can prevent relapse. To delineate these two phenomena, we have identified a novel T cell population called CD4/CD8 double positive T cells (DPT) that are sufficient to mediate GVHD pathology but not GVL activity. We have also shown single positive CD4 T cells have robust GVL activity but little GVHD pathology. Thus, this project has identified individual T cell subsets that effectuate dominant allo-HSCT treatment outcomes with future experiments designed to explore the mechanisms of DPT and CD4 specific GVHD and GVL activity respectively.

VALIDATING INFRARED THERMOGRAPHY AS A DIAGNOSTIC TOOL FOR MASTITIS IN SHEEP

Daniela Hernandez, Sarah Adcock (Mentor)

Mastitis, a bacterial infection in the udder, is an animal welfare issue in sheep. Studies have suggested mastitis causes pain and changes in behavior in the ewe. Diagnosis in meat breed ewes is especially difficult, as they are not routinely milked. Detection using infrared thermography could potentially be a less invasive and more practical solution for these diagnostic challenges. The objective of this study is to evaluate infrared thermography as a diagnostic tool for mastitis. 15 ewes were evaluated through milk sampling to diagnostically confirm mastitis weekly throughout the 10-week lactation period. Thermal images of the udder were photographed for every ewe immediately before each milk sampling. We predict udder temperature will be higher in ewes that have mastitis compared to healthy ewes.

COMBINING COMPREHENSION AND PRODUCTION: WILL BENEFITS OF SPEAKING DURING SECOND LANGUAGE LEARNING TRANSFER TO CONTENT LEARNED BY LISTENING?

Miriam Lebowitz, Maryellen MacDonald (Mentor)

Previous research shows that production (speaking) practice during second language learning results in better learning outcomes than other types of practice (i.e., comprehension; Hopman & MacDonald, 2018). Unfortunately, speaking is not always practical in real-life learning. Additionally, it is unclear whether this improvement arises from production itself or if it is a secondary effect of increased motivation and anxiety associated with speaking in a novel language. To investigate, we taught participants an artificial language using comprehension-only practice, production-only practice, or a mixture of comprehension and production practice. We then examined whether, in mixed practice, production practice transfers to participants' understanding of content learned using comprehension, and whether motivation and anxiety mediated the observed effects. Our results will inform best practices in second language curriculum development.

STUDYING GENETIC RISK FOR GLIOMAS WITH INDUCED PLURIPOTENT STEM CELLS AND GENOME EDITING

Gail Macapugay, Valentina Lo Sardo (Mentor)

Gliomas account for about 80% of malignant tumors of the Central Nervous System (CNS). They are associated with poor prognosis and high mortality. Genome Wide Association Studies (GWAS) have identified few Single Nucleotide Polymorphisms (SNPs) in the 9p21 locus of the human genome, linked to increased glioma risk, but with unknown function. To study the functional consequences of glioma-linked SNPs in different cell types, we used induced pluripotent stem cell technologies and CRISPR genome editing. In this study we designed an experimental plan to modify rs4977756, in the 9p21 locus with CRISPR-Cas9 and Homologous Directed Repair. We then generated a collection of isogenic iPSC lines containing the risk or non-risk form of rs4977756 in the identical genetic background for further functional studies.

ELEVATED MAP1B DECREASES LC3 INTENSITY AND LEADS TO AUTOPHAGY DEFICITS

Ezra Jarzembowski, Sabrina Huang, Megan Keefe, Xinyu Zhao (Mentor)

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects social interaction and communication. A Waisman Center clinic patient with ASD was found to have abnormally high expression of microtubule-associated protein 1B (MAP1B) from gene duplication of chromosome 5q13.2. Our lab has linked pathologically elevated MAP1B to reduced dendritic complexity in mouse and human neurons, increased excitability in human neurons, and behavioral deficits in mice. The quantification data I have collected for this project measures MAP1B's effect on levels of microtubule-associated protein 1A/1B-light chain 3 (LC3), a protein vital for autophagy. The results showed that MAP1B overexpression (OE) leads to a reduction in LC3 levels and impairment of the autophagy pathway. This suggests that MAP1B OE induces the previously stated deficits via the autophagy pathway.

EFFECTS OF OBESITY ON IMMUNE CELL RECRUITMENT AND COLLAGEN DEPOSITION IN THE MOUSE MAMMARY MICROENVIRONMENT

Grace Haugstad, Lisa Arendt (Mentor)

Obesity is a risk factor for breast cancer and is rising in prevalence in the United States. Inflammation and fibrosis are factors that increase breast cancer risk and aggressiveness. We used CCR2/RFP heterozygous and knockout mice in a diet-induced obesity model to show that obesity increases macrophages and promotes fibrosis, demonstrated by increased collagen deposition within the mammary adipose tissue. We observed a population of RFP+CD11b+ cells that expressed smooth muscle actin (SMA). When CD11b+ cells were isolated from mammary tissue and cultured, adherent colonies formed that expressed SMA and collagen. A greater number of colonies grew from CD11b+ cells isolated from high-fat diet-fed mice compared to controls suggesting that obesity enriches for myeloid-lineage cells with the ability to differentiate into fibroblast-like cells.

UNDERREPRESENTATION AS A PREDICTOR OF CONFIDENCE AND COURSE PLANS IN A CHEMISTRY COURSE

Jonathan Tansey, Judith Harackiewicz (Mentor)

Underrepresented minority (URM) students may be particularly likely to experience belonging uncertainty (i.e., general self-doubt about belonging in a particular context) in introductory STEM courses. They may look around at the other students, realize their group is minimally represented, and conclude that people like me do not belong here. Laboratory sections, where students work with peers in small groups, may be the context in which representation is most important. I coded the proportion of URM students enrolled in 31 chemistry lab sections (ranging from 0 to 42%) to test whether representation predicted undergraduates' confidence in the course and STEM persistence. Preliminary results reveal high levels of confidence and persistence in STEM among URM students when representation was higher in their laboratory sections.

SIMULATIONS IN STATISTICAL MECHANICS

Ava Lisette Pezza, Erik Bates (Mentor)

The purpose of our study is to understand large statistical mechanics systems by performing careful simulations in Matlab. One, such system is last-passage percolation, a model of disordered geometry that depends on a large number of random variables. Our goal is to understand both the asymptotics of this model as the system size tends to infinity, and to what degree these asymptotics depend on the distribution of the random variables. In order to reduce uncertainty, particular attention is paid to computational efficiency and a large number of trials. On the basis of our simulations, we are led to conjectures for potentially rigorous mathematical theorems. Overall, having insight into this theory facilitates the understanding of many other physical systems.

STRATEGIES FOR ENGINEERING PROTEINS BY EXTRAPOLATING MACHINE LEARNING MODELS

Sarah Fahlberg, Philip Romero (Mentor)

Engineered proteins are useful in fields from medicine to biotechnology. We are developing a protein engineering pipeline that exploits machine learning (ML) models trained on protein-function data to discover distant, improved protein variants in silico. In our proof-of-concept, we designed a model protein, GB1, with a >20-fold improvement in binding affinity for IgG. However, it remains unclear how to best leverage this protein engineering strategy. We design thousands of GB1s using different ML models and extrapolation distances and experimentally test for their ability to bind IgG. We find that linear and fully-connected ML models can reliably design highly active GB1s up to 10 mutations from wild type. Applying this strategy in the future, we hope to accelerate protein engineering tasks.

DETERMINING WHERE AND WHY GALAXIES FORM NEW STARS IN THEIR OUTSKIRTS

Brooke Kotten, Lewin Shen, Ralf Kotulla (Mentor)

Spiral galaxies with extended ultraviolet disks form new stars in areas further away from their center than expected. Previous research hinted that these galaxies are different in shape and the aging process. By studying other galaxies' properties, we can learn more about how our own Milky Way may evolve. We have analyzed a more sufficient, unbiased sample to understand which galaxies have extended star formation regions and where they reside. We chose 1,000 galaxies similar to the Milky Way, found where they form new stars, and analyzed similarities in their characteristics. Preliminary results suggest size and neighborhood density influences star formation.

OPTIMAL NEURAL NETWORK ARCHITECTURES FOR ELUCIDATING HIGHER ORDER INTERACTIONS IN MICROBIAL SYSTEMS

Pak Lun Kevin Cheung, Ophelia S. Venturelli (Mentor)

Microbial communities are ubiquitous in nature, regulating many biological systems in diverse environments. A community's function is not only determined by its composition but also by the interactions between species. Hence, understanding such mechanisms is crucial for engineering microbial systems. Although many methods exist to quantify pairwise dynamics, capturing higher-order interactions that involve three or more species remains difficult. Flexible machine learning models such as neural networks are increasingly applied to predict the dynamics, but they are uninterpretable. This project aims to construct interpretable neural network architectures capable of elucidating higher-order mechanisms while preserving the ability to capture a wide array of microbial dynamics. Applied iteratively, these models serve as guidance for further experiments determining the exact structure of interactions.

EFFICACY OF COMBINATION NK CELL THERAPIES WITH FIST15 FUSOKINE AFTER SYNGENEIC BMT ON OSTEOSARCOMA

Anne Wong, Christian Capitini (Mentor)

The prognosis of many relapsed pediatric sarcomas is dismal and new therapies are needed to increase the survival rate. Current methods exploit the cytotoxic effect of natural killer (NK) cells against tumor cells. NK cell activation has been shown to increase in the presence of growth cytokines like interleukin-15(IL-15) and decrease in the presence of immunosuppressive cytokines like transforming growth factor-beta(TGFð□›½). The fusokine FIST15, a fusion protein constructed of IL15/IL15RÉ‘ and a TGFð□›½ trap (decoy receptor), has been used to maximize NK cell reactivity against melanoma but has never been studied in sarcoma or after bone marrow transplant (BMT). My research will determine the efficacy of combination FIST15 and NK cell treatments on osteosarcoma after syngeneic bone marrow transplant (BMT) in vitro and in vivo.

INHIBITION OF PATHOGENIC FUNGAL SF3B1 PROTEINS IN SACCHAROMYCES CEREVISIAE

Tristan Argall, Aaron Hoskins (Mentor)

The SF3b1 protein is integral in the formation and correct function of the spliceosome, the large macromolecular structure responsible for splicing. Inhibition of SF3b1 causes inhibition of the spliceosome, leading to aberrant splicing and cell death. Currently, there are few effective treatments for pathogenic fungal infections such as *Aspergillus fumigatus.* Pathogenic fungal SF3b1 is a possible drug target as there are known drugs that inhibit SF3b1 in human and *Saccharomyces cerevisiae* cells. In a novel high-throughput screening (HTS) method developed by the Hoskins lab, drugs were found that selectively inhibit the growth of yeast containing the pathogenic fungal SF3b1 gene. Assays with fluorescence splicing reporters are currently being conducted to determine whether the decreased growth is due to splicing inhibition.

ASHRAFU INTERACTIVE STEM & MENTORSHIP PROJECT (ASHRAFU ISMP)

MILDRED Chome, Nancy Kendall (Mentor)

The Ashrafu ISMP initiative seeks to raise the next generation of women and youth leaders in STEM, from the underserved and marginalized regions of the Kenyan case, Kilifi. Our key focus is girls, as there are numerous economic, social, and political barriers preventing them from accessing and thriving in STEM education. Our educational goals are to increase the access, excitement, and engagement of female students in STEM courses and to provide them experimential learning opportunities, while at the same time providing both educative and life mentorship activities that support them in becoming a generation of well-rounded women. So far, we have worked with a group of 20 high school girls by providing them with a 10-day bootcamp and were introduced to computer skills training, arduino programming, and circuit-building, along with mentorship in career development and life training.

TRANSGENERATIONAL INHERITANCE OF CENTRAL NERVOUS SYSTEM REGENERATION THROUGH MALE AND FEMALE GAMETES

Nedda Besharat, Dominique Gooden, Bermans J. Iskandar (Mentor)

We've shown that folic acid promotes axonal regeneration in the rodent central nervous system (CNS) via the methylation arm of the folate pathway (DNA methylation). Knowing that DNA methylation has heritable potential, subsequent studies verified that folate-treated F0 rodents transmit the regeneration phenotype to untreated progeny (F1 to F4). To confirm epigenetic inheritance, sperm and oocytes from F3 rodents descending from folate- or water-treated F0 progenitors underwent in vitro fertilization (IVF) in a naïve female to produce F4 rodents. After F4 spinal injury, axonal growth in cultured dorsal root ganglions (DRG) is assessed for axonal elongation. Showing whether the environmentally induced, inherited axon regeneration phenotype is mediated via the gametes will enhance our understanding of inheritance and the effect of environmental exposure on gene function.

THE PERSPECTIVES PROJECT

Amita Doiphode, Anusha Ray Dey, Vaishnavi Gundamraj, Reshma Gali, Hersh Pareek, Sarah Short (Mentor)

There is a severe lack of mental health education and support in POC communities, especially in the Asian-American community. Part of this has to do with the culture that surrounds a stigma around mental illnesses like depression and anxiety, but another part relates to the health equity aspect of public health. The Perspectives Project is designed to combat these issues with evidence-based practices in sessions that delve deeper into topics relevant to students, but with an emphasis on understanding its impact on POC mental health. With the help of NAMI Dane County and the Multicultural Student Center, The Perspectives Project (TPP) focuses on POC perspectives with mental health education, group counseling sessions, and social media campaigns.

CHANGES IN EXTINCTION PATTERN OF YEAST UNDER ENVIRONMENTAL STRESS

Atharva Ankush Dhamale, Nathaniel Sharp (Mentor)

Under environmental stress, the species populations go extinct due to an exponential rate of decline. However, the emergence of beneficial mutations can potentially increase the population growth rate, resulting in the evolutionary rescue of the species. Therefore, a mathematical model was developed to predict yeast extinction under stress To understand the effect of environmental stress on population dynamics. This model was developed using the data collected about the changes in yeast growth rate under the environmental stress of higher growth temperature. But, when tested at a large scale, the yeast populations did not follow the expected pattern of extinction predicted by the model. Therefore we concluded that our mathematical model is inadequate due to the possible variation in the growth rate under environmental stress.

BIOFEEDBACK THERAPY FOR CHILDREN WITH BBD: WHAT IS THE MAXIMUM NUMBER OF SESSIONS WE SHOULD OFFER?

Clara Nemr, Walid Farhat (Mentor)

Biofeedback therapy is an effective treatment for pediatric bladder bowel dysfunction (BBD; however there is no consensus on the number of sessions needed to achieve clinical improvement. We sought to determine the relationship between symptom resolution and number of sessions by evaluating our center's experience with children referred for biofeedback therapy.We reviewed all pediatric patients undergoing biofeedback from 2013 to 2021 and included all children with >6 sessions. At each session, patients and their parents documented their urinary symptoms (urgency/frequency, straining, or pain), incontinence, medications, and stool pattern. This longitudinal data was abstracted, and the outcome was defined as resolution of urinary symptoms or incontinence.

EFFECT OF LYMANTRIA DISPAR DEFOLIATION ON QUAKING ASPEN FOLIAR CONDENSED TANNIN CONCENTRATION

Andrew De Sevilla, Richard Lindroth (Mentor)

Plants respond to herbivory by altering their chemical composition, but how such biochemical plasticity varies among genotypes within populations remains poorly understood. We evaluated genotypic variation in response to insect damage in an experimental population of quaking aspen. In summer 2021, an outbreak of *Lymantria dispar* caused defoliation of the aspen garden. Leaf samples were collected from 15 genotypes before and after defoliation, and analyzed for condensed tannins. We found that damage-induced plasticity in levels of tannins varied among aspen genotypes. Condensed tannins are known to alter tree uptake of nitrogen after defoliation, subsequent interactions with other herbivores, and decomposition of leaf litter. This study gives insights into how genotypic variation in aspen populations may affect those processes following defoliation by an outbreak herbivore.

DEVELOPMENT OF A PHYSICAL ACTIVITY PROGRAM FOR FAMILIES LIVING IN RURAL WISCONSIN

Alyssa Lenius, Tom Casey, Jose Martinez, Hailey Reeves, Susan Andreae (Mentor)

Developing strategies to engage all family members in a behavioral program may be a promising strategy to improve the health of families living in rural communities. Our study's aim was to better understand barriers and facilitators in engaging the entire family in a family-centered physical activity program. Seventeen semi-structured interviews were conducted with mothers living in rural Wisconsin. Participants were asked to discuss their current beliefs about physical activity, health needs, research participation, and ideas on how to involve all family members in lifestyle changes. Interviews were analyzed by two coders using open coding. Results indicate that family-centered programs would be feasible and acceptable. However, several barriers will need to be considered in order to achieve a culturally relevant program applicable to the whole family.

ENGINEERING CULTURE SUBSTRATES FOR SPATIOTEMPORAL CONTROL OF HESC-DERIVED NEURAL ROSETTES

Jack Maher, Randolph Ashton (Mentor)

Given the practical challenges of studying human embryonic development, there exists a demand for in-vitro model systems that recapitulate early developmental events. It is found that when human pluripotent stem cells are cultured in neural differentiation media, they spontaneously form multicellular, polarized rosette structures which model neural tube morphogenesis. While advantageous, current techniques which isolate singular neural rosettes can only induce the initial stage of neural tube development. This study aimed to optimize conditions for inducing tissue maturation via controlled outgrowth on microcontact printed culture substrates. These substrates were conjugated with an adhesion-promoting peptide, RGD or heparin binding peptide, via click chemistry and observed cell migration. In-situ functionalization of microprinted substrates provides a feasible means of micropatterning hPSC-derived neural tissue morphology with spatiotemporal control.

DEFINING TWO DIMENSIONAL SYNERGY IN PANCREATIC CANCER

Luke Koeppel, Jeremy Kratz (Mentor)

Pancreatic cancer is the third leading cause of cancer mortality in the United States. Commonly performed two dimensional (2D) cell cultures have performed therapeutic drug screens. Prior work in our group has identified lead agents using three dimensional patient-derived cancer organoids. To better understand the synergy of drug combinations, the viability of lead agents will be validated in established 2D cultures (PANC1, MIA. PaCa2). Using a high throughput 384-well format across drug concentrations, we will evaluate the efficacy using a synergy scoring function. This will include techniques for automated plating, data collection, and analysis as the three basic steps to execute the screen. These assays will help finalize leading synergistic combinations to consider for further mechanistic evaluation for on target effects and in vivo evaluation.

A QUEER GEOGRAPHY OF UW–MADISON

Samuel Fogel, William Gartner (Mentor)

Madison, Wisconsin, is widely known as a progressive college town, and not as widely known as a city whose downtown core houses a veritable smorgasbord of student neighborhoods. In this study, we sought to investigate the interplay between this progressive reputation and the lived realities of UW–Madison's LGBTQ+ population through their residential choices. In other words, *Where do LGBTQ+ UW–Madison students choose to reside and why?* We found the queer student body to be quite dispersed. While there was some clustering, particularly in the outer fringes of near-campus residences, there was not a strong enough clustering to label any one neighborhood as the queer neighborhood. The results showcase a wide range of experiences, painting a disjointed picture of LGBTQ+ student life.

STRESS-INDUCED GENE EXPRESSION CHANGES IN PV NEURONS

Sabrina Huang, Xinyu Zhao (Mentor)

Parvalbumin interneurons (PVIs) are inhibitory neurons that play a role in proper brain functioning and neuronal communication through intracellular calcium regulation. It is known that PVIs mediate gamma oscillations, which are important for sensory processing, attention, and cognition. Additionally, PVIs are highly vulnerable to experience-induced stress. However, the association between stress and genetic changes in PVIs is unknown. Therefore, we sought to investigate whether induced stress modifies various genes or cellular properties of PVIs and if those changes alter morphological properties. We assessed differentially expressed (DE) genes in mouse prefrontal cortex (PFC), dorsal hippocampus (dHC), and ventral hippocampus (vHC) under stress using Ribotag RNA sequencing and immunohistochemistry validation. Our findings indicate KAT6A was upregulated in both PFC and dHC regions under stress treatment.

CASE STUDIES IN DIFFERENT PALMYRENE SCRIPTS

Ashton Jenks, Jeremy Hutton (Mentor)

The Wisconsin Palmyrene Aramaic Inscription Project aims to analyze the text of Palmyrene inscriptions in museums to further knowledge of their written culture, create a catalog system, and make them more accessible to the public. The significance of this project is in better understanding the Palmyrenes' scribal and funerary cultures, and supplying a more detailed linguistic and epigraphic understanding of them. I analyzed the funerary inscriptions on three reliefs from the University Museum at the University of Pennsylvania (PAT 1766, 1772, 1781), using RTI produced by members of WPAIP. I have produced detailed descriptions of these inscriptions by performing digital measurements in Adobe Photoshop. The level of detail in this analysis allows me to draw conclusions regarding consistencies and differences in handwriting and scribal practices.

ANALYSIS OF PROBABILISTIC CLASSIFIERS FOR DISEASE DETECTION IN MEDICAL IMAGING

Camilla Appiani, Alan McMillan (Mentor)

The medical field is constantly growing with regards to new applications of artificial intelligence and machine learning. Current implementations include using neural networks with multiple layers to classify medical scans, to suggest diagnoses from medical images. This project analyzes probabilistic classifiers that associate a confidence rating to diagnostic classifications, where our goal is to understand how reliable and consistent probabilistic classifiers are. Using large datasets of chest x-ray images, we aim to test deep generative and Monte Carlo dropout classifiers, and compare their diagnostic performance. If successful in demonstrating the consistency of probabilistic classifiers, it will promote further work to build and implement probabilistic classifiers in automated disease detection from medical images.

UNDERSTANDING MOLECULAR FORMATION IN LOW METALLICITY ENVIRONMENTS OF THE INTERSTELLAR MEDIUM

Lucille Steffes, Snezana Stanimirovic (Mentor)

The Magellanic Stream, a tidal tail of gas, formed by interactions between the Small and Large Magellanic Clouds with the Milky Way, is primarily composed of neutral atomic hydrogen (HI). Because there is very little dust, and the gas present is diffuse, molecular formation is rare and difficult. Molecular formation could lead to a region suitable for future star formation. Although H2 is the most abundant molecule, it does not emit radiation at low temperatures. We use other molecules to trace where it is likely present. Using data from the Atacama Large Millimeter Array (ALMA), we calculate the upper limits for the abundance of molecules, starting with HCO+. We also compare the data collected by ALMA with HI archival data to investigate environmental conditions.

IDENTIFYING MARKERS FOR HUMAN Î² CELL FUNCTIONAL MATURATION

Sakar Gupta, Sara D. Sackett (Mentor)

Diabetes can cause major long-term complications such as organ failure, making it one of the leading causes of death worldwide. Advancements in human pluripotent stem cell-derived therapies have been promising in the generation of insulin-producing stem cell-derived Î² cells (SCÎ²Cs), yet unable to produce functionally mature Î² cells that present a comparable glucose-stimulated insulin secretion to adult human islets. Specific cell markers have been identified across Î² cell development, which serve as a guide or checkpoint for proper differentiation at specific stages. However, no such markers have been clearly identified for the progression of immature to functionally mature human Î² cells. We used immunohistochemical staining on fetal and adult human pancreas tissue to identify functional maturation markers for human Î² cells to generate functionally mature SCÎ²Cs.

IMPACT OF ENDOGENOUS HEME BIOSYNTHESIS ON ADIPOCYTE FUNCTION

Mindy Yadev, Andrea Galmozzi (Mentor)

Heme is an essential biological molecule that serves a multitude of functions, such as signaling for cellular processes and adipocyte function, however the intracellular trafficking of heme is largely unknown. In this study, we seek to determine the role of endogenous heme biosynthesis on adipocyte function by targeting 5'-Aminolevulinate Synthase 1 (ALAS1), the enzyme that catalyzes the rate-limiting step in the heme biosynthetic pathway. Preliminary results have shown efficient knockdown of ALAS1 in adipocytes using CRISPR-Cas9 genetic engineering technology. We intend to use these validated tools to conduct functional assays in fully mature adipocytes to evaluate the impact of endogenous heme on adipocyte function. Completion of this work will allow us to explore novel therapeutic interventions aimed at treating obesity and obesity-associated type 2 diabetes.

BIOACTIVITY SCREENING FOR ANTIMICROBIAL METABOLITES IN MICROBIAL ISOLATES FOUND WITHIN THE HUMAN ORAL AND NASAL CAVITY

Timothy Davenport, Susan Zelesko (Mentor)

The emergence of multidrug-resistant microorganisms (MDROs) poses a substantial threat to modern healthcare systems. Discovering antimicrobial compounds that are less toxic to non-target microbes, but as effective in mitigating pathogen growth are therefore a key solution for addressing present shortcomings of antibiotics prescribed today. It is hypothesized that microbes isolated from the human nasal and oral cavity can serve as a reservoir for novel antimicrobials which are able to deter the growth of MDROs and pathogens that inhabit the oral and nasal cavities. Bioactivity assays using human nasal and oral microbiome samples have been used to assess the ability of a given isolate to deter the growth of clinically-relevant pathogens. Future investigations aim to isolate metabolites generated by isolates for prospective drug leads.

MAPPING THE TOR GENETIC PATHWAY IN ORBICULATA MUTANTS

Jeffrey Pietroske, Jacob Brunkard (Mentor)

Target of Rapamycin (TOR) is an evolutionarily conserved eukaryotic serine/threonine kinase that helps regulate cell growth and proliferation in response to the availability of nutrients. When nutrients, like amino acids, are abundant, TOR is active and promotes growth and development. Little is known about how TOR senses and responds to amino acids in plants. Here, I began to take a forward and chemical genetic approach to define the pathways that elevate TOR activity and cause developmental defects in an *Arabidopsis* amino acid synthesis mutant, orbiculata. I defined growth conditions for reproducibly scoring orbiculata phenotypes, including yellow leaves (chlorosis) and rounded leaf shape. Currently, I am initiating a suppressor/enhancer screen to identify mutants that rescue these phenotypes.

MRI FEATURES OF IMMUNOTHERAPY USE IN LUNG CANCER BRAIN METASTASIS PATIENTS

Chengnan Li, Alan McMillan (Mentor)

Immunotherapy treatments like immune checkpoint inhibitors (ICIs) are now routinely used for treatment of metastatic non-small cell lung cancer (NSCLC). Brain MRI changes in response to ICI and stereotactic radiosurgery (SRS) can sometimes be challenging to interpret. This project uses radiomic analysis to objectively characterize the differences between NSCLC brain metastases treated with and without immunotherapy after SRS. Post-SRS radiomic features were analyzed with a machine learning model using extreme gradient boosting algorithms to predict the presence of immunotherapy treatment. Preliminary results yielded a receiver operator curve AUC of 0.84 Â± 0.12, but will be expanded on with more patients and MR imaging modalities. Radiomics and machine learning analysis can provide insight into assessing effectiveness of immunotherapy treatments and predicting patient outcomes.

ASSESSING THE EFFICIENCY OF DUAL-LANGUAGE STORYBOOK FORMATS ON CHILDREN'S WORD LEARNING

Stephanie Delgado, Haley Vlach (Mentor)

More than 12 million children in the U.S. speak two languages. Many of these children receive variable language input, which negatively affects their language development. dual-language storybooks are a promising way to support vocabulary learning in bilingual children. However, we do not know how to structure the storybook to optimize learning. For instance, the storybook could block (e.g., Lisa has a little llama. Lisa tiene una llamita) or mix (e.g., Lisa has una llamita. Lisa tiene a little llama) both languages. Thus, the aim of the present study is to assess which bilingual book format is most effective for vocabulary learning based on children's prior language abilities. This will reveal how code-switching affects language learning and inform the development of educational materials for bilingual children.

EFFECTS OF APOLIPOPROTEIN E DEFICIENCY ON INFLAMMATION AND NEURONAL CELLS

Dylan Nelson, Ragini Bora, Robert J. Dempsey (Mentor)

Apolipoprotein (Apo)E regulates the clearance of lipoproteins and plays a key role in metabolism, neurobiology, and neurodegenerative diseases. ApoE deficiency is associated with atherosclerosis (building up of plaques in arteries) that can lead to stroke and heart failure. Previous work done by my mentors showed that the absence of ApoE in mice increases inflammatory cytokines in the plasma. High fat diet (HFD) enhances atherosclerotic plaque formation in ApoE mice. Using immunohistochemistry and immunofluorescence, we observed increased number of microglial cells and increased levels of neuron specific enolase, a marker of neurodegeneration in the brains of mice lacking ApoE. Our data supports the idea that enhanced inflammation in ApoE mice is likely to play an important role in brain dysfunction, which needs to be further confirmed.

ARTIFICIAL INTELLIGENCE AND DEEP LEARNING IN MEDICAL IMAGING

Paridhi Gupta, Alan McMillan (Mentor)

Many diseases are time-sensitive, i.e., they can become much worse and even fatal if they do not get detected and treated in time. Detecting them using medical images requires careful observations, which takes a lot of focused time. This research aims to speed up the analysis process of whole body images, making it more reliable, efficient and accurate. It aims to use deep learning techniques to create an artificial intelligence to analyze and detect abnormalities and diseases from segmentations of medical images. It builds on the previously created technique of training Convolutional Neural Networks (CNN) to identify organs and abnormalities in from whole body images. The program trains, validates, tests, and then provides its accuracy rate for each organ.

METABOLIC COST OF INFECTION: A META-ANALYSIS

Alexander Van Dam, Justin Buchanan (Mentor)

This project aims to obtain a more accurate understanding of how pathogens influence a host's metabolic rate. By gathering data from past research relating to pathogenic effects on metabolism this project will give insight into how hosts use energy expenditure to respond to pathogens Due to the range of variables studied across years of research, a meta-analysis will be used to generalize findings. Understanding how metabolism changes when introduced to pathogens allows for greater insight into mechanisms of immune response and provides potential mechanisms for pathogen mitigation.

APPLICATION OF SOURCE-BASED MORPHOMETRY IN IDENTIFYING GRAY MATTER COVARIANCE ACROSS THREE CLOSELY RELATED MACAQUE SPECIES: INSIGHTS INTO MACAQUE SOCIAL BEHAVIOR COVARIANCE

Yufan Ye, Allyson J. Bennett (Mentor)

Comparative primate research can reveal the evolutionary roots of humans' social behavior. Given their diverse social structures, well-studied physiology, and well-documented phylogeny, the genus *Macaca* is ideal for research that provides insights into neural foundations of social behavior. I compared gray matter organization patterns using source-based morphometry (SBM) in macaque species that differ in social style and behavior. SBM analysis of neuroimages from rhesus (*Macaca mulatta*), bonnet (*M. radiata*), and cynomolgus (*M. fascicularis*) macaques identified eight distinct components, or unique patterns, of gray matter covariance between brain regions. Species differences were evident in six components, including those weighted by covariation in brain regions associated with socioaffective behavior. Consistent with their distinct social styles, gray matter organization patterns differed for the rhesus and bonnet macaques.

EFFECTS OF FOOD WEB STRUCTURE ON MACROINVERTEBRATE COMPOSITION AND ABUNDANCE

Sofia Ferrer, Tyler Butts (Mentor)

Lake food webs are composed of both benthic and pelagic food chains. Macroinvertebrates serve as prey for fishes and important consumers within the benthic chain. Higher benthic-pelagic food chain connectivity by fish is theorized to strengthen top-down control and weaken food web interactions, which should reduce predation pressure on macroinvertebrate communities. However, studies on this theory in real lakes are rare, so we used large experimental ponds to establish food webs ranging from low to high benthic-pelagic coupling. In food webs with greater benthic-pelagic coupling, we anticipate more stable macroinvertebrate density dynamics as well as a more diverse community composition. Our results will help bridge the gap between food web theory and empirical data in lake food webs.

STUDYING THE FEASIBILITY OF A MUON COLLIDER FOR THE SEARCH OF DARK MATTER

Nikhilesh Venkatasubramanian, Tulika Bose (Mentor)

Presently, the use of proton-proton colliders, such as the Large Hadron Collider (LHC) operating at a center of mass (COM) energy of 13 TeV, is proving fruitful in the effort to study the nature and interactions of dark matter (DM). However, further studies of these interactions and answering open questions on DM would require the development and construction of higher energy colliders. Among these, the Muon Collider is emerging as a clear candidate for a more efficient and powerful collider. To this end, this research will focus on studying the feasibility of such a collider for the search of dark matter using experience from LHC data analysis and simulations, well-established methods of data collection and signal optimization, as well as other phenomenological models.

SPATIALLY RESOLVING OUTFLOWS IN A Z~1 EXTREMELY RED QUASAR TO OBSERVE A SHORT-LIVED BLOWOUT PHASE IN GALAXY EVOLUTION

Hannah Wallace, Ellen Zweibel (Mentor)

A quasar is a rapidly accreting black hole in the center of a galaxy. This project is looking at a newly discovered class of quasar called "Extremely Red Quasars (ERQ)." These quasars are thought to occur because of massive galaxy mergers. As the quasar puts out energy, it is thought to blow away the gas and dust and end the galaxy's ability to form new stars. ERQ's are hypothesized to be an early part of the process when itself and the host are covered by dust. With the help of the Hubble Space Telescope, it will be possible to identify how ERQ's interact with their host galaxy by measuring the dust content of of their host galaxy and by looking for signs of galaxy merging.

CHARACTERIZATION OF PEPTIDE MODIFYING ENZYMES FROM THE MCCB ENZYME FAMILY

Brendyn Ramos, Clara Frazier (Mentor)

Bacterial enzymes can attach functional chemical groups, or post-translational modifications, onto their substrates to create natural products with antibiotic properties or other useful functions. We are studying MccB enzymes, a family of enzymes known to synthesize products with antibiotic activity. We are comparing MccB enzymes from *Escherichia coli* and *Helicobacter pylori*, which modify different peptide substrates to generate the same antibiotic product. To study these enzymes, we have expressed and purified these proteins from *E. coli*. We have synthesized the corresponding peptide substrates to measure enzyme activity. Our end goal is to characterize how these enzymes use different substrates to generate the same antibiotic product. This work will help us understand natural product biosynthetic enzymes and how they create antibiotic compounds.

INVESTIGATING TREE CANOPY COVER AND RACIAL, ECONOMIC, AND EDUCATIONAL FACTORS IN MADISON, WISCONSIN

Matthew Krempely, Erin Cerveny, William Gustav Gartner (Mentor)

Our research analyzed the relationship between tree canopy and racial, economic, and educational factors in Madison, Wisconsin. Tree canopy is associated with mental and physical health benefits, such as urban heat and pollution reduction, and reduction of stress-related diseases, but is often unequally distributed across demographics, precluding equitable distribution of the subsequent health benefits. Our research uses GIS and statistical methods to analyze patterns between selected demographics and tree canopy cover. The results indicate that White, well-educated, and wealthy communities enjoy positive relationships with tree canopy, while minority, Hispanic, poor, and less-educated populations are negatively associated with tree canopy. Our findings show racial and ethnic demographics display relationships of varying strength, while economic, educational, and temporal factors are the strongest predictors of tree canopy.

EVALUATION OF EXOGENOUS AND ENDOGENOUS HEME IN BROWN ADIPOCYTE FUNCTION

Carlie Wyckoff, Andrea Galmozzi (Mentor)

Heme is an essential signaling molecule for biological processes including adipogenesis. We recently showed that heme is a key regulator of brown adipose tissue (BAT), a specialized fat depot with a central role in systemic energy homeostasis and thermogenesis. Total cellular heme is the sum of endogenous biosynthesis and uptake via the heme transporter HRG1. We found that in cultured adipocytes inhibition of endogenous heme biosynthesis, but not exogenous heme depletion leads to severe mitochondrial dysfunction. This suggests that endogenous and exogenous heme are two independent pools that are not interchangeable. To understand how endogenous and exogenous heme contribute to adipocyte function, my work will focus on the generation using CRISPR/Cas9 technology and characterization using multiple functional assays of HRG1 null brown adipocyte cell lines.

MAPK BRAIN ALTERATIONS AFTER TRAUMA-LIKE STRESS

Carla Zuniga, Vaishali Bakshi (Mentor)

Post-traumatic stress disorder (PTSD) involves deficits in the neurobiological pathways that play a prominent role in fear/anxiety responses. One potential modulator of PTSD is mitogen-mctivated protein kinase (MAPK), which is known to be involved in the progression of PTSD. This study focuses on the presence of MAPK in the basolateral amygdala (BLA) and paraventricular nucleus of the hypothalamus (PVN) of rats exposed to fox odor, a natural predator type stress that induces PTSD-like responses. Results demonstrate no elevation of MAPK in the BLA, but a significant elevation in the PVN. These findings suggest the MAPK system may help modulate trauma-like responses through the PVN, which aids in identifying which pathways to regulate while treating PTSD.

THE IMPACT OF THE EICHMANN TRIAL ON INTERNATIONAL LAW

Rachel Rosen, Andrew McWard (Mentor)

Research question: What impact did the Eichmann trial have on international law? The Eichmann trial was the first case after the Nuremberg trials in which a domestic government tried an international crime by invoking universal jurisdiction. Because one of the primary sources of international law is customs, we would expect that the first usage of principle would set a precedent in state practice. This paper assess the extent to which universal jurisdiction is widely practiced by states to try international crimes based on the precedent set by the Eichmann trial. In particular, the Israeli court's invocation of passive personality. Evidence is collected from the 52 cases since 1961 in which states invoked universal jurisdiction to try international crimes.

CHARACTERIZING TRAITS IN FEMALE RHESUS MACAQUES WITH NATURALLY OCCURRING POLYCYSTIC OVARY SYNDROME

Yuhan Sun, Elizabeth Laning, David Abbott (Mentor)

Polycystic ovary syndrome (PCOS) is a gynecological hormonal condition present in female-bodied individuals characterized by two of three Rotterdam criteria: high testosterone levels, polycystic ovaries, and absent or irregular menstrual cycles. Furthermore, PCOS is correlated with increased body fat and abdominal circumference, insulin resistance, infertility, among other virilized traits. Though occurring at an increased rate among families, mechanisms causing PCOS are still unknown. Based on genetic and physiological homology, non-human primate models likely provide the most similar insights of PCOS etiology and symptoms for people with PCOS. We are attempting to better understand the heritability and pathogenesis of PCOS by monitoring the somatometric measures, ovarian morphologies, and LCMS (liquid chromatography-mass spectrometry) hormone levels from pedigrees of naturally occurring PCOS-like female rhesus macaques.

DIRUTHENIUM PADDLEWHEEL ELECTROCATALYSTS: A SIMPLE SOLUTION TOWARDS EFFICIENT AMMONIA OXIDATION

Alex Pavelic, John Berry (Mentor)

The development of alternatives to carbon-based fuels is of paramount importance to society. This work capitalizes on a recent discovery that compounds containing the metal ruthenium can catalyze the electrochemical oxidation of ammonia to nitrogen, an exciting reaction that paves the way for the development of new zero-carbon fuel cells that utilize ammonia to produce electricity. Current work seeks to understand how the unusual bimetallic core and ligands found in the catalyst impact electrocatalytic efficiency. Computational and synthetic study led to the discovery that new diruthenium tetrabenzoate and tetraacetate complexes display spontaneous ammonia oxidation without the need of an applied potential and at increased rates of reaction as compared to the first-generation catalysts.

PEER GROUP GOVERNANCE

Helen Simpson, Charlie Fahey, Shahd Abdel-Wahad, Yaron Nili (Mentor)

Every organization requires rules. Clubs need bylaws, businesses need charters, and governments need constitutions. Public corporations are no different. Labeled as corporate governance, public companies adapt to fit the ever-changing interests of their organization through the formulation of rules and regulations. The strictness and specificity of corporate governance rules can impact corporate practices, which, in turn, have a large influence on the broader economy. This research focuses on identifying trends in the way companies select their peers who then directly impact an organization's corporate governance. Using SEC filings of self-designated peer groups, which companies and investors compare practices to, we contrast the governance practices of Fortune 500 and Russell 3000 companies against their peers.

UNDERSTANDING THE STRUCTURE AND FUNCTION OF FTSLB PROTEIN COMPLEX

Claire Schwabe, Samridhi Garg (Mentor)

Cell division, the process of bacteria multiplying, is controlled by a multi-protein complex called the divisome. The function of divisome is to create the restrictive forces for the bacterial cell to pinch off and to create a cell wall at the septum. FtsLB is one of the middle protein complexes on the divisome, and its purpose is to help regulate the peptidoglycan cell wall synthesis at the divisome. The goal of this project is to understand FtsLBs structure and function. First, cloning is done by PCR. Then, the FtsLB protein complex is purified using Nickel Affinity Chromatography. Lastly, the protein complex is analyzed using SDS- PAGE. Ultimately understanding the process of bacterial cell division can help in designing new antibiotics.

MONITORING CLINICAL DIAGNOSTIC TESTING OF CIRCULATING TUMOR CELL WITH SYNTHETIC CELL LINES

Isabella Fernandez, Jennifer Schehr (Mentor)

What is the most efficient way to determine the best treatment for patients with cancer? Through minimally invasive blood draw, these biomarkers can be characterized on circulating tumor cells (CTCs) as one method for physicians to figure out the best treatment for the patient. In order to gain regulatory approval of these novel testing approaches, systems must be designed to confirm whether different batches of antibodies used to capture CTCs are performing adequately. Development of a synthetic cell line system to monitor capture antibodies revealed that different combinations of reagents, shaking forces during incubations, or the degree of washing impacted performance. More work needs to be done to maximize performance and consistency.

DEER FORAGING BOUT DURATION AND VIGILANCE CHANGES OVER THE DURATION OF A FIELD EXPERIMENT

Amelia Weidemann, Savannah Bartel (Mentor)

Individual experience can shape behavior; however, there is limited knowledge of how the behavior of wild animals may change over the duration of field studies using remote cameras to monitor behavior. We evaluated how deer foraging behavior changed over the duration of the deployment period of 250 baited cameras deployed across an ~80,000-ha area. We found that individual foraging bouts were significantly longer in duration on the first day of camera deployment than on all subsequent days. The distribution of vigilance events during foraging bouts also changed with deployment duration: vigilance was more concentrated at the beginning of the bout on the first day of deployment as compared to all subsequent days. These results indicate that individual experience may shape the foraging decisions of deer.

CHARACTERIZING PCOS-LIKE TRAITS IN PREGNANT FEMALE RHESUS MACAQUE MONKEYS

Cheyenne Michelsen, David H. Abbott (Mentor)

Polycystic ovary syndrome (PCOS) is a hormonal condition that occurs most commonly in women of reproductive age. To be considered a true PCOS candidate a woman must have two of the three common symptoms, otherwise referred to as the Rotterdam criteria. These symptoms consist of oligo/anovulation, hyperandrogenism, and polycystic ovaries. PCOS can naturally occur in female adult rhesus macaque monkeys and can impact phenotypic traits. It is most common to see an increase in body mass index, clitoral volume, and other increased body measurements. Using nonhuman primate models such as pregnant female rhesus macaques provides us with the best insight into PCOS. We are currently analyzing fetal programming and its correlation to gestational weight gain over the course of a pregnancy.

SOCIAL ISOLATION IN NURSING HOMES DURING COVID-19

Sara Wilke, Tonya Roberts (Mentor)

COVID-19 has significantly impacted older adults in U.S. nursing homes (NHs). COVID-19 regulations restricted visitation and social interaction in NHs, and little is known about the impact on resident health wellbeing. The purpose of this qualitative study was to describe how NH residents (n=7) experience social isolation during COVID-19. Results show residents compared experiences during COVID-19 to living through traumatic situations. They simultaneously described a process of actively reframing and accepting the situation. They found comfort in small things and moments of connection. Residents described tools and strategies that foster a sense of community and connection. Findings suggest opportunities exist to provide enhanced mental health support to promote healthy coping. Results also suggest opportunities to integrate technological interventions to facilitate and maintain connections.

THE CONTENT OF IMAGE-BASED POSTS ON VAPING-RELATED HASHTAGS ON INSTAGRAM

Diana Morales Mijares, Brad Kerr (Mentor)

Adolescent exposure to media advertisements is associated with vaping. The content of vaping-related Instagram posts remains unclear. The aim of this content analysis study is to understand vaping-related content on Instagram. Five popular vaping-related hashtags will be identified. The first 25 posts for each hashtag will be evaluated for the presence of promotional content (i.e., advertisement or user content) and message type (i.e., informative, entertaining, or persuading) Findings may inform pediatrician conversations with adolescents about vaping use and its relation to Instagram use.

DEFINING BICC1S INTERACTION WITH THE CNOT3 PROTEIN

Alexander Gall, Mike Sheets (Mentor)

Bicc1 is a translational repressor that plays an important role in regulating mRNA translation. Previous research has shown Bicc1 to be very important in early embryonic development as well as organ formation and function, though little is known on how it represses its target mRNAs. The Sheets labs hypothesizes that Bicc1 interacts with CNOT3 to repress translation. My research focuses on determining if there is a direct interaction between Bicc1 and CNOT3 using in vitro protein pulldowns followed by an analysis with gel electrophoresis to see if the two proteins bind to each other. By understanding this mode of repression, it could increase our knowledge on how Bicc1 works to regulate development and functions in human disease.

PHYSICAL ACTIVITY, SCREEN TIME, AND EMPLOYMENT IN ADULTS WITH DOWN SYNDROME

Sydney Domagala, Victoria Fleming (Mentor)

Limited research has explored the relationship between physical activity and screen time in adults with Down Syndrome (DS). The objectives of this study were to (1) compare time spent doing physical activity, viewing screens, and employment activities in adults with DS; and (2) determine if physical activity was associated with screen time and/or employment. Analyses included 49 adults with DS. When controlling for age and BMI, exercise was associated with reading ($r = .496$, $p = .002$). Participants watched TV ($M = 106.93$ min/day) three times as much as they participated in physical activity ($M = 37.83$ min/day). Findings have implications for understanding the role of exercise in aging in DS and suggests policies aimed at increasing physical activity and reducing screen time may be beneficial.

ELUCIDATING THE RELATIONSHIP BETWEEN GATA2 EXPRESSION AND MYELODYSPLASTIC SYNDROME

Tatiana Pavletich, Daniel R. Matson (Mentor)

Myelodysplastic syndrome (MDS) is a lethal hematopoietic malignancy which causes low blood counts and ultimately progresses to acute leukemia. GATA-binding factor 2 (GATA2) is a transcription factor that is critical for development and function of the hematopoietic system. Using custom anti-GATA2 antibodies, we performed immunohistochemistry (IHC) for GATA2 on bone marrow biopsies from healthy human patients and patients with MDS. We identified which bone marrow cells express GATA2 under normal and diseased conditions, and we compared GATA2 expression levels in MDS marrows to relevant clinicopathologic metrics. We found that in MDS GATA2 is primarily expressed in myeloid blasts, and GATA2 expression correlates with increased bone marrow blasts, myeloid lineage dysplasia, and disease severity. GATA2 may have value as a myeloid specific lineage marker.

INTRODUCING THE 5 STA-Z BOARD GAME AS AN EDUCATIONAL RESOURCE TO KYANGWALI SCHOOL GOING CHILDREN AS A LEARNING RESOURCE

Joel Baraka, Nancy Kendall (Mentor)

This project's goal was to broaden and introduce the 5 STA-Z educational board game as an educational resource to primary school-going children in Kyangwali refugee camp in Uganda. The introduction of the 5 STA-Z had two main objectives: (1) offer an at-home, play-based learning opportunity, which was particularly important during the pandemic time when children could not access school. (2) Introduce a new approach to curricular review and test preparation for the students. I also partnered with COBURWAS as the local organization that helped bring the whole project to completion.

OPTIMIZING MESENCHYMAL STROMAL CELLS (MSCS) ORIGIN FOR TREATMENT OF RADIATION-INDUCED XEROSTOMIA

Annie Glassey, Randall Kimple (Mentor)

Mesenchymal stromal cells (MSCs) are candidates for cell therapies due to their innate ability to modulate immune responses, enhance epithelial cell proliferation, and reduce inflammatory damage, properties attributed to the MSC secretome. Our goal is to use MSCs to develop a novel treatment of radiation induced xerostomia. It is unclear how MSC source impacts therapeutic potential, so we seek to compare adipose, bone marrow, and submandibular gland derived MSCs to identify an ideal origin. We hypothesize that bone marrow derived MSCs will be more effective than adipose and have a similar secretome to submandibular gland derived MSCs. MSCs were isolated from B6 male mouse tissues and identity confirmed via flow cytometry and differentiation. Secretome analysis was used to identify optimal tissue source for future studies.

CORRELATION OF PROXIMAL EVENTS ON PH TESTING WITH LARYNGOPHARYNGEAL REFLUX SYMPTOMS

Jalen Corey, Anne Lidor (Mentor)

Gastroesophageal reflux disease (GERD) impacts an estimated one in five U.S. adults. Typical symptoms include heartburn and chest pain, however, patients can also present with atypical laryngopharyngeal symptoms (LPR) such as hoarse voice, choking and coughing. pH esophageal monitoring is used to diagnose GERD, but does not provide an objective measurement for LPR symptoms. Therefore, it must be inferred that if a patient has evidence of reflux, it may or may not be the cause of their LPR symptoms. Esophageal impedance testing provides data to determine if reflux reaches the pharynx. The number of proximal events on impedance testing can be analyzed to determine correlation with a patient's LPR symptoms. Knowledge of this possible correlation will help guide the treatment of patients with atypical symptoms.

MACHINE LEARNING METHODS IN DIAGNOSING ALZHEIMER'S DISEASE

Dhruv Gupta, Julia Paciorek, Chirag Gupta (Mentor)

Machine learning, deep learning, neural networks: all of these new and developing technologies have been outperforming humans in many different applications. We are using novel machine learning methods to help diagnose Alzheimer's disease through gene expression data. By training our models on a mapped gene network of the human brain as well as known genes related to Alzheimers, the model will be able to predict whether a new patient has Alzheimers and also identify new genes that might be linked to Alzheimers. This can help guide future research into genes linked to Alzheimers. Previously, machine learning has only been applied on MRI scans and blood plasma spectroscopy, whereas we are using gene expression data which has been effective in diagnosing other neurological disorders.

THE INCARCERATED VAGINA: CONDITIONS OF MENSTRUATION IN U.S. STATE PRISONS

Regan Hawkins, Frankie (S. Frank) (Mentor)

Various models of menstrual product access exist in U.S. prisons; incarcerated women across the country report problems with access. The present research includes an examination of the type and extent of menstrual product access in prisons and the formal pathways through which that access is established. Preliminary analyses indicate that menstrual product access is acutely restricted due to uniformly low wages for incarcerated women, high commissary prices, item and spending limits, and discretionary distribution. Prison policies and state laws requiring the provision of products are few, and those that do exist are woefully insufficient. The implications of these findings are such that, until further action is taken to improve access, these prisons are in violation of the U.S. Constitution and the United Nations Bangkok Rules.

OPTIMAL PREVENTION OF CLIENT-PROTEIN AGGREGATION ON THE SURFACE OF THE HSP70 CHAPERONE: A COMPUTATIONAL STUDY

Jasmine Machhi, Silvia Cavagnero (Mentor)

Proteins are key components of living cells. Proper protein shapes, i.e., proper folds, are essential for life. The Hsp70 chaperone plays a key role in generating folded proteins via a process known as homeostasis. Hsp70 facilitates in vivo protein folding by reducing undesirable aggregation. However, how Hsp70 reduces aggregation remains unknown. We employed the CHAMPION70 computational model to understand and predict how Hsp70 interaction with client protein affects aggregation propensities. The folding of proteins of variable thermodynamic stability and folding kinetics was simulated. We found that (a) folding while bound to the chaperone dramatically decreases aggregation timescales, and (b) Hsp70 is most effective at preventing aggregation of thermodynamically stable slow-folding proteins. This research is important because it inspires strategies to cure deadly aggregation-related diseases.

ROLE OF MITOTIC CHROMOSOME TERRITORIES IN CHROMOSOME SEGREGATION

Ying Lin, Aussie Suzuki (Mentor)

During cell division, replicated DNA is passed on to daughter cells. Cell division errors often result in incorrect numbers of chromosomes, leading to cancer, developmental diseases, and poor therapy response. Earlier studies reported chromosome territories affect gene regulation, and chromosome organizations are generally maintained during mitosis. However, technological limitations prevent single chromosome resolution analysis and thus a proper exploration of mitotic chromosome territories. Through our new modified expansion microscopy (mExM) method, we can view and annotate individual chromosome sets spatial distributions. We found that chromosome territories exist during mitosis. Moreover, observed nearest-neighbor patterns revealed distinct chromosome-specific localizations. Future experiments will discover how drugs that disturb microtubules disrupt this spatial organization, how organization affects mis-segregation phenotypes, and if specific chromosomes pertain to certain mis-segregation phenotypes.

THE ROLE OF AFFECT IN WHETHER AND WHERE TO GIVE: A STUDY OF PREFRONTAL CORTEX DAMAGE

Michel Justen, Mike Koenigs (Mentor)

Strong emotional reactions may have two competing influences on the impact of our donations: they can motivate us to donate in the first place, but they can also bias us towards charities that do not save or improve as many people's lives as possible. To test the influence of our emotions on (1) how much we donate and (2) how effectively we donate, the present study examined the donation behavior of individuals who exhibit blunted emotional responses despite no logical reasoning impairments, namely, individuals with ventromedial prefrontal cortex damage. Data collection for this study is ongoing, but results should illuminate how our emotional reactions may help or hinder us from helping as many others as we can.

EXPLORING THE INFLUENCE OF SKIN BACTERIA ON MOSQUITO FEEDING PREFERENCE

Skyler Finucane, Lyric Bartholomay (Mentor)

Mosquitoes are attracted to human odors like carbon dioxide and lactic acid, but we still cannot explain why mosquitoes seek out some people with greater frequency than other people. We tested the effect of different human skin microbiomes on mosquito feeding preference by observing the blood-feeding patterns of the yellow fever mosquito (*Aedes aegypti*). Bacteria were grown in media containing artificial human sweat and sebum, and presented to mosquitoes on a fabric membrane stretched over an artificial blood feeding device. The number of adults that fed to completion were analyzed by beta regression. The data revealed that the media itself significantly impacted mosquito feeding behavior, as compared to controls, and a *Kocuria* sp. significantly deterred feeding.

CRX EXOSOMES SAVE MICE FROM LETHAL DOSES OF RADIATION

Daniel Chacko, Derek Krismer, John Kink (Mentor)

Few viable treatments exist to treat acute radiation sickness (ARS), an illness of increasing interest in the contemporary era. Exposure to high levels of radiation can cause several significant comorbidities, but patients typically die from infection and pancytopenia resulting from destroyed bone marrow. Real world treatments need to be effective at least 24 hours post radiation exposure. Exosomes are signaling vesicles naturally produced to direct and coordinate cell responses to stimuli. Co-culturing mesenchymal stem cells (MSCs) with CRX, a synthetic LPS, produces exosomes that induce monocytes to differentiate into M2 (repair) macrophages. We found CRX exosomes promoted significant survival of irradiated mice, improved clinical scores over time, and significantly increased expression of genetic markers of radiation healing like IL-6, IL-8, G-CSF, IDO, and CCL-5.

CONFRONTING ANTI-TRANSGENDER HIRING BIAS USING IMAGINED INTERGROUP CONTACT: A REPLICATION AND EXTENSION

Jonathan Orth, Patricia Devine (Mentor)

Transgender individuals experience hiring discrimination due to prejudiced beliefs that they are less hireable than cisgender applicants (Moss-Racusin & Rabasco, 2017). The present study tests the boundary conditions of the efficacy of Imagined Intergroup Contact (IIC) as an intervention against anti-transgender hiring bias by manipulating the applicant's gender identity (transgender man or transgender woman) and job type (gender-stereotyped or neutral) (Moss-Racusin & Rabasco, 2017). Participants in the IIC condition will view the job application materials, then write about an imagined interaction with the applicant. All participants will rate the hireability, likeability, and competence of the applicant. We predict IIC will be effective in reducing prejudice against trans men, but not in reducing prejudice against trans women applying for a gender-stereotyped job. Data collection is ongoing.

CELL CULTURE MEDIUM GLUCOSE CONCENTRATION AND ITS IMPLICATIONS IN CANCER RESEARCH

Lexi Luo, Randall J Kimple (Mentor)

Commonly used mediums in current cancer research have a significantly higher concentration of glucose than physiological conditions, which is even higher than severe hyperglycemia. Here, we performed common cancer research assays using mediums with different glucose concentrations to evaluate the impact of glucose concentration. Findings show that cells grown in high glucose concentration medium (25 mM) have a significantly higher proliferation rate than cells grown in low glucose concentration medium (5 mM). However, the opposite happens with the addition of metformin, an AMP-activated protein kinase (AMPK) activator. Cells grown in different glucose concentration mediums also showed significant differences in glycolysis rate. Our results exemplify the effect of cell culture medium glucose concentration on proliferation, drug sensitivity, and metabolic plasticity.

POSTURAL YOGA AND POLYCYSTIC OVARIAN SYNDROME (PCOS)

Kasturi Thorat, Gudrun Buhnemann (Mentor)

Polycystic ovarian syndrome (PCOS) is a hormonal disorder common among women of reproductive age. Women with PCOS may have infrequent or prolonged menstrual periods or excess male hormone (androgen) levels. The ovaries may develop numerous collections of fluid (follicles) and fail to regularly release eggs. The exact cause of PCOS is unknown. My research will focus on how modern postural yoga affects PCOS in women of reproductive age. My research aimed to find out if modern postural yoga helps with PCOS management by analyzing existing research. The connection between modern postural yoga and PCOS is worth exploring because it affects 6–12% women of reproductive age. If yoga interventions help in PCOS management then women suffering from PCOS can benefit greatly.

SPEECH VARIABILITY WITH ALTERED AUDITORY FEEDBACK

Angela Pescatore, Ben Parrell (Mentor)

Every time we say a word, our pronunciation is slightly different with each repetition. Our previous work has proven that this variability is not only caused by noise in the motor system, but people actively control speech variability based on auditory feedback. In our current study, participants' auditory feedback about their speech is altered, such that their repetition variability is either increased or decreased (participants hear each word either closer or farther from its vocal target). Based on our previous data, we predict the increase in variability by these perturbations is linked to different neural processes. To test this, we assess how these perturbations affect both variability in speech behavior (auditory resonances, or vowel formants) and neural processing of auditory feedback through magnetoencephalopathy.

UNDERSTANDING DISPOSITION DECISION MAKING FOR OLDER ADULTS AS IT OCCURS WITHIN THE EMERGENCY DEPARTMENT

Emma Loveless, Lily Jaeger, Nicole Werner (Mentor)

Despite its importance to patient safety, little is known about disposition decision-making (DDM) for older adults within the emergency department (ED). Our goal was to characterize the work system within which DDM occurs. We conducted a directed content analysis of contextual inquiry data capturing older adults' ED visits using the Systems Engineering Initiative for Patient Safety (SEIPS) model. We identified elements within all six work system components (person = 8, task = 6, tools and technologies = 8, physical environment = 3, organization = 7, external environment = 1). Our results highlight the interconnected elements that influence DDM in the ED and provide the foundation necessary to facilitate system redesign that balances the ED work system to improve care processes and outcomes.

REGIOSELECTIVE HETERODIFUNCTIONALIZATION OF ALKENES VIA CONSECUTIVE ADDITION INTO AN ELECTROGENERATED DICATION

Casey Winter, Zachary Wickens (Mentor)

Organic electrochemistry is a powerful method to induce electron transfer, enabling new reactivity compared to traditional chemical oxidants and reductants. Previous work in our lab has leveraged electrochemistry to generate high energy dicationic adducts from alkenes and thianthrene. These adducts can be reacted with nucleophiles to generate products such as aziridines and allylamines. Here we demonstrate a new intermediate can be accessed by regioselective single addition of select nucleophiles into the adduct. This intermediate, an alkylsulfonium salt, contains a leaving group that can be subsequently displaced by a second nucleophile to generate heterodifunctionalized products. A variety of nucleophiles can be coupled to alkenes in this manner, enabling the construction of valuable, densely functionalized molecules from simple starting materials.

SIMULATIONS IN STATISTICAL MECHANICS

Ambika Lakshmi Sharan, Urmi Shukla, Erik Bates (Mentor)

Statistical mechanics is the study of physical systems in which there are many interacting components, so much so that probability theory is needed to understand these systems mathematically. In this area of research, there are a number of famous "toy" models used by theorists to acquire mathematically rigorous sense of various physical phenomena. Therefore, mathematicians want to prove results about these models, and doing so is often impossible without numerical evidence which suggests a pattern than can be extrapolated into a theorem. Here we investigate one such model—first-passage percolation—and provide simulations which illuminate its behavior on very large scales.

THE EFFECTS OF DEPRESSION ON CONNECTED SPEECH OUTCOMES

Madeline Wherley, Kimberly Mueller (Mentor)

Dementia is characterized by declining cognition, which is associated with speech and depression. We examined the relationship between depression and connected speech in adults at risk for Alzheimer's disease using linear mixed-effects models for participants from the Wisconsin Registry for Alzheimer's Prevention (WRAP). n=1,003 participants had a mean age of 60.36(sd = 6.57) for depressed participants and 62.06(sd = 6.48) for not depressed participants. The depressed group had a higher percentage of African Americans and American Indian/Native Americans. Models showed a significant main effect for depression and words per minute (WPM); individuals with higher depression had fewer WPM. Depression was not a significant predictor of change in speech. These findings can provide further insight into the interaction between depression, dementia, and communication.

SEX DIFFERENCES IN THE CARDIOVASCULAR AND CEREBROVASCULAR RESPONSE TO ORTHOSTATIC TILT

Alex Miller, Andrew Pearson (Mentor)

Sex differences in blood pressure and cerebral blood flow regulation are complex and age-dependent. Sex differences in the cardiovascular and cerebrovascular response to orthostatic tilt in older adults remains unclear. The purpose of this study was to evaluate sex differences in the cardiovascular and cerebrovascular response to orthostatic tilt. Seventy adults, 24 men and 46 women, between the ages of 55 and 69 years old participated in this study. Participants rested for 5 minutes while supine, followed by 5 minutes at 30, 45, and 60 degrees of upright tilt. Throughout the test, blood pressure and cerebral blood velocity were continuously measured. We hypothesized that women would demonstrate improved regulation of blood pressure and cerebral blood velocity in response to orthostatic tilt compared with men.

METABOLIC IMPACT OF ALZHEIMER'S DISEASE PATHOLOGY IN PRIMARY NEURON

Joshua Hall, Rozalyn Anderson (Mentor)

The number of cases of Alzheimer's Disease (AD) is expected to double to 13 million by 2050 in the United States. AD is defined by the accumulation of amyloid plaques and tau protein based neurofibrillary tangles (NFT) in key brain regions, leading to cognitive decline and dementia; however, the molecular basis for this remains unknown. Here we investigate the consequence of forced tau pathology, working with primary neurons from transgenic mice. The impact of NFT on mitochondrial metabolism and lipid storage will be determined by live-imaging microscopy, and direct comparisons made between wildtype and NFT-laden neurons. Metabolic integrity is critical for normal neuronal function and this study will reveal if neuronal metabolism might be a suitable target for treatment of neuronal functional loss with AD.

LOG2LOSE

Valentina Castano, Gabriela Sanchez, Corrine I. Voils (Mentor)

One-third of the U.S. adult population has obesity, which increases their risk for leading causes of death, and it's costly. Behavioral weight loss programs for adults help individuals develop habits to generate and maintain a healthy lifestyle. Success in such programs can be predicted by initial weight loss and self-reported nutrition intake. This study investigates the effectiveness of incentive intervention strategies in promoting long-term weight loss by assessing those who achieve weight loss of 5%. Seven-hundred adults with obesity from Madison, Wisconsin and Durham, North Carolina, will partake in a 18-month behavioral weight management program where they will be randomized in a 2x2 design to receive incentives for logging their food in an app, losing weight, both or neither.

INFLUENCE OF ACUTE AEROBIC EXERCISE ON CEREBRAL BLOOD FLOW AND HEMODYNAMICS

Ansel J. Fellman, Adam T. Corkery (Mentor)

The prevalence of cognitive decline is increasing and projected to continue increasing. Poor cerebral blood flow and hemodynamics are associated with cognitive decline. As exercise increases blood flow and improves vascular health, it may help prevent or treat cognitive decline. This study aimed to determine whether an acute bout of aerobic exercise affects cerebral blood flow and hemodynamics post-exercise. Participants ran on a treadmill at 70% maximal aerobic capacity for 30 minutes. Middle cerebral artery blood flow velocity and hemodynamics were measured pre- and post-exercise. We hypothesized that a single bout of aerobic exercise would increase cerebral blood flow and improve cerebral hemodynamics post-exercise. The findings from this study may be able to help determine whether an exercise intervention could improve cerebrovascular health.

UNDERSTANDING ANTIBIOTIC RESISTANCE IN MICROBIOME SAMPLES FROM 2-YEAR-OLDS IN RURAL WISCONSIN

Naomi Ledrowski, Jared Godfrey (Mentor)

In this study, we are looking to examine the microbiome composition of 2-year-olds in rural Wisconsin. We will identify six key antibiotic resistant microbes using culture and molecular methods. *Moraxella catarrhalis*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, vancomycin resistant, *Enterococcus* spp. (VRE), methicillin resistant *Staphylococcus aureus* (MRSA), and fluoroquinolone resistant gram-negative rods (FRGNB) are pathogens of interest in clinical settings and have demonstrated antibiotic resistance. This study intends to determine how antibiotic resistance differs in 2-year-olds in rural areas from clinical findings, and how the presence of these pathogens varies within the samples and as compared to previous studies.

ASSOCIATIONS BETWEEN SLEEP QUALITY AND BMI IN INDIVIDUALS WITH DOWN SYNDROME

Olivia Avery, Brianna Gambetti (Mentor)

Adults with Down syndrome (DS) are at high risk for Alzheimer's disease, and one sign of the onset of Alzheimer's disease dementia is weight loss (Prasher et al., 2003). The goal of the current study was to examine the association between disrupted sleep and body-mass-index (BMI). To assess sleep quality, 36 adults with DS (M = 37.94, SD = 8.26 years) wore a wrist-worn Actigraph accelerometer for 7 nights. Partial correlations controlling for age indicated that BMI was positively associated with average nightly sleep efficiency (r =.484, p =.036), and negatively associated with average nightly minutes awake after sleep onset (r =-.509, p =.026). Findings suggest that disrupted sleep may have important associations with weight loss associated with the onset of Alzheimer's disease in DS.

A SCOPING REVIEW OF THE DISPOSITION DECISION PROCESS IN THE EMERGENCY DEPARTMENT

Claire Carlson, Eleanore Scheer, Nicole Werner (Mentor)

A patient's emergency department (ED) disposition is a critical juncture in their care journey. The objective of this scoping review was to understand how disposition decision making has been previously conceptualized and synthesize what previous studies reveal about the work systems within which disposition decision making occurs. Through a rigorous search of relevant databases, we identified 48 articles that focused on the process of disposition decision-making in the ED. A work systems analysis of included articles revealed that disposition decision-making in the ED is a longitudinal process comprised of numerous interaction components, rather than a single decision point. These findings demonstrate the need for more comprehensive models of disposition decision-making that captures all components of the ED work system.

FLUORESCENCE EXPLORATION LAB

Galilee Lien Montero, Andreas Velten (Mentor)

Despite its day to day use in society, the phenomenon of fluorescence is invisible to most people. The purpose of this project is to educate and inform the importance of fluorescence in science through a variety of experiments that fit all ages. This project uses a website and classroom activities to display the multiple uses of fluorescence, as well as explain how fluorescent objects may be used in scientific and other applications. The website and activity have explanations that help the audience understand and observe how fluorescence functions. Experiments focus on fluorescence in food items, and can be easily done at home. Through these activities, people will be able to create connections between fluorescence and any scientific field.

DEVELOPMENT OF A NONLINEAR OPTICAL CRYOGENIC SYSTEM FOR 2D MATERIALS ANALYSIS

Anna Hendrick, Jun Xiao (Mentor)

2D materials are atomically thin crystal lattices whose small size and unique quantum properties make them ideal for use in next-generation electronics. Some 2D materials possess functional properties such as ferroelectricity, magnetism, and topological spin textures. These materials have tremendous potential to enable electronic devices that are faster, more compact, and use less energy. The purpose of this project is to develop an in-house automated nonlinear optical system coupled with a magneto-optical cryostat in order to analyze these properties in certain 2D materials under user-defined temperature, electrical and magnetic stimuli. Targeted bulk and atomically-thin flakes will be fabricated by mechanical exfoliation for systematic investigation using this unique and versatile system.

STAFF BARRIERS TO FULFILLING NURSING HOME RESIDENT PREFERENCES: DEVELOPMENT AND TESTING OF AN INSTRUMENT

Ella Greenhalgh, Tonya Roberts (Mentor)

Person-centered care (PCC) can enhance quality of life and lead to better health outcomes for nursing home residents. Delivering PCC can be challenging and little research has been conducted to measure the barriers nursing home staff face to implementing PCC. The purpose of this study was to develop and test the content validity of a survey developed to measure staff barriers to fulfilling nursing home resident preferences for daily care and activities. Survey items were informed by a review of literature and our previous research. An expert panel was recruited to test content validity. Content validity indices were calculated and will be presented. After future psychometric testing of the refined survey, it can be used to measure barriers and identify targets to improve PCC delivery.

EFFECT OF PARENTAL ANGER EXPRESSION AND CHILDHOOD UNPREDICTABILITY ON EMOTION CATEGORIZATION

Chloe Stevens, Seth Pollak (Mentor)

As children age, their emotion categorization becomes incrementally more adult-like. While children use dimensions like valence and arousal to categorize emotion, childhood unpredictability and anger exposure on emotion categorization, when children can sort across multiple dimensions in a spatial arrangement method (SpAM), is unknown. Research suggests maltreated children experience greater anger and over identify angry expressions. Likewise, children receiving unpredictable parental emotion input are biased towards anger and sadness. Therefore, children with higher anger exposure and perceived unpredictability may have broader anger categories. The present study investigates how children's emotion categorization changes with parental anger expression and environmental unpredictability. Children (8–9 years) sorted emotional expressions using SpAM. Categorization patterns were compared to parental anger expression reports and child unpredictability perceptions. Data collection is ongoing.

READING THE CITY: CONTESTING PUBLIC SPACE THROUGH GRAFFITI

Madeline Walaszek, Ksenija Bilbija (Mentor)

This research focuses on how graffiti impacts public space and the political significance of this act. For this research, I analyzed graffiti in Santiago, Chile, and Madison, Wisconsin, in the wake of major social unrest. Chile erupted in protest in autumn 2019 over economic inequality and the lingering legacy of the Pinochet dictatorship. Madison became one of many cities that protested police violence against Black Americans after the murder of George Floyd. Both cities experienced a transformation of public space and graffiti remained visible for weeks or months afterwards. Through this research, several key questions are examined: Who belongs in public space and how does graffiti contest this? How can we read layers of graffiti? And how does it promote public discourse?

THE TIANLAI PERIODICITY SEARCH

Gage Siebert, Peter Timbie (Mentor)

Tianlai is a 16-dish radio array that was constructed to map the density of hydrogen throughout large volumes of our universe. To do this, Tianlai has observed the north celestial pole for over 200 days. Telescopes rarely observe a single place in the sky for more than a few hours, making our data rather unique. The long observation time makes our data extremely sensitive to repeating signals, motivating the Tianlai Periodicity Search (TPS). TPS uses the data collected by the Tianlai to search for periodic astronomical radio signals with periods ranging from seconds to hours. Here, we present progress on executing the search. We also describe the data reduction pipeline as well as the search algorithm we are developing.

LA FOLLETE FOOD PANTRY PROJECT

Sidney Schrage, Michael Maguire (Mentor)

The Madison La Follette High School Pantry Project's goal is to intervene food insecurity and to provide resources on equitable and responsible volunteering for students at Madison La Follette High School. This project works to establish the necessary infrastructure for a food pantry and school resource room at La Follette High school. The project also engages students in learning about food justice, helping them grow into passionate, involved community members. The goal is to establish a needed community resource at La Follette High School and develop high school student's leadership and community engagement skills.

TRACING THE ORIGINS OF ARCHAEOLOGICAL ARTIFACTS OF THE INDUS CIVILIZATION USING HIGH-PRECISION LEAD ISOTOPE ANALYSIS

Emma Basel, Sean Scott (Mentor)

The Indus civilization, an ancient society of the Near East and South Asia, once occupied the region now known as the Indian state of Gujarat. Much remains unknown about this civilization. To better understand commerce and trade, we analyzed stable lead isotopes extracted from artifacts of this region. Lead was leached from the artifacts by submersion in an EDTA solution, which is then heat evaporated. The remaining sediment is dissolved in hydrobromic acid in preparation for column chromatography. Isotopic compositions of the isolated lead samples were then analyzed by multi collector inductively coupled plasma mass spectrometry. By comparing measured ratios to those with known origins, the lead has been sourced to Oman, Saudi Arabia, and North Western India.

ROE AND BEYOND? THE ABORTION LANDSCAPE DURING AND AFTER THE COVID-19 PANDEMIC.

Mikaela Steckelis, Sarah (Frankie) Frank (Mentor)

In the United States, abortion has been a political issue highly contested since Roe v. Wade (1973). Although there are legal protections for abortion, legislatures around the country have used their power to limit access. Since the onset of the COVID-19 pandemic in 2020, state legislatures have increased their persecution of abortion access. This thesis provides insights into how COVID-19 altered the abortion landscape in the United States. Through content analysis of state legislation from March 2020 through 2021, this study uncovers the extent to which state legislatures have been working to overturn abortion rights in the United States during the COVID-19 pandemic era. States have employed various legal strategies to systematically work toward ending abortion access in the United States.

UW JUSTICE LAB: PRISON PROLIFERATION PROJECT

Hannah Li, Lily Karl, Serrae Conerly, Kamilah Islam, Kayley Seow, John Eason (Mentor)

The effects of mass incarceration are often overlooked, specifically on rural communities where prison building directly impacts local populations through directed economic and political agendas. Proponents see prisons as sources of opportunity: jobs, economic stability, and long-term investment. However, this notion often ignores the increasing stigma, underdevelopment, and stigma against rural Black communities. The "prison boom" and the rise of mass incarceration saw many new prisons built, historic rates of incarceration, and misconceptions about the impact of prisons arise. The Prison Proliferation Project debunks myths surrounding the prison boom in factors such as geography, race and ethnicity, and privatization. This project uniquely considers the causes and economic and demographic consequences of prison proliferation.

SHAPING BETTER SEARCH ENGINES

Mridini Thippisetty, Jiepu Jiang (Mentor)

Search engines are essential to the daily consumption of the internet, but most users do not realize the powerful implications that come with the influence of search engine's on our daily thoughts, queries, and conversations. We conducted a user study to observe how humans interact with search engines. Classified by different levels of cognitive complexity, participants complete a writing task by collecting information through the engine. Our study follows two inquiries: Will existing text affect people's subsequent search behavior? How will the contents of web pages help people's writing? Nevertheless, our findings will accelerate people's everyday information access and evolve how modern marketing is approached.

PARTNER2LOSE: USING PARTNERS TO ENHANCE LONG TERM WEIGHT LOSS

Shubhangi Sneha, Corrine Voils (Mentor)

Obesity causes detrimental effects on overall health, ranging from hypertension to cancer. While behavioral interventions can help with weight loss and reduce obesity risks, it is only effective short term. This study focuses on combating these issues, as its purpose is to understand how weight maintenance can be achieved and improve weight loss in adults. A randomized control trial method is used by dividing participants into two arms where they are either in the weight management program alone or with their partner for 24 months. Currently, all participants are enrolled and randomized into their arms, along with all cohorts finishing their sessions. This data collection will help find strategies on weight maintenance and observe positive impacts of participants losing weight with their partners.

ARCTIC COASTAL EROSION AND OCEAN WAVE HEIGHTS

Ian Franda, Stephen Vavrus (Mentor)

The Arctic is warming faster than anywhere else on Earth, and it is rapidly losing its sea ice. This poses a major problem for Arctic communities, as sea ice protects coasts from erosion by suppressing ocean waves. Already, several Arctic communities have moved further inland, and more will need to soon. Predictions on how wave heights will change in the future will be important for decision makers seeking to address these issues. Sophisticated computer models have been created to forecast how wave heights will change in the Arctic, but these models are complex and fairly inaccessible to most decision makers. As an alternative, this project will develop a simpler model for future wave heights and compare the results to predictions made by previous studies.

WHAT IS SCOTTISH SWEATER?: HISTORIES OF TWENTIETH-CENTURY FASHION, MARKETING AND PLACE

Malee Thor, Marina Moskowitz (Mentor)

Often worn for sports and cold weather, it's important to acknowledge the origination of Scottish knitwear. Therefore, together with the guidance of my mentor, I'll be investigating and gathering information on Scottish and Shetland knitwear, and how it has evolved over time in the fashion industry, specifically from the American perspective. The approach that has been taken to accomplish this goal is research through a variety of databases that have access to magazine archives' *Vogue*. Our hope is to gain insight on the main target audiences, usages, and overall pattern that was involved with marketing these knitwears. Once the research is concluded, we'll be focusing on condensing everything into a comprehensive piece of information and art.

SENSOR DESIGN USING LIQUID CRYSTALS

Shraddha Byndoor, Shengli Jiang (Mentor)

Computation has profoundly shaped the way we approach sensing. In this project, liquid crystal-based sensors are designed by supporting a thin film of LC on a solid surface that reacts with a targeted gaseous analyte. When the system is exposed to a gaseous analyte, the analyte reacts with the solid surface and triggers a change in the LC orientation. The transition of the LC that is induced by the surface reaction can be easily visualized by using optical methods like topological data analysis, convolutional neural nets, and color analysis. Computational sensing systems, if connected in a widely distributed manner will have the major advantage of collectively learning online from evidence-based sensing outcomes, solving, and converging to sensing solutions otherwise intractable with a single sensing unit.

THE EFFICACY OF POROUS PAVEMENTS WITHIN THE UW–MADISON CAMPUS

Cole Koffron, Nick Balster (Mentor)

Watershed health relies on managing stormwater pollution, especially within heavily urbanized watersheds. Limited resources often require monitoring stormwater pollution through modeling. Such modeling is difficult in urban systems using extensive green infrastructures to minimize surface water impact. Despite the implementation of various porous pavements within the UW–Madison campus, there exists a lack of data regarding their effect on Lakeshore Preserve surface waters. This study aimed to model from measured concentration of typical urban pollutants found in stormwater and compare annual loading into Lake Mendota. Additionally, infiltration tests were conducted on four different porous paved areas to assess their relative efficacy compared to the WDNR standard. Results revealed discrepancies between modeled and measured stormwater pollutant yields and varied performance of the different porous pavement systems.

IDENTIFICATION OF SARS-COV-2 RECEPTOR IN THE TESITS OF THE RHESUS MACAQUE (MACACA MULATTA) AND ITS IMPLICATIONS ON REPRODUCTIVE HEALTH AND FERTILITY

Sierra Block, Thaddeus Golos (Mentor)

Severe respiratory complications from severe acute Coronavirus 2 (SARS-CoV-2) have prompted an array of research to understand its pathophysiology in the COVID-19 pandemic. Angiotensin-converting enzyme 2 (ACE2) has been identified as the receptor for SARS-CoV-2 with widespread expression across organ systems, including unexpectedly high expression in the testis. SARS-CoV-2 has also been identified in semen samples of men recovering from COVID-19. This study investigated localization of ACE2 expression in the testis and the presence of ACE2 in rhesus macaque semen. Immunohistochemistry and western blot methods performed on testis tissues and semen confirmed the expression of ACE2 in the testis and sperm cells, and absence in seminal fluid. The presence of ACE2 in the male reproductive tract has implications regarding reproductive health, fertility, and sexual transmission.

VISCOELASTIC BEHAVIOR PREDICTION OF NATURAL RUBBER BLENDS VIA MACHINE LEARNING AND ITS APPLICATION FOR REVERSE ENGINEERING

Madison Tan, Amy Qin (Mentor)

Foot insoles are critical in orthopedics to prevent foot disorders and long-term muscle and join pain by absorbing shock and pressure. The purpose of this research is to find the optimal material for insoles by creating a model that measures the effects of sulfur and paraffin content as well as percent void. This model is created using scikit-learn, a machine learning library for statistical analysis in Python. By using scikit-learn's model, such as linear regression, the data set is manipulated by training and validating to find the optimal model. These weights are then used to measure the influence of each input to predict the optimal outcome. This research will determine which shoe insole material will closely result in the optimal, calculated outputs.

THE RELATIONSHIP BETWEEN INFLAMMATORY CYTOKINES AND FATIGUE IN PATIENTS WITH BREAST CANCER

Anna Bruk, Kristine Kwekkeboom (Mentor)

Patients diagnosed with advanced breast cancer receiving chemotherapy often experience high levels of fatigue. Investigators have hypothesized that inflammation related to the disease process or effects of treatment may be an underlying causal mechanism of fatigue. The purpose of this research is to further explore the relationship between inflammatory cytokines and fatigue in patients with advanced breast cancer receiving chemotherapy. Current findings provide evidence supporting a consistent, reliable relationship between fatigue and TNF-Î± and further evidence of a relationship with the markers IL-6 and CRP. However, there is still conflicting evidence regarding the relationship between fatigue and the pro-inflammatory cytokine interleukin-1Î², and anti-inflammatory cytokines IL-8 and IL-10. Further research is needed to explore these relationships and investigate treatment options to help decrease fatigue levels.

JUST THE PILL: INVESTIGATING EXPERIENCES WITH SELF-MANAGED MEDICATION ABORTION

Freya Ebbesen, Kelly Ward (Mentor)

As abortion laws continue to restrict access to clinical abortion, at-home abortion is proving to be a popular alternative. Recent years (especially during the Covid-19 pandemic), have seen an increase in people undergoing medication-induced abortions in their own homes (sometimes called "self-managed abortions") as opposed to "surgical abortions" performed in-clinic. Because of the private nature of these procedures, little is known about how people experience at-home abortion. In response to this increase in popularity, our team conducted interviews with dozens of people who had undergone at-home abortion through the telehealth service "Just The Pill." In our research, we explore themes of de-medicalization and feminist ethics of care (how people care for themselves and others), challenging conceptions about what self-managed abortion means.

METHOD DEVELOPMENT FOR THC ISOMER AND METABOLITE QUANTIFICATION

Rebecca Hadzima, Heather Barkholtz (Mentor)

THC has several common isomers, the most prevalent being 9-THC. Delta 8-THC is an increasingly popular isomer, about which little is known. Quantification of THC isomers via established laboratory detection techniques presents challenges. Typical analysis relies on mass differences to identify and quantify molecules, and isomers have identical masses, with THC isomers' sole difference in double bond location. No published method describes separation and quantification of THC isomers and their metabolites. With increasing cannabis use, as well as increasing delta 8-THC presence in cannabis, a precise and accurate method is needed in order to separate and quantify isomers and metabolites. This project seeks to develop and validate a method to separate and quantify THC isomers and major metabolites via liquid chromatography and mass spectrometry.

THE EFFECTS OF GLYCINE BETAINE ON THE OSMOTIC STRESS RESPONSE OF THE E.COLI LIPIDOME

Will Langholz, Tom Record (Mentor)

E.coli bacteria adapt to changes in their environment, including large shifts in concentration of solutes and salts (changing osmolarity). A shift to high osmolarity dehydrates the cytoplasm, and adaptation involves transport and biosynthesis of solutes to increase the amount of cytoplasmic water. Transport of the osmoprotectant glycine betaine (GB) allows the cell to recover its original amount of water and growth rate. What are the consequences of these changes for the lipidome? *E.coli* were grown in unstressed and osmotically stressed conditions, both with and without GB. Their lipidomes were analyzed using high-throughput mass-spectrometry. Without GB, we find the amount of cyclopropane-containing lipids increases significantly with osmotic stress in *E.coli*. With GB, the lipidome of osmotically-stressed cells returns to its unstressed state, mirroring growth rate recovery.

GROWTH HORMONE RECEPTOR EXPRESSION IN HUMAN PROSTATE CANCER CELL LINES

Abby Onesti, Paul Marker (Mentor)

The human growth hormone (GH) receptor (GHR) signaling pathway plays an important role in cell proliferation via its role in the GH/insulin-like growth factor 1 (IGF-1) axis. GH also contributes to growth by direct stimulation of GHR in tissues. The GH/IGF-1 axis has been implicated in cancers including that of the prostate. This study measured the relative expression of GHR in common prostate cancer cell lines. RNA was extracted from in vitro human prostate cancer models, and gene expression was measured by PCR. Results showed that all observed cell lines variably expressed GHR, while none of the cell lines appeared to express GH. This variability in GHR expression may coincide with prostate cancer aggression.

DO MIRROR NEURONS REALLY EXIST IN HUMANS?

Katelyn Rokus, Morton Ann Gernsbacher (Mentor)

Mirror neurons were first identified in macaque monkeys in 1992. Since their initial discovery in monkeys, mirror neurons have been claimed not only to exist in humans but also to underlie a wide array of human phenomena including the power of advertising, the development of musical talent, and the calibration of ballerinas' balance. However, a core question remains: Is there evidence that mirror neurons even exist in humans? Collating and evaluating that evidence were the goals of my senior thesis. I conducted a systematic review of published articles. I methodically coded and then analyzed each article to determine whether any study provided the critical evidence that mirror neurons exist in humans. I concluded that no article provided conclusive evidence that mirror neurons exist in humans.

CHARACTERIZING TRAITS IN JUVENILE FEMALE RHESUS MACAQUES FROM PEDIGREES WITH NATURALLY OCCURRING POLYCYSTIC OVARY SYNDROME

Ava Grotting, David Abbott (Mentor)

Polycystic ovary syndrome (PCOS) is a gynecological condition presenting in reproductive-aged women characterized by two of three characteristics: high testosterone levels, polycystic ovaries, and absent or irregular menses. Additionally, PCOS is associated with increased body fat and virilized genital measures, among other traits. Though present at an increased rate among families, the mechanisms causing PCOS are unknown. Increased testosterone exposure in utero has been thought to program PCOS-like traits in offspring. Based on genetic and physiological homology, nonhuman primate models provide insight into PCOS origins and its accompanying traits. Using somatometric measures and testosterone levels determined by liquid chromatography-mass spectrometry, we will phenotype juvenile females from pedigrees of naturally occurring PCOS-like adult female rhesus macaques to understand the heritability and pathogenesis of PCOS.

ROLE OF VISUAL INPUT FOR FORMATION OF INNER RETINAL SYNAPTIC CONNECTIONS

Tae Ji Lee, Mrinalini Hoon (Mentor)

Visual input is crucial in determining the development and connectivity of light-dependent visual pathways. Connectivity between neurons occurs at synapses, and dark rearing decreases the strength of synaptic connections in the outer retina. However, there is little knowledge about the role of visual input for the formation of inner retinal circuits, specifically those involving the retinal output neurons called ganglion cells. This project aims to study how the lack of visual input affects the structural organization of ganglion cell types in the mouse retina. Our observations will reveal the dendritic organization, lamination and connectivity of ganglion cells in a dark reared condition, thereby enabling a better understanding of the factors that influence inner retinal development.

NOVEL ANTIBODIES IN SJÖGREN'S DISEASE

Addie Vande Loo, Sara McCoy (Mentor)

Sjögren's is the second most prominent autoimmune disease, resulting in systemic organ involvement. The diagnosis is delayed three years in patients who have hallmark antibody positive, the anti-SSA-antibody; however, diagnosis is delayed even further in those lacking anti-SSA-antibody. Further, SSA patients require a painful invasive lip biopsy. Using a statistical comparison of Elisa reading between SSA-positive and SSA-negative patients we hope to discover that there are an array of antibodies present in elevated rates in patients with SSA-Sjögren's compared to controls. These antibodies would then be used to create a blood test that would provide patients with a clear, comprehensive, and efficient diagnosis.

UNDERSTANDING WHY S. CEREVISIAE SPLICING FACTOR SPP381 IS IMPORTANT DURING SPLICEOSOME ACTIVATION

Lukas Voigts, Xingyang Fu (Mentor)

Messenger RNA processing is essential for eukaryotic life. Pre-mRNA splicing is the process of removing non-coding regions (introns) from a nascent pre-mRNA transcript. The splicing reaction is carried out by a highly dynamic enzyme called the spliceosome. The spliceosome must undergo activation to become catalytically active, involving large-scale compositional and conformational changes. Spp381, an essential splicing factor in *S. cerevisiae*, is recruited and released during activation, yet the action of Spp381 remains poorly understood. To elucidate the molecular mechanism of Spp381, we mutagenized Spp381 by either a structure-guided or random mutagenesis strategy. Utilizing ACT1-CUP1 assays and temperature assays, we characterized Spp381 mutants and found that certain charged residues in the c-terminus of truncated Spp381 could affect the in vivo splicing of ACT1-CUP1 reporters.

THE EFFECT OF PHOSPHORUS AND COLD TEMPERATURE ON ANTHOCYANIN PRODUCTION IN HEMP (CANNABIS SATIVA L.)

Azura Jorda, Shelby Ellison (Mentor)

Anthocyanins are important group of polyphenolic pigments that prevent damage to photosynthetic tissue caused by solar radiation and certain stressors such as drought, UV-B, and heavy metals. Inducing certain stressors, phosphorus limitation and cold temperatures, appears to induce the production of anthocyanins in other plants. To study the effects of phosphorus deficiency and cold treatment on anthocyanin production we will compare different levels of phosphorus (control + 4 varying concentrations) and cold (10°C versus RT) treatments. Anthocyanins will be measured visually and with HPLC. A better understanding of anthocyanin accumulation in hemp will help the research community develop improved hemp cultivars.

COMMUNITY-ENGAGED SCHOLARSHIPS OF MICROPLASTICS IN WASTEWATER STREAMS AND 7 R'S OF RENEWABILITY

Sabryna O'Brien, Derek Ho (Mentor)

Due to the ubiquity, transportability, and ability of microplastics (plastics <5mm) to act as vectors for environmental contaminants, microplastics have become a growing concern for the ecosystem. One unexpected source for microplastics in the environment is wastewater treatment plants (WWTPs), where poorly disposed plastic waste is transported, processed, and further fragmented into microplastics during its treatment. To educate both students and their parents about the processes and fate of microplastics within WWTPs, an activity called Plastic Panic was instructed through community-engaged scholarship. To supplement and bolster this activity, activity stations detailing the 7Rs of renewability of waste products —Rethink, Refuse, Reduce, Reuse, Repair, Rot, and Recycle—were conceptualized and fabricated to decrease and limit plastic use and their eventual degradation to microplastics.

IN VIVO VALIDATION OF NOVEL WIRELESS BRAIN SENSORS FOR FUNCTIONAL MAGNETIC RESONANCE IMAGING

Emily Masterson, Aviad Hai (Mentor)

Current in vivo techniques for monitoring neural activity at the single neuron level are bulky and invasive, limiting our ability to achieve whole brain readouts of electrophysiology. Minimizing the invasiveness of existing brain interrogation techniques while maintaining direct detection of electrical activity will expand the scale of readouts we can acquire and advance the field towards whole-brain electrophysiology. This project aims to validate a new form of minimally invasive wireless sensors for functional magnetic resonance imaging by way of circuit sensing for brain ionic fluctuations by an ion-sensitive field effect transistor with a radio frequency resonator in parallel. Following this initial validation, this setup could be implemented as a microfabricated sensing circuit to wirelessly record electrophysiological activity from multiple regions of the brain concurrently.

FARM 2 FACTS: CREATING ACTIONABLE INSIGHT FROM AGRICULTURAL AND CUSTOMER DATA FOR FARMERS AND MARKET ORGANIZATIONS

Michael Kuhn, Hyunmin Park, Alfonso Morales (Mentor)

Farm 2 Facts (F2F) is a data-analytical platform which creates accessible and individualized metrics on sustainability, environmental impact, and customer behavior for both farmers and the markets they haul to. Access to this information, provided in English or Spanish, aids not only in advancing customer service and farming techniques, but provides proof-of-concept for both organizations in grant applications and business promotion. F2F operates in a survey format, relying on a statistical model to output a nuanced measure of categorical performance on a "Good, Better, Best" scale. Along with grading by each metric, F2F provides precise and constructive feedback to the farmer or market containing potential next strategies, such as in minimizing detrimental ecosystem impact. Currently F2F is beta-testing its product with farmers and market organizations.

BIM EXPRESSION AND ANTI-VEGF RESPONSE IN EXUDATIVE AMD

Barbara Hanna, Christine Sorenson (Mentor)

Neovascular age-related macular degeneration (nAMD) is a major cause of visual impairment in aging individuals. Vascular endothelial growth factor (VEGF), a proangiogenic factor, is largely responsible for choroidal vascular abnormalities in nAMD. Continuous injections of anti-VEGF are needed to keep the disease in check. Approximately 30% of nAMD patients do not respond to current anti-VEGF therapies, and the underlying mechanisms remain unknown. Neovascularization is kept in check by a balanced production of anti-apoptotic and pro-apoptotic proteins, including Bcl-2 and Bim. Little is known about how Bim expression in choroidal endothelial cells (ChEC) modulates VEGF expression and response to anti-VEGF. My hypothesis is that Bim expression is necessary for appropriate expression of VEGF, efficacy of response to anti-VEGF treatment, and restoration of vascular permeability.

EFFECTS OF PRENATAL FLUOXETINE EXPOSURE ON EWE DYSTOCIA AND OFFSPRING VITALITY

Kathy Tran, Sarah Adcock (Mentor)

Antidepressants are commonly prescribed during pregnancy, but their use has also been associated with adverse outcomes, including pregnancy complications and behavioral deficits in the newborn. The study used sheep as an experimental model to investigate whether antidepressant (fluoxetine) treatment during late gestation affects ewe and lamb welfare. In the last month of gestation, 20 ewes were treated with a daily dose of fluoxetine or saline as a control. We predicted that fluoxetine-treated ewes will exhibit larger portions of the observation period spent lying down with longer bout lengths that are associated with dystocia. We further predicted that fluoxetine treatment will increase the lambs' latency to stand. The research will help to identify risk factors for maternal-offspring health and better inform clinical practices in human reproduction.

PEER REVIEW: THE MEDIATING EFFECT OF GENDER AND RACIALLY BASED BIASES

Alexis Garbisch, Chaoqun Ni (Mentor)

The peer review process is designed to uphold the integrity of scientific research via sorting out invalid or inadequately developed manuscripts. However, it is possible that in this gate-keeping stage, gender and racial biases on the part of the reviewer, are taking precedence over the identification of poor quality articles. The presence of such biases would perpetuate the continued lack of racial or gender diversity within scientific research, as gaining publications is the backbone of such. Through the creation of a classification schema to identify the efficacy of peer reviewers and determine if gender or racial based commentary were left, trends in the efficacy of reviewers and the correspondence of such to the presence of racially or gender driven commentary were identified.

HORIZONTAL GENE TRANSFER INTERACTIVE TEACHING MODULE

Soniya Patel, Briana Burton (Mentor)

The objective of this project is to study the mechanism of horizontal gene transfer (HGT) between bacterial genomes. An integral part of the project includes creating an interactive teaching module that serves to teach high school students about natural transformation, a type of HGT. During natural transformation, bacteria can acquire new genetic material from their neighbors. Whole genome shotgun sequencing will be used to extract data from the bacterial transformants and will be presented to the students via graphical format in the teaching module. The interactive module will allow students to reach a basic understanding of bacterial gene transfer and apply what they learned to understand the results generated by the lab's sequencing data.

THE ROLE OF ENGAGEMENT IN NOVEL WORD LEARNING

Anna Compton, Jenny Saffran (Mentor)

Infants show preferences for learning from familiar adults and perform better on novel word learning tasks when taught by their caregivers than by strangers. However, it remains unclear why infants learn more from their caregivers. We hypothesize that adults who have demonstrated infant-focused engagement are more effective as teachers than adults who have not demonstrated infant-focused engagement. The current study tested this hypothesis by investigating the effects of engagement before word learning. Infants were taught the names of novel objects by two experimenters, one who had been engaging, and one who had been unengaging. We predict that engagement will facilitate novel word learning. Data collection is underway and preliminary findings will be discussed. Results will enhance our understanding of factors important for infant language development.

RECORDING AND OBSERVING LILIUM SPECIES

Adeline Wells, Ingrid Jordon-Thaden (Mentor)

Earth's biodiversity can be recorded and preserved through the formal process of the documentation of species. Growing different Lilium specimens, identifying the specimens taxonomically, and then confirming their species through DNA/RNA and plastid genome sequencing, contributes to the already established database of global biodiversity. This project will also expand the Wisconsin State Herbarium database as the Lilium specimens will be pressed and added to the collection. No matter how we record biodiversity, it is not nearly as important as maintaining the species diversity here on Earth. This record of Lilium specimens will not only help to preserve their biodiversity, it will provide a greater understanding of the specimens' evolutionary history and their relationships to other species around us.

DIETARY INTERVENTIONS IN ALZHEIMER'S DISEASE

Anna Tobon, Reji Babygirija (Mentor)

Alzheimer's disease (AD) is a progressive neurodegenerative disease that affects memory and cognition. AD is among the top leading causes of death in the United States, and a comprehensive treatment remains to be discovered. Previous research concludes that protein-restricted (PR) diets improve metabolic health and extend lifespan in rodents. This study investigates the relationship between a PR diet and the progression of an early-onset AD model. To accomplish this, triple transgenic (3xTg) and wild-type (B6129SF2/J) mice models are randomized to a PR or control diet. Metabolic and behavioral phenotyping methods were used to measure metabolic and cognitive effects in the mice. Using cognition as a marker for symptom progression, the results of this study will determine the effect of a PR diet on AD pathology.

UNDERSTANDING THE IMPACTS OF HIGH SCHOOL TO COLLEGE PIPELINE PROGRAMS FROM THE PERSPECTIVES OF PROGRAM ADMINISTRATORS AND ALUMNI

Krista Hanna, Sarah Jung (Mentor)

In the United States, there is a lack of underrepresented and underserved in the healthcare field. Students from these populations may have more difficulty finding research opportunities in the medical field. There are programs that are created solely to give these students an opportunity to delve into scientific research and gain additional academic skills, often referred to as "pipeline programs." My research focuses on qualitative analysis of interviews from program administrators and alumni from eight programs throughout the country. We are using a phenomenological approach to gain insight into the lived experiences and perceptions of the program administrators and alumni as to the impacts of these programs. Initial results suggest that communication skills, in addition to research skills, are a valuable component of these programs.

THE PROCESS OF SAFETY REPORTING BY PARENTS OF HOSPITALIZED CHILDREN WITH MEDICAL COMPLEXITY: A QUALITATIVE ANALYSIS

Tessa Chen, Miguel Garcia, Michelle M. Kelly (Mentor)

Although evidence suggests that parents of hospitalized children with medical complexity (CMC) have legitimate safety concerns, little is known about parents' experiences reporting these concerns during their child's hospital stay. This study's objective is to describe the process of reporting concerns from the perspective of parents of hospitalized CMC. Three researchers coded semi-structured parent interviews using an iteratively refined codebook with validation by a fourth researcher, and a conceptual model of family safety reporting was created. Four steps emerged illustrating this process: (1) parent recognizing concern, (2) parent reporting concern, (3) staff/hospital response to concern, and (4) parent feelings of validation. Effective family safety reporting interventions must help parents recognize and report concerns and help staff effectively respond to, acknowledge, and validate parent concerns.

COMPARISON OF SUBSTRATE SPECIFICITIES OF TYROSINE AMINOTRANSFERASES FROM PLANTS

Axel Semidey, Hiroshi Maeda (Mentor)

Tyrosine aminotransferases (TAT) are Pyridoxal-5'-phosphate dependent enzymes which catalyze transaminase reactions involving tyrosine. While most TAT's are active with tyrosine, they are often also active with other substrates, particularly aromatic compounds which can differ between plant species. To determine how the substrate specificity of TATs differ between monocots and dicots, we phylogenetically identified sorghum bicolor TAT genes and introduced them in *Escherichia coli*. Corresponding recombinant TATs were purified using imidazole metal affinity chromatography, and their substrate specificities were determined and compared to *Arabidopsis thaliana* TATs. The results of this study further explored the ancestral background of TATs, as well as their respective roles in nitrogen metabolism, which will help to improve nitrogen use efficiency of crop species.

ISOTOPIC RATIO ANALYSIS TO INVESTIGATE WILDLIFE LEAD EXPOSURE IN WISCONSIN

Mahak Kathpalia, Sean Ross Scott (Mentor)

An estimated 10–20 million birds and other species die each year of lead poisoning in the United States. The contaminant is known to accumulate in the environment, causing significant pollution and severe health risks to humans. This project aims to identify the causes of acute and chronic lead exposure using necropsy samples from lead-poisoned wildlife in Wisconsin. The lead isotope ratios of the samples measured by plasma mass spectrometry will be compared to those of potential sources in the bird's surroundings, such as water, soil, ingested metallic objects, etc. This will help inform administrative bodies, allowing them to initiate more targeted responses towards mediating and regulating the spread of the toxin.

GENOME-WIDE ASSOCIATION STUDY OF ANTERIOR CRUCIATE LIGAMENT RUPTURE IN THE LABRADOR RETRIEVER

Hannah Kearney, Lauren Baker, Jordan Gruel, Margaret Patterson, Nyah Kohler, Ryan Anderson, Peter Muir (Mentor)

Anterior cruciate ligament (ACL) rupture is a common complex disease in humans and dogs. ACL rupture is a polygenic, heritable complex disease with genetic and environmental risk. There is a critical gap in knowledge regarding the genetic architecture of ACL rupture that has never been studied. Our long-range goal is to define the genetic architecture of canine ACL rupture and use this knowledge to develop a genetic test for disease risk. Our hypothesis is that ACL rupture is a polygenic disease where thousands of loci influence disease risk. In a genome-wide association study of 1,006 ACL rupture case and control Labrador Retrievers, we have obtained an updated estimate of heritability of 0.62 and are now investigating polygenicity and polygenic risk score prediction of disease risk.

EXTRACTION OF PER- AND POLYFLUOROALKYL SUBSTANCES FROM DRINKING WATER USING FLUORINE-MODIFIED JANUS-LIKE GOLD NANOPARTICLES

Neha Thalpur, Haoran Wei (Mentor)

Per- and polyfluoroalkyl substances (PFAS) are persistent organic compounds detected in the bloodstream of 97% Americans. Exposure to PFAS via drinking water, non-stick pans, and PFAS-containing materials (pizza boxes, popcorn bags) has adverse effects on human health (e.g., thyroid disease, pregnancy complications, cancer, etc). In drinking water, PFAS occurs at trace levels, and current analysis requires tedious and expensive pre-treatment processes. In this project, a novel method using Janus-like gold nanorods (Au JNRs) functionalized with fluorine-containing silica polymers to capture PFAS based on fluorine-fluorine interactions is proposed for fast and cost-effective extraction. Elution can be achieved by solar irradiation due to strong interactions between Au JNRs and visible light. This will enhance the efficiency of PFAS detection in the light of increasing public health concerns.

NOVEL METHODS TO STUDY HORIZONTAL GENE TRANSFER IN COMPLEX MICROBIAL COMMUNITIES

Katie Krauska, Freeman Lan (Mentor)

Horizontal gene transfer (HGT) allows bacteria to exchange genetic information such as antibiotic resistance genes (ARGs) in microbial communities. Proliferation of antibiotic resistance via HGT threatens public health and food security. HGT is difficult to study in microbial communities because current methods such as bulk qPCR fail to connect species and ARG composition. Colony PCR and single-cell PCR can bridge this gap by identifying species identity and ARG presence in colony-forming units or single cells. We evaluate the use of colony PCR and single-cell PCR methods to monitor HGT in synthetic microbial communities challenged with antibiotics. These methods allow us to understand the dynamics of HGT in microbial communities and prevent the spread of antibiotic resistance.

EXPRESSION OF BAFF RECEPTORS ON TUMOR INFILTRATING IMMUNE CELLS

Ella Martell, Peiman Hematti (Mentor)

The tumor necrosis superfamily (TNFSF) includes two ligands, B cell activating factor (BAFF) and a proliferation inducing ligand (APRIL) and three receptors: B-cell activating factor receptor (BAFFR), transmembrane activator and CAML interactor (TACI), and B-cell maturation antigen (BCMA). Previous studies have established the role of BAFF signaling in B-cell survival, maturation, and differentiation, and have indicated the presence of these receptors on other immune cells. This study aims to identify the difference in expression of BAFF receptors on tumor-infiltrating immune cells in multiple myeloma and immune cells from healthy donor bone marrow. A real time PCR, confocal microscopy, and flow cytometry will be used to quantify the expression of these receptors. Findings will be used to identify and develop a novel therapeutic against cancer.

CAN THE ROOT METABOLOME HELP TREES COPE WITH DROUGHT AND BARK BEETLE ATTACKS?

Melissa Langkilde, Amy Trowbridge (Mentor)

Recent large-scale drought and bark beetle-induced mortality of pinyon pine (*Pinus edulis*) has prompted research into identifying mechanisms underlying tree susceptibility to herbivores. Research suggests that drought alters the specialized metabolites produced in above-ground tree tissues, leading to increased vulnerability to bark beetle attack. Yet the importance of root metabolites has received little attention despite their critical roles in maintaining whole-tree function. To fill this knowledge gap, I examined variation in defense metabolites in root cores collected from trees that have undergone either short or long-term drought during a 10-year manipulative field experiment. Drought events are expected to increase in severity and frequency, and this study will expand our mechanistic understanding of how processes in the roots may mitigate the impacts of above-ground disturbances.

IMPROVING CRYOPRESERVATION METHODS USING CHOLESTEROL TO MODIFY CELL MEMBRANES

Olivia Evans, John Parrish (Mentor)

Genomic testing has shifted the typical age distribution of bulls used for artificial insemination to younger bulls (1). However, younger bulls produce less sperm than mature bulls, creating a lack in supply to satisfy the demand (7). In response to this deficit, it is critical to increase bull semen quantity without compromising genetic quality. A potential way to accomplish this is to decrease the cryopreservation cell death rate. Incorporating cholesterol into the cell membranes attempts to maintain plasma membrane fluidity by minimizing intracellular ice formation, the primary source of cell death (5). Here we report the addition of cholesterol to sperm cell membranes increases post-thaw survival, without negatively impacting oviduct binding processes. This provides incentives for further study for application in optimizing cattle breeding.

COSMIC RAY AND MAGNETICALLY DRIVEN BUBBLES IN GALAXIES

Sherry Wong, Ellen Zweibel (Mentor)

The Parker instability is important to understanding the magnetic structure and evolution in galaxies. It describes the feedback loop between magnetic warping and buoyancy. In numerical simulations like the FLASH code, this results in large arches in the magnetic field that appear to merge and reconnect, accelerating gas bubbles perpendicular to the galactic disk. Reconnection in the scope of the Parker Instability has not yet been studied. This project investigates the origin and behavior of these gas bubbles using data analysis of numerical simulations. I confirm that the bubbles are created by reconnection. I study the importance of different forces on the bubble.The FLASH code does not rigorously model reconnection. I am working to rerun the simulation in Athena++, which better models cosmic rays.

GENOTYPING STRATEGIES TO CHARACTERIZE GENETICALLY MODIFIED MOUSE MODELS

Ethan Labriel, Andrea Galmozzi (Mentor)

The adipose tissue plays a central role in regulating glucose and lipid metabolism. Alterations in adipocyte function are tightly correlated with the onset of obesity and obesity-associated metabolic disorders, including insulin resistance and type 2 diabetes. Research in the Galmozzi lab focuses on identifying novel functional pathways in adipocytes that can be targeted pharmacologically to treat metabolic diseases. Towards this goal, we generated genetically modified animal models that recapitulate in part the molecular defects of human obesity. As part of a larger team effort to characterize these models, I extract DNA from tissue biopsies and, using a DNA amplification method called PCR, I define the exact genetic sequence of these animals and divide them into appropriate groups for downstream studies.

SYSTEMATIC REVIEW: PAIN EXPERIENCES OF LIMITED ENGLISH PROFICIENCY PATIENT POPULATIONS IN HEALTHCARE

Shoua Xiong, Nancy Bea Yang, Maichou Lor (Mentor)

While it is common that language and cultural barriers negatively affect care for patients with limited English proficiency (LEP), little is known about its impact on LEP patients with pain. This systematic review identifies and evaluates pain research with LEP patients. We searched articles in PubMed, CINAHL, PsychInfo, and Google Scholar from 1970 to 2021. Twenty-eight studies met our inclusion criteria. Most studies focused on the Spanish language (n=9) and were conducted in the United States (n=20). We identified six themes: (1) pain experience, (2) pain prevalence, (3) impacts of patient characteristics on pain, (4) communication, (5) pain severity, and (6) treatment and/or pain outcomes. Findings revealed that LEP populations experience disparities in pain care. More culturally and linguistically appropriate pain interventions are needed.

STEROID HORMONE IMBALANCE STIMULATES OSTEOPONTIN EXPRESSION AND INFLAMMATION IN THE MOUSE PROSTATE

Elise Schroeder, William Ricke (Mentor)

Inflammatory processes in the prostate are linked to the development of lower urinary tract symptoms (LUTS) in men. Our previous studies identified that osteopontin (OPN), a pro-inflammatory cytokine, is abundant in the prostate of men with LUTS and its secretion is stimulated by inflammation. We are interested in the steroid hormone imbalance of estradiol:testosterone (T+E2) ratio, and how it drives inflammation in the prostate, which is not well understood. Male C57BL/6J and OPN knock-out mice were surgically implanted with slow-releasing hormone pellets then euthanized two or six weeks later. The protein expression of OPN and inflammatory marker, Nuclear factor kappa B (NF-KB), was detected by immunohistochemistry.We identified T+E2-treatment stimulates OPN expression in the prostate. OPN-KO mice have decreased levels of Nf-kB suggesting reduced inflammation.

NEURONAL

Elise Schroeder, Andrew Bearnot (Mentor)

Our bodies are extremely reliant on the complex interactions that take place at the cellular level. We are made up of a nervous system that coordinates information via signaling pathways from our environment and translates it into daily actions we perform. My focus is on the central nervous system, and it contains a specialized cell type that creates myelin sheath around neurons which increase conduction and allow signals to travel faster. My research and final piece will be a three-foot-long glass neuron, encased in a glass spinal cord. I will show that I chose to create a glass neuron because the connections of the molecular components of glass: silicon, sodium carbonate, and oxygen, mirror neurons complex interactions with each other in the body.

EXPLORING ARCHIVES: A MICROCOSM OF HISTORY

Melina Mueller, Andrea-Teresa Arenas (Mentor)

Since October, I have been involved in the Wisconsin Latinx Historical Collective led by Andrea-Teresa Arenas. My assignment has been working with Ricardo Gonzalez to submit his archives to the Wisconsin Historical Society. He is a former Madison Alderman, the owner of the Cardinal Bar, the cofounder of the Madison Camaguey Sister Association, along many other roles in the community. I will discuss the lessons learned from working with archives and the importance of the implementation of archives for the Latinx community and the precedent it sets for future documentation of history.

AGE-RELATED CHANGES IN ELECTRORETINOGRAPHY PARAMETERS OF DOGS

Hannah Lillesand, Freya Mowat (Mentor)

Electroretinography (ERG) is a tool commonly used to study the electrical activity of the retina, a specialized neurologic eye tissue that detects light and mediates vision. Age-related retinal dysfunction in humans is well-characterized and predisposes to visual and psychological decline. Dogs are an important companion species, and age-related diseases often mirror that of humans; however, there is no report of age-related visual decline in dogs. For this study, healthy dogs across the lifespan with a normal eye examination underwent ERG. Commonly measured ERG variables (amplitude and peak time) were compared with dog age. Understanding these changes in ERG will aid in understanding what parts of the retina are responsible for age-related vision loss and how best to support dogs with these changes in sensory perception.

A BIOLOGICAL DEFENSE AGAINST UTIS

Piper Bandera, Marcela Ambrogi (Mentor)

Fifty to sixty percent of United States women experience urinary tract infections (UTIs), and many are recurrent infections. UTIs can ascend to the kidneys to cause permanent damage, and antibiotic resistance is a growing problem. We need alternative approaches to treat UTIs. Our overarching hypothesis is that the urethral neuroendocrine cells (UNECs) synthesize and secrete serotonin, drive urethral muscle contraction and expel bacteria from the urinary tract to reduce bladder bacterial colonization. Thus, these UNEC cells exert a natural defense against UTI that can be therapeutically leveraged. To test the hypothesis, I will use wild-type mice and those deficient in UNECs or UNECs serotonin synthesis. We expect to establish a key role for urethral neuroendocrine cells in protecting against ascending infection.

DEVELOPMENT OF ORGANOTYPIC MODELS FOR PRIMARY LIVER CANCER

Ellie Riedl, Jeremy Kratz (Mentor)

Advanced primary liver cancer results in survival on the order of months with a clear unmet need for understanding the disease biology. Patient-derived organoids (PCOs) are cultured in a 3-dimensional matrix to improve modeling of the tissue microenvironment. The use of these models is affected by physical features of the matrix as well as components of the media such as growth factors and small molecules. Here, we describe the development and testing of PCOs using a select set of growth factors and differentiation inhibitors. The growth of the organoids is measured using high-content imaging to track organoid growth. In the future, liver cancer organoids will be used to test standard and experimental drug therapies with the goal of developing novel therapeutic strategies.

UNDERSTANDING MECHANISMS OF PAPER FOLDING IN AUTISTIC AND NON-AUTISTIC CHILDREN

Michelle Adler, Brittany Travers (Mentor)

Paper folding is a simple task that can reveal information about the motor and cognitive development of children (Harris et al., 2013). The present study used cohort sequential longitudinal data from autistic and non-autistic children. We analyzed group differences in paper folding using a linear mixed-effects regression model. We analyzed visuospatial skills (composite PRI, matrix reasoning, and block design scores from the WASI-II), fine motor precision (penny transfer task from the BOT-2), and grip strength as potential mediators for group differences using structural equation modeling and Tobit regression models. Results showed that group differences do exist between autistic and non-autistic children in paper folding that are partially mediated by composite PRI and penny transfer scores, but that the groups' developmental trajectories are similar.

EVALUATING PARTICIPANTS' ABILITY TO DETECT LIES IN CONVERSATION

Abbey O'Byrne, Yasmin Mirhashemi, Harmon Bhasin, Stav Atir (Mentor)

Research shows that people lie in about 25% of their interactions (DePaulo & Bell, 1996). How can we change our behavior to better detect when someone is being dishonest with us? This study aims to evaluate the difference in how well participants can distinguish lies from truth in two conditions: when they simply hear a response versus when they can talk about the response. Participants are paired, and one is asked six questions, each with a command to tell the truth or to lie. Pairs with the "monologue" condition may only hear the response, whereas those with the "dialogue" condition may ask questions and discuss. This study could have applications in daily life and encourage people to probe further when they suspect someone is lying.

EFFECTS OF ESTRADIOL DEPRIVATION ON PANCREATIC ISLET MORPHOLOGY OF OVARIECTOMIZED FEMALE MARMOSETS

Mihika Sathe, Ashley McQuiston-Keil, Alison Gregorian, David Abbott (Mentor)

Estradiol (E2) is a female sex hormone that regulates the reproductive cycle. E2 depletion is a common side effect of taking letrozole, a drug that prevents the conversion of androgens to estrogen and is used to treat breast cancer. Previous studies in rodent models suggest that E2 deprivation leads to the accumulation of extracellular plaque in the pancreatic islets due to oxidative stress and apoptosis. This study aims to determine whether the same effects occur in non-human primates. We hypothesize that ovariectomized female marmosets undergoing total estradiol deprivation will have increased extracellular plaque in their pancreatic islets as compared to controls.

BASELINE SNAKE SPECIES DIVERSITY IN MADISON-AREA PRAIRIE RESTORATIONS

William Vuyk, Catherine Woodward (Mentor)

Despite being the most abundant reptile taxon in Wisconsin, little is known about snake populations that live within miles of the state's flagship research university. This study aimed to assess the local efficacy of snake cover board sampling, and provide baseline data on snake species diversity for eight isolated prairie restorations in the Madison-area. Across 1000 board checks divided between Biocore Prairie, Greene Prairie, Lake Farm County Park, Overlook Prairie, Owen Conservation Park, Pheasant Branch Conservancy, Prairie Ridge Conservation Park, and Turville Point Conservation Park, I recorded 140 snake encounters representing five different species. Snake communities were detected at every site except for Biocore Prairie. Occupancy models informed by GIS analysis of landscape factors were employed to investigate observed differences in species diversity between sites.

MECHANISMS UNDERLYING FAITHFUL CHROMOSOME SEGREGATION

Ainslie Homan, Aussie Suzuki (Mentor)

Kinetochores are protein complexes located on centromeric chromatin, which exist at the primary construction of mitotic human chromosomes. They play a key role in cell division, microtubule assembly and mitotic progression. The Suzuki laboratory research seeks to determine the molecular mechanisms that ensure faithful chromosome segregation with a focus on kinetochores. To study chromosome and kinetochore dynamics with fluorescence microscopes, I am involved in the process of cloning and tagging fluorescence proteins to histones in a modified episomal mammalian expression vector system. Researchers aim to discover how kinetochores contribute to carcinogenesis and what underlying mechanisms impact this process. As cancer is the second leading cause of death in the United States, this research could work toward a greater understanding of the impactful disease.

MICROPLASTIC CONCENTRATION IN LAKE SUPERIOR SEDIMENT

Sabeel Samrah, Nimish Pujara (Mentor)

Plastics are seen everywhere, from grocery packaging to toothbrushes to household utilities. Unlike natural materials, many plastics do not break down completely; rather, they fragment into continuously smaller pieces that remain in the ecosystem. These small pieces, known as microplastics, can contaminate our food and water supplies, which can negatively affect health over time. This study examines the size and density of microplastics in beach sediment from Lake Superior. Microplastics from samples were categorized based on size and shape using a microscope. The sediment from the samples will be sorted by mass and size using standard ASTM sieving methods. Trends in this data will help us understand the abundance of microplastics and their beaching patterns.

COMPARING THE POLYPHENOL CONTENT OF ARONIA AND CRANBERRY FRUIT JUICES

Madison Herman, Bradley Bolling (Mentor)

Consuming polyphenols from plants may improve health by reducing the risk of cardiovascular disease and cancers. Aronia berries and cranberries are grown in Wisconsin and known to have high concentrations of polyphenols. To understand and compare their polyphenol content, we evaluated the juices at a similar Brix level of 7.5. The pH differential method revealed that aronia berry has an anthocyanin content of 8.18 mg/100 mL, whereas cranberry juice has 1.08 mg anthocyanins/100 mL. The Folin method estimated the total concentration of polyphenols as gallic acid equivalents in aronia and cranberry juices to be 310 mg/100 mL and 132 mg/100 mL, respectively. Both juices are high in polyphenols, and these data inform future experiments that optimize juice polyphenol bioaccessibility and determine their specific health benefits.

POLLEN ACTINOBACTERIA INHIBIT COMMERCIAL HONEY BEE HIVE AND CROP PATHOGENS

Claire Reichardt, Daniel May (Mentor)

Managed honey bee populations play an important role in agriculture, their pollination services are used widely for monoculture crops, most commonly fruits and nuts. Increased hive pathogen loads have led to a decrease of managed honey bee hives. Additionally, widespread antibiotic resistance to commonly used honey bee antibiotics such as oxytetracycline have made current treatments less effective. Actinobacteria, gram-positive bacteria known for production of antibiotics, are found in pollen and may have a symbiotic relationship with honey bees and plants. This study investigates the isolation of actinobacteria from diverse pollen sources and their ability to inhibit bee and plant pathogens. Incorporating these bacteria or the antibiotics they produce into managed honey bee hives could serve as replacement for currently used honey bee antibiotics.

EFFECTS OF KISSPEPTIN-10 (KP10) ON THE TIMING OF PUBERTAL INITIATION

Veronica Goveas, Ei Terasawa Grilley (Mentor)

Gonadotropin-releasing hormone (GnRH) neurons regulate gonadotropin release, which is critical for pubertal initiation. While the hypothalamic kisspeptin neuron is an upstream regulator of GnRH release, whether kisspeptin determines pubertal initiation is unknown. Two prepubertal male rhesus macaques at 16 months (mo) of age continuously received hourly pulsatile infusion of either KP10 or saline and the signs of puberty were assessed. The preliminary results at 21 mo indicate that the KP10-treated male exhibited accelerated increase in testicular volume and body weight as compared to that in the saline-treated male. Because an increase in the testicular volume does not characteristically start until ~30 mo, KP10 infusion appears to accelerate the timing of puberty. Whether KP10 accelerates the pubertal changes in gonadotropins and testosterone remains to be assessed.

COMMEMORATIVE PALIMPSESTS IN POST-AUTHORITARIAN ARGENTINA: THE CASE OF ESMA

Emily Nelsen, Ksenija Bilbija (Mentor)

The authoritarian military regime in Argentina (1976–83) left lasting impacts on the country's social, political, and economic way of life. ESMA, a notorious former clandestine torture center in Buenos Aires, became a site of memory on March 24, 2004, a date that also came to symbolize the anniversary of the coup d'etat. Using the case study of ESMA, my research into how four Argentine presidential administrations since 1989 have commemorated the anniversary of the dictatorship on March 24 investigates the following issues: (1) How did political leaders influence the cultural prominence of ESMA? (2) As a physical reminder of past conflict, how have commemorative events at ESMA generated new rounds of conflict in each presidential term?

GESTATIONAL ORIGIN FOR METABOLIC DYSFUNCTION IN PCOS-LIKE FEMALE RHESUS MACAQUES

Caitlyn McQuiston-Keil, David Abbott (Mentor)

Polycystic ovary syndrome (PCOS) is an endocrine and metabolic disorder endured by many women from adolescence to menopause. Gestational exposure to testosterone (T) excess generates a PCOS-like phenotype in female rhesus macaques that meets all three of the Rotterdam criterion. Researchers in the Abbott/Levine lab have found that adult female PCOS-like rhesus macaques develop pancreatic islet abnormalities, insulin resistance and experience a progression to type 2 diabetes (T2D). These conditions result from increased oxidative stress in the macaque's beta cells causing apoptosis and, therefore, an accumulation of extracellular fibrin and plaque in the macaques islets. We hypothesize that gestational exposure to testosterone excess negatively impacts female PCOS-like rhesus macaques abilities to create and sustain healthy islet cells, and therefore maintain homeostasis.

FIRST CONSTRAINTS ON ADDITIONAL PLANETS IN THE WD 1856+534 SYSTEM

Sarah Kubiak, Ke Zhang (Mentor)

WD 1856+534 b (or WD 1856 b for short) is the first known transiting planet candidate around a white dwarf star. WD 1856 b is about the size of Jupiter, has a mass less than about 12 Jupiter masses, and orbits at a distance of about 2% of an astronomical unit. Here, we present constraints on the presence of long-period companions in the WD 1856+534 planetary system. We show that existing transit observations can rule out many plausible orbits for Jovian planets with periods less than about 500 days. With additional transit observations over the next few years, it will be possible to test whether WD 1856 also hosts additional long-period planets that could have perturbed WD 1856 b into its current close-in orbit.

EFFECTS OF DYNEIN-DEPENDENT TRANSPORT ON DENDRITIC SPINE MORPHOLOGY

Kelly Gottschalk, Erik Dent (Mentor)

All cells, including neurons, have two major microtubule motor proteins, kinesin and dynein, which allow for bidirectional transport of cargo along microtubules. While most research has focused on the mechanisms by which kinesins and dynein move along axonal microtubules, little is known about cargo transport into and out of dendritic spines. My study has built on recent research from our lab, showing kinesin transports cargo into dendritic spines, by investigating how dynein may transport cargo out of spines. To explore this, we used pharmacological agents and shRNA knockdown to inhibit dynein and observed dendritic spine morphology of rat cortical neurons. Information from this study will be important for our understanding of how dynein is involved in synaptic plasticity, which has implications for learning and memory.

CLASSIFYING GLACIAL ABRASION MORPHOLOGY

Lillian Smith, Lucas Zoet (Mentor)

The objective of this study is to characterize glacier striation morphology and link striation morphology to glacier basal forces. Striations were created using a unique ring-shear device that slid ice with 311 rocks over a marble bed. Experiments were performed where the contact force between rocks and the bed was either high or low. Striations were counted, measured, and characterized as type 1, 2, 3, chatter marks, non-specific indent, specific indent, or miscellaneous for each experiment. The high force experiment produced 291 striations with 45% type 3 while the low force produced 157 striations with 52% type 3. The data suggest that the majority of striations tend to conform to the type 3 morphology, and shear stress influences striation characteristics.

INVESTIGATING POST-TRANSCRIPTIONAL CONTROL & ITS EFFECTS ON ADULT NEUROGENESIS

Tala Shaibi, Darcie Moore (Mentor)

Adult neurogenesis, the lifelong production of neurons, decreases with age and is attenuated in disease pathologies such as dementia and mood disorders. This decrease in neurogenesis is largely the result of an increased barrier for neural stem cells (NSCs) to exit quiescence and activate. Successful NSC quiescence exit is facilitated by aggregated protein clearance via a vimentin intermediate filament cage. The absence of vimentin protein decreases NSC quiescence exit, suggesting its crucial role in quiescence exit. Previously, we found that vimentin mRNA is translationally repressed in quiescence. We hypothesized that substituting vimentin transcript's 3' untranslated region (3'UTR) with a translationally activating UTR will enhance vimentin mRNA translation in quiescent NSCs. Our study showed that this substitution increases vimentin mRNA translation in qNSCs, leading to NSC activation.

VIRTUAL FRIENDSHIP FACILITATION

Elijah Ikard, Marcos Balleza-Calvo, Kristin Shutts (Mentor)

This study asks the question, "Does facilitating social interactions between children help improve intergroup relations?" This study relates to the social and cognitive development of children and how certain behaviors can increase social intimacy. The focus is to compare the affinity between children after taking part in the Fast Friends paradigm or control activities. In the Fast Friends paradigm, children engage in reciprocal self-disclosure, whereas children in the control condition simply read a script of dialogue. The findings could benefit children of younger age groups to make more by facilitating important relations with others and increasing proficiency in social skills, learning, and interpersonal communication. Data collection is ongoing, but initial data support the study predictions that Fast Friends paradigm can facilitate meaningful relationships among children.

THE CHARACTERISTICS OF VIRTUAL AND FACE-TO-FACE COMMUNICATION DURING CLINICIAN-SURROGATE DECISION-MAKING CONVERSATIONS

Emily Wulf, Lauren E. Shefchik, Kristen Pecanac (Mentor)

Virtual visits have revolutionized communication during the COVID-19 pandemic. This study aims to characterize clinician-surrogate decision-maker communication through face-to-face and virtual modalities (telephone, video). We audio-recorded seven clinician-surrogate decision-making conversations in one hospital. We used conversation analysis and descriptive statistics to analyze the conversation length, number and length of pauses, the usage of knowledge claims, and the amount of conversation overlap. Virtual conversations were longer (31.8 vs 27.0 minutes), had more pauses (58 vs. 50.3), and longer pauses (1.56 vs 1.17 seconds) than face-to-face. However, the average number of knowledge claims (10.33 vs. 10) and conversation overlap (12 vs. 10.66) was higher for face-to-face. These findings can inform next steps in improving virtual clinician-surrogate interactions.

PARENT-CHILD CONVERSATIONS ABOUT EVOLUTION

Aleena Ann Banuelos, Greta Hansen, Zoe Young, Aaron Cecil-Xavier, David Menendez (Mentor)

Evolution is a complex subject typically not taught until high school. Teaching evolution at an earlier age might prevent developing misconceptions. In this study, we look into how parent-child conversions teach children about evolution. We recruited 83 parent-child dyads to participate in a two-session online study. During the first session, participants were given a pretest to measure their previous knowledge of evolution. Approximately 1 week later, the dyads completed the second session where they read an e-book about evolution and completed an assessment of their learning and generalization. Data analysis is ongoing, but we will examine how children understand evolution before and after reading the book. Our study suggests that children can learn about evolution at an earlier age than has previously been taught.

TESTING THE "STICKY-SPOT MIGRATION HYPOTHESIS" AT BENCH GLACIER WITH SEISMIC DATA FROM 2007 AND 2021.

Lindsay Summers, Lucas K. Zoet (Mentor)

The physics of glacier sliding is one of the largest sources of uncertainty in models forecasting sea-level rise. Glacier beds are largely inaccessible, hindering direct observation, but sliding produces ice-quakes on "sticky-spots" that provide information about sliding mechanics. Some sticky-spots are thought to migrate through time as particularly dirty basal ice moves along the glacier's bed. In this study, we investigate sticky-spot migration using seismic recordings from 2007 and 2021 at Bench Glacier in Alaska. We identified basal ice-quakes in both records, finding that seismic activity shifted down-glacier by ~250 meters in this time. Our results are consistent with a particularly dirty band of basal ice flowing down-glacier, supporting the hypothesis of sticky-spot migration.

DOSE-DEPENDENT MODULATION OF HIPPOCAMPAL CONTEXTUAL MEMORY, PLACE CELLS, AND SPATIAL ENGRAMS VIA A POTENT NMDAR ANTAGONIST, (R)-CPP

Mengwen Zhu, Robert Pearce (Mentor)

N-methyl-D-aspartate receptors (NMDARs) are ionotropic glutamate receptors (iGluRs) that contribute to higher cognitive functions and many neuropathological conditions. They are enriched in the hippocampus, a brain structure important for episodic memory, and are pivotal for hippocampus-dependent learning. One way to study the functional importance of NMDARs in hippocampal memory-encoding circuit is via NMDAR antagonism. In the present study, we aim to understand how (R)-CPP, a potent NMDAR antagonist, dose-dependently modulates hippocampal contextual memory, place cells, and spatial engrams via context preexosure facilitation effect (CPFE) paradigm and in-vivo calcium imaging. We were able to suppress contextual memory in a dose-dependent manner and demonstrate that the two mechanisms through which (R)-CPP induces amnesia involve place cells and spatial engrams.

ADOLESCENT SOCIAL MEDIA INTERACTIONS AND FOMO

Abby Hommer, Maggie Bushman (Mentor)

For adolescents, fear of missing out (FoMO) is associated with decreased wellbeing and increased social media use. The purpose of this study is to understand the relationship between adolescents' FoMO and specific social media interactions, such as posting photos, commenting, and direct messaging. These actions can be assessed with the adolescents' digital technology interactions (ADTI) scale. A secondary analysis of a cross-sectional survey of adolescents ages 12–17 will be conducted. The analysis will include a Pearson correlation, focusing on the ADTI and FoMO scales. Our hypothesis is, a higher score on the FoMO scale will be positively correlated with higher social media use for social interaction. The findings from this study could help with understanding how adolescents manage feelings of FoMO through social media use.

MEASURING PERMEABILITY OF ROUGH ROCK FRACTURES UNDERGOING SLIP AT IN-SITU STRESS STATE

Porter Garst, Hiroki Sone (Mentor)

Accurate prediction of rock permeability is important for industries that rely on subsurface fluid flow. For the geothermal energy industry, reservoir permeability enhancement through fracture generation is important because it allows more efficient recovery of heat. We fracture granite samples at in-situ stress conditions, ensuring a realistic fracture profile is created, and then measure the permeability of these fractures. Permeability is measured while the fractures are slid further to highlight the influence of fracture slip and rock type on permeability. Our data will build upon past research on fracture permeability while ensuring it is applicable in subsurface environments. The data will help improve larger scale reservoir models in accurately simulating resource recovery from subsurface reservoirs.

THE RELATION BETWEEN INSTAGRAM USAGE AND STRESS

Aarti Patel, Ellen Selkie (Mentor)

There have been conflicting findings about the relationship between social media usage and stress. Previous studies have examined social media broadly but not specific platforms such as Instagram. The purpose of this study is to augment previous research on the association between stress and social media by measuring different types of Instagram usage and their relations to stress levels. Through snowball sampling, 118 participants were recruited to complete an online survey with questions about demographics, stress, and Instagram usage. Once data collection is complete, analysis will assess the relationship between specific Instagram usage behaviors (active vs. passive) and stress levels. This study could show many relationships and benefit people such as therapists by finding conclusions to their patients mental health status.

COMPARISON OF RESORBABLE SUTURES TO NONABSORBABLE SUTURES FOR NERVE GRAFTING

Alison Jacobs, Emily Ott, Amgad Hanna (Mentor)

When treating peripheral nerve injuries with nerve gaps, autologous nerve grafts are ideal for treatment. However, even with nerve grafts, not all patients regain function. Nonabsorbable sutures for nerve grafting induce scar formation, impeding neural regeneration. Contrastingly, absorbable sutures avoid the scar-forming cascade, inducing better neural regeneration. Our research will compare nonresorbable 9-0 nylon sutures to resorbable 9-0 Vicryl sutures in nerve graft surgery and measure the immune response and axon regeneration postoperatively. We hypothesize resorbable sutures will not induce a harmful immune response when used to suture autografts. We will suture a 10 mm sciatic nerve isograft in Lewis rats with 9-0 nylon sutures or 9-0 vicryl sutures and compare the immune response and axon regeneration in the grafts.

INVESTIGATING TES MAGNETIC FIELD SENSITIVITY AND SUPERCONDUCTING SHIELDING EFFICACY

Haley Stueber, Elisa John, Aidan Lewandowski, Dan McCammon (Mentor)

Half the normal matter in the universe takes the form of diffuse gas at temperatures above one million degrees and can only be seen in the x-ray region. But most of this material has never been observed because doing so requires large-throughput instruments with energy resolutions better than 2 eV. For this purpose, we are developing microcalorimeter detectors that perform thermal calorimetry on individual x-ray photons by exploiting the superconducting transition-edge as a sensitive thermometer at temperatures below 100 mK. The detectors are very sensitive to magnetic fields, so proper magnetic shielding is crucial for their operation. This study evaluates the ability of magnetic shielding to prevent magnetic fields and field fluctuations around microcalorimeter detectors in order to optimize their performance for space-based observations.

X-RAY SPECTROSCOPY OF AMMONIUM IONS IN JAROSITE AND OTHER SULFATE AND SILICATE MINERALS

Eatai Sasson, Simon Bushmaker, William Nachlas (Mentor)

Jarosite, a hydrous K-rich sulfate mineral, was detected in soils on the Martian surface. Jarosite can accommodate ammonium ions (NH_4^+) which commonly replaces K^+ within its crystal structure. Several other sulfate and silicate minerals accommodate NH_4^+ similarly. Utilizing electron-excited x-ray spectroscopy (EPMA and SEM), we will characterize Jarosite's geochemistry and investigate how NH_4^+ undergoes ionic substitution in sulfate and silicate minerals. X-ray spectroscopy will provide insight into the concentration and distribution of N in ammonium-bearing minerals. Ammonium incorporation into Jarosite reflects the availability of N in ancient Martian environments to reconstruct biological and hydrological processes. Our research seeks to advance our understanding of N incorporation into ammonium bearing sulfate and silicate minerals to provide constraints on the abundance of N in terrestrial and Martian environments.

THE PHYSICIAN WORK-LIFE INTERSECTION: A SCOPING REVIEW OF ITS DEFINITION AND MEASUREMENT

Andrew Yang, Sarahi Garcia, Sarah A. Webber (Mentor)

In the United States, many physicians deal with balancing work and life amid the COVID-19 pandemic. Many experience imbalance in their work-life intersection, including managing family and career responsibilities. There is a need to universally define what the work-life intersection (WLI) is through terms, definitions and measures. The purpose of this study is to use a scoping review of the literature to create a "Work-Life Interface" conceptual model that should be used to understand and improve physicians' wellbeing. We hope this model will improve future research in understanding and improving the work-life intersection.

THE STUDY OF BAFF AND APRIL RECEPTORS ON MONOCYTES AND MACROPHAGES

Reyna Dogru, Peiman Hematti (Mentor)

A proliferation inducing factor (APRIL) and B-cell activating factor (BAFF) are part of the tumor necrosis factor ligand family (TNF), and are required for B-cell development and survival. APRIL and BAFF activate signal transduction through three receptors; B cell activating factor receptor (BAFFR), Transmembrane activator and CAML interactor (TACI), and B-cell maturing agent (BCMA). These receptors were known to be restricted to B-cell lineage, but recent studies are showing their expression in other immune cells. I will employ quantitative PCR and flow cytometry to determine BAFFR, BCMA, and TACI expression in healthy human monocytes and monocytic cell lines. This study will be extended to tumor associated macrophages in multiple myeloma. Findings from this study will be used to develop a novel immunotherapy against cancer.

HEALTH AND VOTING IN WISCONSIN: USING HEALTH AS A METRIC FOR MOBILIZATION OF FEMALE VOTERS IN MIDTERM ELECTIONS

Paige Leiser, Amy Gangl (Mentor)

Political scientists, epidemiologists, and public health professionals have begun to consider health as a predictor of voter engagement and mobilization. To make a small contribution to this research area, this thesis will engage in a comprehensive study of health and voter mobilization in the state of Wisconsin, with a specific focus on female voters and midterm elections. The emphasis of this work will be on understanding ways in which organizations and political interests can better speak with voters about these vital connections between health and voting. To test the hypothesis of this thesis, a regression analysis will compare county-level health data from the Robert Wood Johnson Foundation's County Health Rankings with voter turnout data collected by the United States Census American Community Survey.

FREEDOM, INC.: SOUTHEAST ASIAN & BLACK COMMUNITIES KEEPING EACH OTHER SAFE

CLARA Yu, Christy Zheng, Cindy I-Fen Cheng (Mentor)

Freedom, Inc. (Southeast Asian and Black communities keeping each other safe) is a Wisconsin Idea Fellowship Project dedicated to ensuring that the education at UW–Madison is benefiting the communities beyond the campus borders. Our project works to address the challenges of racially discriminatory experiences in America's system through conversations with our local community partner Freedom, Inc. (FI). In order to do so, community discussion panels with the leaders of FI's Mutual Aid Programs and FI director Kabzuag Vaj were facilitated for UW–Madison undergraduates and community members, which were crucial to build unity between Southeast Asian and Black folx. These opportunities for discussion enable ethnic communities to keep each other safe so all ethnic communities can recognize, heal from, and respond to their collective experiences.

THE ROLE OF OSTEOPONTIN IN STEROID HORMONE-INDUCED IMMUNE CELL INFILTRATION OF THE PROSTATE

Kegan Skalitzky, William Ricke (Mentor)

Inflammatory processes in the prostate have been linked to the development of lower urinary tract symptoms in men. This study elucidates immune cell infiltration associated with alterations of the estradiol/testosterone ratio, and assesses whether osteopontin (OPN), a pro-inflammatory cytokine, plays a role in steroid hormone-induced inflammatory responses. Male C57BL/6J (WT) or Spp1tm1Blh/J (OPN-KO) mice were implanted with testosterone and estradiol pellets and euthanized after two weeks. We quantified immune cells in the ventral prostate with immunohistochemical staining of CD45. In addition, we analyzed several immune cell subsets using fluorescent in-situ hybridization, toluidine blue staining, and hematoxylin and eosin staining. Treated WT mice exhibited increased leukocyte counts and increased macrophage infiltration relative to treated OPN-KO mice, indicating that OPN deficiency may inhibit steroid hormone-induced inflammation.

FAMILIES WITH INCARCERATED PARENTS: THE ROLE OF CAREGIVER WELLBEING ON CHILD WELLBEING

Bertha Gonzalez, Julie Poehlmann (Mentor)

Although the literature on children of deported parents is sparse, there are lessons to be learned from studying other types of forced parent-child separation, such as parental incarceration. The present study examines the association between caregivers' wellbeing and children's wellbeing when a parent is incarcerated. The study includes caregiver and parent-reported data from families of children who are between 2–6 years of age who have an incarcerated mother or father (Poehlmann-Tynan et al., 2017), focusing on caregiver economic wellbeing and mental health in relation to children's behavior problems. Analyses revealed significant associations between caregiver mental health and children's behavior problems. The study has implications for caregiver needs for support and may spark ideas for investigating other forms of forced parent-child separation in vulnerable families.

CRACKING SKIN MICROBE COMPETITION: FINDING NEW DRUGS IN THE HUMAN SKIN

Sherrie Wu, Uyen Thy Nguyen (Mentor)

While colonizing the skin, microbes secrete small molecules that inhibit the growth of other microorganisms to promote their own wellbeing. A low-abundance species in the genus *Microbacterium* was found to have antimicrobial properties, especially antifungal. To select for secreted molecules, after the bacterium was grown, crude extracts were collected and separated by reverse-phase chromatography. The fractions were tested against various skin pathogens using susceptibility assays, which revealed two fractions with strong antimicrobial activity against gram-negative *Acinetobacter baumannii* and skin fungal pathogen *Candida albicans*. Future directions will focus on elucidating the identities of the antimicrobial molecules. Ultimately, discovering the molecules with profound antifungal properties will create a better understanding of microbial interactions on the skin and may lead to a new antifungal treatment.

MOLECULAR DYNAMICS SIMULATIONS OF POLYETHYLENE TEREPHTHALATE (PET) DISSOLUTION IN PLASTICS RECYCLING

Dane Christiansen, Lisa Je (Mentor)

Chemical recycling methods promise to ease concerns regarding the environmental impact of continued plastic use while producing high-quality reusable plastic resins. Though these recycling techniques often use hazardous solvents, ionic liquids offer a potential replacement for such chemicals. In this study, we analyzed and ranked the abilities of water, tetrahydrofuran (THF), trichloroacetic acid (TCA), and the ionic liquid (IL) 1-ethyl-3-methylimidazolium tetrafluoroborate (EMIM BF4) to dissolve polyethylene terephthalate (PET) plastic. The analysis and ranking were produced using molecular dynamics (MD) simulations of PET dissolution in each solvent. MD simulations use Newton's laws of motion to calculate theoretical molecular movements. These calculations serve as a "omputational microscope," allowing the molecular-scale interactions between PET and solvent molecules to be visualized and studied.

TESTING BROAD SPECTRUM CANCER THERAPEUTICS IN MURINE MODELS

Amanda Carston, Reinier Hernandez (Mentor)

The goal of this research is to discover how radiolabeled NM600, a tumor-targeting agent, may serve well as both therapeutic and diagnostic tools to provide targeted and personalized cancer treatments. Current radiotherapy is typically successful in eradicating cancer at the cost of exposing healthy tissue to radiation, which may cause adverse events. Murine cancer models are used to test the efficacy of these radioligands through in-vivo and in-vitro techniques. If found viable, this powerful technique does not only have anti-tumor effects, but it may also prevent excessive radiation exposure to healthy tissues by only attacking the tumor cells, which would reduce the severity of unwanted side effects cancer patients tend to suffer from.

EFFECTS OF AN INDIVIDUATION ACTIVITY ON CHILDREN'S RACIAL BIAS

Beatrice Lazarski, Kristin Shutts (Mentor)

Children show explicit racial biases early with more prevalence in White children. It is important to reduce White children's racial biases. Previous research shows that encouraging adults to see racial/ethnic out-group members as individuals (individuation) reduces their biases. Research has yet to examine whether individuation can be used in children. My research aims to discover if individuation reduces explicit biases in White children ages five to eight. The study randomly assigns participants to an individuation condition or control conditions. The child's evaluation of Black children is then assessed. Data collection is ongoing. My research has potential to create a tool to reduce explicit racial biases in young children. It could have positive impacts on intergroup relations, and reduce negative impacts on minority children.

KEPLER'S LAST PLANET DISCOVERIES: SINGLE-TRANSIT PLANET CANDIDATES FROM K2 CAMPAIGN 19

Elyse Incha, Susanna Widicus Weaver (Mentor)

The Kepler space telescope was responsible for the discovery of over 2,700 confirmed exoplanets (planets orbiting stars other than the Sun) during both its primary and extended K2 mission. As K2 ran out of fuel, it made its last observations, and an extremely short dataset called Campaign 19 was collected. Thus far, no other teams have attempted to use Kepler's final dataset to search for planets. Our team has combed these data and found three possible planet transits. Each planet candidate has only one recorded transit, from which we were able to determine many characteristics, including each planet's most likely period. We hope this work will help ensure that all Kepler data is utilized to its full potential so that no planets are left behind.

REMOTE SENSING ANALYSIS OF THE RELATIONSHIP BETWEEN SAND DUNE TOPOGRAPHY AND VEGETATION RESPONSE TO VARYING PRECIPITATION IN THE CENTRAL GREAT PLAINS

Tien Vo, Joseph Mason (Mentor)

The Central Great Plains is a premier site of potentially mobile loess (wind-blown dust deposits) and sand dune landscapes. As climate quickly changes, these landscapes are vulnerable to destabilization and movement as the likelihood of extreme weather increases. To predict their response to changing climates in the future, it's important to understand how loess and sand dune landscapes have historically responded to changing climate. The objective of the study is to determine how vegetation in these landscapes have responded to years with high and low precipitation. Vegetation is a potential factor in susceptibility to erosion and thus landscape stability. Using various remote sensing data, the study aims to determine how vegetation responds to unusually dry and wet years in different parts of sand dunes.

SURGICAL SIMULATOR OF PERIACETABULAR OSTEOTOMY FOR ORTHOPEDIC SURGICAL TRAINING

Josh Andreatta, Joshua Roth (Mentor)

Orthopedic resident training curricula lack sufficient opportunities for residents to develop and practice their surgical skills. Current methodologies to provide these opportunities have begun to incorporate simulation to provide more opportunities for residents to learn and practice new skills. I developed a surgical simulator for periacetabular osteotomies (PAOs) to aide orthopedic residents in surgical skills training and medical preparedness. The simulator incorporates simulated fluoroscopic images, immediate feedback on performance, and provides an environment that mimics an operating room. This project investigated the effectiveness of the simulator by analyzing the relationships between time spent on the simulator, accuracy in acetabular repositioning, and skill improvement over subsequent use. This project allows for further understanding of and insight to the effectiveness of simulators in surgical training.

SPATIAL AND TEMPORAL PATTERNS OF SEED DEPOSITION IN ENCROACHED TALLGRASS PRAIRIES

Eliza Soczka, Katherine Charton (Mentor)

Woody encroachment, or the spread of woody vegetation into previously grass-dominated ecosystems, threatens the persistence of tallgrass prairies. By researching how woody seeds disperse, we can better understand how woody species establish in tallgrass prairies. We quantified the spatial and temporal patterns of woody and herbaceous seed deposition in a tallgrass prairie to investigate positive feedbacks generated by existing woody vegetation. We deployed seed traps on the ground in areas of high and low woody vegetation cover and found a significantly higher number of seeds were deposited in areas of high woody vegetation cover mid-summer. Percent cover of woody vegetation also positively correlated with seed deposition of woody species, specifically. We recommend practitioners target woody vegetation removal before seed set to minimize further establishment.

THE ROLE OF CARD IN TRANSCRIPTION INITIATION IN ZYMOMONAS MOBILIS

Allison Czora, Mike Wolfe (Mentor)

Understanding the mechanisms of transcription initiation is crucial for predicting the coordination of gene expression in an organism. Essential for transcription in some bacteria, RNA polymerase binding factor CarD could possibly be used to shape the transcriptome by controlling initiation. *Zymomonas mobilis*,an ethanologenic bacteria with promise for biofuel production, contains CarD, but expression is not necessary for survival. Currently, CarD's role in Zymo gene regulation is poorly understood. To determine where CarD may aid in initiation across the genome of Zymo, we engineered a tagged, inducible CarD knockdown strain, allowing us to control CarD expression. With this strain, we performed ChIP-seq to identify genomic sites where CarD is binding and possibly involved in initiation, to learn more about what governs initiation in this promising biofuel producer.

SEARCHING FOR CHEMICAL SIGNALS IN ORANG-UTAN URINE USING LIQUID

Anusha Ray Dey, Graham Banes (Mentor)

Orang-utans are critically endangered great apes, where morphologically female and socially subordinate male orang-utans cannot be easily distinguished. Socially dominant males develop irreversible cheek pads. In this study, a total of 116 samples were analyzed to quantify the chemical compounds excreted. This was done to identify what compounds might differ in presence or quantity between the different classes of orang-utan. Using the liquid chromatography-tandem mass spectrometry (LC-MS/MS) technique, it is expected to better understand how male bimaturism might manifest in orang-utans, and if chemical signals might be involved in their development, maintenance and/or suppression. All samples are going through LC-MS/MS, and results will be analyzed with appropriate statistical methods and will be presented in the spring 2022 at the Undergraduate Symposium.

ASSESSING THE RISK: OBESITY AND BREAST DENSITY EFFECTS ON MAMMARY GLAND INFLAMMATION

Megan Halambeck, Lisa Arendt (Mentor)

Obesity and breast density are both risk factors for breast cancer. Although both risk factors have been explored separately, little is known about the risk of breast cancer for women with dense breasts that later become obese. To model breast density and obesity, we use a Col1a1tmjae mutant FVB/N mouse model (het) with enhanced collagen deposition and non-transgenic littermates fed a low (LFD) or high-fat-diet (HFD) for 9, 12, and 15 weeks. We quantified F4/80+ macrophages and CD8+ T cells using immunohistochemistry and collagen deposition using picrosirius red staining. Our results suggest that obesity contributes to collagen deposition and inflammation within dense breast tissue and reduces CD8+ T cells. Breast density and obesity may enhance breast cancer risk together through interactions on immune cell function.

DOES SLEEP MODERATE THE RELATIONSHIP BETWEEN AMYLOID-BETA BURDEN AND SPEECH-LANGUAGE OUTCOMES?

Erin Bruehlman, Kimberly Mueller (Mentor)

Alzheimer's Disease (AD) is characterized by abnormal accumulation of beta amyloid (AÎ²) plaques, and literature shows relationships between sleep and AÎ². Because sleep has a documented effect on executive function and working memory, two cognitive functions that are associated with both AÎ² accumulation and language measures, we hypothesize that sleep will moderate the effect of AÎ² on language outcomes. Participants were from the Wisconsin Registry for Alzheimer's Prevention (n=255). Predictors include Epworth Sleepiness Scale scores and estimated AÎ² levels from participants' most recent AÎ² PET scan. Outcomes include speech efficiency, disfluency index, categorical fluency, and phonemic fluency. Although our results found no significance for sleep as a moderating effect between AÎ² and speech outcomes, there was a significant effect of sleep on speech efficiency.

PARENT LITERACY BELIEFS AND STRATEGIES FOR CHILDREN WITH INTELLECTUAL AND DEVELOPMENTAL DISABILITIES

Hayley Bazarek, Audra Sterling (Mentor)

Parents of children with Down syndrome (DS), fragile X syndrome (FXS), and autism spectrum disorder (ASD) positively impact their child's literacy development. This study investigated how literacy beliefs varied based on child diagnosis. Additionally, we examined what strategies parents identified as effective for engaging/motivating their child to read/write. Parents completed a reading belief questionnaire and answered an open-ended question on literacy strategies. Ninety-six parents of school-age children with DS, FXS, and ASD participated. Parents of autistic children reported less reading enjoyment and instruction compared to the other groups. All groups reported using the child's interests to personalize literacy activities. Only parents of children with DS reported using social motivation. Findings indicate similarities and differences in literacy beliefs and strategies in DS, FXS, and ASD.

ROLE OF NEUROESTRADIOL IN THE BRAIN: SEX DIFFERENCE

Stephanie Li, Ei Terasawa (Mentor)

Gonadotropin releasing hormone neurons in the hypothalamus controls reproductive function in both males and females. Despite the clear sex difference in reproductive function, the hypothalamus in primates is not sexually differentiated. Because neuroestradiol, synthesized in the brain, also plays a role in regulation of GnRH release in female macaques, this study examines whether neuroestradiol also plays a similar role in male macaques. To test the neuroestradiol's role, castrated males will be treated with high dose of estradiol benzoate along with the aromatase inhibitor letrozole, which blocks the synthesis of estradiol from testosterone, while periodical blood samples for hormone analysis are obtained. Controls will receive estradiol benzoate and vehicle. Findings from this study will clarify the sex difference in the role of neuroestrodiol in the hypothalamus.

INVESTIGATING THE RELATIONSHIP BETWEEN STUDENT SENSE OF BELONGING AND ACADEMIC ACHIEVEMENT

Christy Zheng, Haania Khan, Grace Qiu, Anna Kowalkowski (Mentor)

This study aims to assess the relationship between students' sense of belonging and academic achievement throughout the Biocore Honors Curriculum. We hypothesize that there will be a positive relationship between a student's self-reported sense of belonging and self-reported academic achievement. We also hypothesize that there will be a positive relationship between a student's self-reported sense of belonging and their cumulative GPA in Biocore. Our study aims to identify factors in the community that are associated with a student's sense of belonging. We used students' survey responses to determine if a relationship exists among variables of academic performance and achievement, sense of belonging, and DEI awareness. The study will help preserve and enhance programmatic approaches that foster community and provide opportunities of academic success.

STUDYING MORPHOLOGICAL ASPECTS OF UNDERGROUND AND AERIAL ROOTS FROM A GIANT CORN

JP Gutierrez, Jean-Michael Ane (Mentor)

Nitrogen-fixing bacteria impact the world's agriculture by providing nitrogen to plants as an alternative to synthetic fertilizers. Corn landraces from Sierra Mixe in Mexico grow in low nitrogen soil and display a rare trait of producing aerial roots that support nitrogen-fixing bacteria. These roots release border cells that secrete mucilage after rain where the fixing bacteria is hosted. We studied several morphological aspects to characterize this novel trait. We cultivated plants in vitro and in a greenhouse to explore aerial and underground root traits. Our results showed that the border cell number is the same for the two studied genotypes of landraces. The root diameter of underground and aerial roots from several genotypes showed no correlation. Root layers from underground and aerial roots seem different.

A COMPARISON OF MALE AND FEMALE YOUTH ICE HOCKEY INJURIES THAT PRESENTED TO UNITED STATES EMERGENCY DEPARTMENTS FROM 2011 THROUGH 2020.

Lindsey Repins, Traci Snedden (Mentor)

Background: Youth ice hockey participation in the United States (U.S.) has grown annually. Although sport participation provides positive benefits, risk for injury exists. Past injury studies focused predominantly on males. Knowledge surrounding female youth ice hockey injuries is limited. **Purpose:** To summarize national injury incidence rates and compare injury characteristics of male and female youth ice hockey players who presented to U.S. emergency departments from 2011–20. **Study Design:** Retrospective analysis of national survey data. **Conclusions:** Injury rates were higher for males. However, injuries to the head and diagnosis of concussion were highest in both groups. This is concerning considering the effects of concussion on youth health. Additional investigation on mechanism of injury will offer insight on preventative strategies to decrease head injury in youth hockey.

BIOFUNCTIONALIZED PLANT LEAF-DERIVED BIOMATERIALS AS SCAFFOLD FOR BIOMEDICAL APPLICATION

Chanul Kim, William Murphy (Mentor)

Decellularized plant-derived biomaterials have been studied recently as potential natural scaffolds with substantial advantages over conventional materials. In addition to having the advantage of sustainability and biocompatibility, those materials contain pre-vascularized and highly porous structures which enable sufficient oxygen and fluid transport. Moreover, diverse plant species have unique topographies that can control cell behaviors. In this study, we investigated fundamental material properties and geometries of three varied plant leaf species as potential scaffolds in tissue engineering. After the decellularization process using chemicals, the plant leaves were coated with Poly-L-Lysine and Poly (PEGMEMA-r-VDM-r-GMA) copolymer, followed by cell-binding peptides to biofunctionalize the materials. These biofunctionalized plant-derived biomaterials are expected to be novel platforms to study human stem cells' behaviors.

THE ROLE OF STONE TOOLS IN CLOTHING PRODUCTION: BONE NEEDLES AND SEWING

Giulia Kanwischer, J. Mark Kenoyer (Mentor)

Stone tool use in the production of bone needles was studied to understand the types of tools needed and the resulting use wear. Sewn clothing is needed in cold climates, and recording the origins of this technology provides useful insight for understanding cultural adaptation in different regions of the world. Four bone sewing needles were produced using stone saws and drills. The bone needles were polished and shaped with grinding stones. The use wear resulting from drilling the eyes of the needles was analyzed in order to better identify lithic tools that could have been used in needle production in future studies. This study shows that particular types of stone tools are necessary for needle production and they should be identifiable at an archaeological site.

EVALUATING SENSORIMOTOR ADAPTATION TO VOWEL-CENTRALIZING AUDITORY PERTURBATION IN SENTENCE PRODUCTION

Sophie Johnson, Carrie Niziolek (Mentor)

Recent research has identified that altered auditory feedback that centralizes vowels can increase vowel space area and the average spacing between vowels for single words. In the current study, we examined how a vowel centralization perturbation affects the vowel space area of typical speakers when producing sentences. Participants from different age groups read sentences under vowel centralization auditory feedback and, in a separate control session, under normal auditory feedback. Preliminary analyses suggest that participants oppose the perturbation, producing vowel formants that are further from the center of the vowel space, especially for the corner vowels. These increases in the working vowel space area demonstrate the potential of vowel centralization feedback to enhance vowel contrast and intelligibility for the natural speech production of typical speakers.

(UN)BURIED STORIES: THE DEATH OF FEDERICO GARCIA LORCA AND SPAIN'S CONTENTIOUS PAST

Sam Canney, Ksenija Bilbija (Mentor)

Throughout the 20th century, Spain withstood a civil war and the Franco dictatorship. Among the victims of Francoism is world-renowned writer Federico Garcia Lorca, murdered in the Civil War's early days. The location of Lorca's remains is unknown, and like the conversation surrounding Spain's past, the search has been fraught with debate. As this conversation grows and efforts to find Lorca's body fail, right-wing politicians against examining Spain's past clash with Spaniards who see Lorca as symbolic of their own murdered loved ones. In this project, I examine how various Lorca-related sites present the story of his death and the search for his body, in order to understand varying views on Spain's legacy of terror and how these different approaches affect views of Spain's present.

COLLEGE STUDENTS' VIEWING PREFERENCES

Damien Short, Marie-Louise Mares (Mentor)

This study examined what kinds of media depictions are sought out by students from lower-socioeconomic status (SES) backgrounds versus those from higher-SES backgrounds and the impact of being reminded of their SES background either before or after making their choices. Data collection has just begun. We expect that there will be a negative association between subjective social class and the clips depicting mostly lower-SES characters, and a positive relationship with the clips featuring higher-SES characters. We also expect effects of identity on media selections to be stronger when individuals are reminded of their SES before making selections. This study will provide knowledge about how SES as an identity impacts media use.

BACTERIAL IDENTIFICATION BY 16S RRNA GENE SEQUENCE ANALYSIS AND ITS EFFECT ON ANTIMICROBIAL USE IN ORTHOPEDIC INFECTIONS

Memee Moua, Joseph McBride (Mentor)

16S ribosomal RNA are nucleic acids found in ribosomes of prokaryotic bacteria. 16S rRNA gene sequencing can identify and classify bacteria more definitively based on genotypic methods and can help identify poorly defined bacteria, differentiate between closely related species, isolate infectious bacteria, and more. This analysis is beneficial in clinical care settings in identifying infectious microorganisms which can help medical professionals properly prescribe the correct antibiotics. The goal is to analyze whether 16S rRNA gene sequencing can de-escalate the antibiotic stewardship in the number of anti-pseudomonal, anti-MRSA, and the total number of antibiotics prescribed. Currently, the population of interest are orthopedic patients but we hope to initiate further research on other populations of interest as well.

OH RADICAL RETENTION IN DIFFERENT BIOSOLUTIONS

Mark Hurst, William Dunn, Hau D. Le (Mentor)

Cold atmospheric plasma (CAP) and the resulting hydroxyl radical (OH) have proven to be a direct, pertinent approach to treating solid tumors in humans. However, in order to bypass direct-application limitations, OH radical concentration must be maintained for an extended period in solution. This project studies various biosolutions to determine the ideal solution to carry OH radicals. Five different biosolutions were exposed to CAP and stabilized with terephthalic acid (TA) after specified incubation periods. The fluorescence of the resulting monohydroxy terephthalate was measured via microplate reader, then analyzed to determine the concentration of OH radical upon stabilization. Determining which biosolutions can hold the OH radical for the longest periods will present a pathway to a systemic, indirect, minimally invasive CAP-based cancer treatment.

MODELING THE IMPACT OF CLIMATE CHANGE ON THE ELECTRIC GRID

Lucas Franke, Line Roald (Mentor)

In California, climate change causes stronger, more frequent wildfires, posing imminent danger to homes, businesses, and lives. Since power line faults can ignite large, powerful wildfires, it is important for power companies to upgrade their electrical equipment. Unfortunately, many of these upgrades, such as putting power lines underground, are expensive. Therefore, it is crucial for power companies to prioritize upgrading those power lines most at risk of starting wildfires. This risk is calculated using known data about power lines and public information about environment-related wildfire risk, but synthesizing this risk data with power line data requires substantial processing time. This project examines how to reduce this computation time through increased processing efficiency and data clustering.

SECONDARY ATHLETIC TRAINERS' CLINICAL MANAGEMENT DECISIONS TOWARD LOW SOCIOECONOMIC STATUS STUDENT ATHLETES

Elena C Miller, Mayrena I. Hernandez (Mentor)

Evidence has shown that patient socioeconomic status (SES) has contributed to observed disparities in health care. SES acts as a component of the social determinants of health (SDOH) because individuals with lower SES are at higher risk for negative health outcomes. Athletic trainers (ATs) are health care professionals who provide direct care for athletes of low SES. To assess ATs' perceptions of clinical management decisions toward their athletes of low SES, we conducted an online survey followed by data analysis. The results concluded that secondary school ATs perceived 4/5 SDOH as somewhat to very relevant when providing care to low SES athletes. Of these SDOHs, the health and health insurance determinant was the most relevant when making clinical decisions for their low SES athletes.

UNDERSTANDING RECOVERY AND DEVELOPMENT IN CHILDREN WITH EARLY BRAIN INJURY AND CEREBRAL PALSY

Alina Grimaldo, Bernadette Gillick (Mentor)

Infants who experience perinatal brain injury are at high risk for developing motor and cognitive disabilities such as cerebral palsy. This study aims to longitudinally assess infants who experience perinatal brain injury to better understand how the brain develops post-injury. Predictive assessments including magnetic resonance imaging, age-appropriate developmental assessments, and transcranial magnetic stimulation will be performed at 4–5 time points over the first two years of life.These assessments may help detect atypical brain development and predict cerebral palsy diagnosis. Analysis of differences between brain hemispheres may further contribute to understanding motor development in children with asymmetrical perinatal brain injury. This study will provide novel information about brain plasticity and recovery, and inform potential therapies to contribute to greater quality of life for affected individuals.

SIMULATED MERGER IN THE DISH SOAP INDUSTRY: EFFECT ON PRICES AND PROFITS

Martha Kowalski, Christopher Sullivan (Mentor)

Much of industrial organization literature has developed methods for estimating demand in markets with differentiated goods to analyze measurements such as price elasticities, effects on welfare, and price changes. One popular area is analyzing the price effects of a merger, first by modeling demand as a function of product characteristics, then using demand parameter estimates and the assumption of Nash-Bertrand competition to recover marginal costs, and finally, using the estimates and marginal costs to simulate new equilibria under proposed mergers. Our research analyzes the effects of product prices and firms' profits if such a merger were to occur in the dish soap industry.

MICROFLUIDIC MODELING OF RENAL CARCINOMA RESPONSE TO ANTI-ANGIOGENIC THERAPIES

Jack Loken, David Beebe (Mentor)

Renal cell carcinomas (RCC) are common genitourinary tumors with high vascularization that lead to poor prognosis despite treatment. The complex cellular RCC environment (e.g., angiogenesis, tumor-vasculature interactions) has been challenging to accurately model in vitro. We used microfluidics to engineered a tubular blood vessel model utilizing iPSC-derived endothelial cells with an adjacent 3D carcinoma model. Our model recapitulated the sprouting angiogenic response of vessels as a response to RCC tumors seen in vivo. Utilizing our model, we showed a decrease in angiogenic sprouting after anti-angiogenic treatment but no restoration of vessel barrier function. This microfluidic model may be used to investigate the effects of specific environmental components (e.g., stromal cells) of RCC in modulating response to treatments, thus improving patient prognosis.

THE EFFECTS OF AUTOPHAGY INHIBITION ON HNSCC SENSITIVITY TO CTX

Samantha Bradley, Randall Kimple (Mentor)

Cetuximab (CTX) is a monoclonal antibody commonly used in the treatment of head and neck squamous cell carcinomas (HNSCCs) that acts by targeting the epidermal growth factor receptor (EGFR). Autophagy is a naturally occurring mechanism activated within cells to protect them from harsh conditions or stress, but can also provide cancerous cells with protection against further treatment attempts. In this study, we were able to demonstrate that CTX treatment can inadvertantly activate pro-survival autophagy, conferring cells with resistance to cancer therapies. Here, we examine the efficacy of combining CTX with autophagy inhibitors, as well as investigating the specific mechanism of CTX-induced autophagy in HNSCC.

MODELING AND OPTIMIZATION OF ENERGY SUPPLY SYSTEMS WITH A FOCUS ON ENERGY STORAGE: A CASE STUDY ON THE UW–MADISON CAMPUS

Sooyra Davanagere, Styliani Avraamidou (Mentor)

Changing existing energy storage technologies with renewable energy is paramount when it comes to contribution to a greener, more sustainable environment. Keeping existing models in mind, this report will focus on the modeling and optimization of energy supply chains to facilitate decision making and accelerate the penetration of renewables in existing power grids. Superstructure representations of the chain will be developed, including various types of energy storage systems and smart grid applications. Economic, environmental, and social attributes of these systems will be considered in a multi-objective optimization formulation that will be optimized under different scenarios. The developed framework will be applied to identify the most promising renewable energy system and pathways for each smart grid application to supply the UW–Madison campus with electricity and heat.

MANAGEMENT OF ANOMALOUS AORTIC ORIGIN OF CORONARY ARTERIES

Hareem Rauf, John Hokanson (Mentor)

An anomalous aortic origin of the coronary artery (AAOCA) is a condition present at birth where the left or right coronary arteries arise from the opposite cusp. These coronary artery patterns have been associated with sudden cardiac death, but the risk of sudden cardiac death is poorly defined. Surgical correction of these anomalous coronary origins is available, but the risks and benefits of these operations are evolving but not yet clear. Due to this uncertainty, balancing the risk of surgical and nonsurgical is challenging. We created an online survey to gain more insight into a practitioner's management approaches. We hope to provide a contemporary assessment of what is considered best practice for the management of patients with anomalous origins of a coronary artery.

GENE KNOCKDOWN OF HYPOTHALAMIC ESTROGEN-RECEPTOR ALPHA IN RELATION TO NEUROPEPTIDE S RECEPTOR 1 EXPRESSION IN ADULT FEMALE RHESUS MACAQUES

Jaclyn Fahey, David Abbott (Mentor)

Endometriosis is an estrogen-dependent inflammatory condition of the uterus causing pelvic pain and infertility. Its cause is unknown and treatment options are limited. Whole exome sequencing of women and female rhesus monkeys, however, recently associated gene variants in neuropeptide S receptor type 1 (NPSR1) with naturally occurring endometriosis. An unrelated study focusing on estrogen regulation of female weight gain and employing estrogen receptor alpha (ERa) knockdown (KD) in the hypothalamus of adult female rhesus monkeys to block estrogen action in a brain center regulating metabolism, has induced a high incidence of endometriosis compared to controls. To test whether altered hypothalamic NPSR1 expression is associated with ERaKD-induced endometriosis, immunohistochemistry experiments are underway. This investigation will increase our understanding of the role of NPSR1 in endometriosis.

GESTATIONAL TESTOSTERONE ALTERS PANCREATIC ISLET MORPHOLOGY AND PROGRESSION TOWARDS DIABETES IN ADULT MALE RHESUS MONKEYS

Nicole Byington, David Abbott (Mentor)

Although polycystic ovary syndrome (PCOS) is a women's reproductive disorder, it is commonly accompanied by metabolism dysfunction of unknown origin. Adult female rhesus macaques exposed to gestational testosterone (T), a known model for PCOS, manifest PCOS-like metabolic disorders, including insulin resistance and type 2 diabetes (T2D). Male macaques exposed to the same gestational T, exhibit insulin resistance and poor pancreatic beta cell response to glucose in adulthood. The PCOS-like male monkeys exhibit islet morphology indicative of increased oxidative stress and apoptosis: fibrin with plaque accumulation. Reduced functional islet area may accelerate progression to T2D. Gestational T exposure may provide a common origin for diabetic dysfunction in women with PCOS and their close male relatives.

CHARACTERIZING DECADAL METHANE EMISSION TRENDS IN ARCTIC WETLANDS

Isaac Ogunleye, Christian Andresen (Mentor)

In an era of evident climate change, research must now explore new aspects of environmental change that can influence potential feedbacks to climate. In recent years, rising temperatures in the Arctic are affecting different aspects of the tundra ecosystem, particularly wetlands which are hot-spots for methane, a potent greenhouse gas released into the atmosphere. This study aims to address how methane emissions are changing in Arctic Wetlands associated to enhanced vegetation growth and permafrost thaw from warmer and longer summers. By measuring and monitoring decadal-scale changes in permafrost active layer depth and vegetation growth in small arctic ponds, we can identified trends to determine whether the Arctic is acting as a dangerous greenhouse gas emitter.

ELECTROCHEMICAL ETHANOL EPOXIDATION VIA 2-CHLOROETHANOL

Taobo Wang, Marcel Schreier (Mentor)

Ethylene oxide is a common platform chemical and important precursor to polymers. However, the industrial production of ethylene oxide is energy-consuming and has a large carbon footprint. In this project, we use a sustainable electrochemical method to produce ethylene glycol from ethanol, which is widely available as a biofeedstock. We designed a chlorine-mediating pathway, using 2-chloroethanol a reaction intermediate, and implemented a flow cell design to achieve ethylene epoxide generation using only electricity as energy input.

ADDITIONAL GREEN LIGHT EXPECTED TO INDUCE SHADE RESPONSE IN BRASSICA RAPA FAST PLANTS

Kaylynn Imsande, Janet Batzli (Mentor)

Green light acts as a shade signal in some plant species, though this hasn't been studied in *B. rapa* specifically. Green wavelengths activate photoreceptors which signal shading to the plant and stimulate auxin synthesis; increased auxin promotes lateral root formation. I hypothesize that *B. rapa* grown under high-intensity red, blue, and green light will exhibit more laterally oriented roots than *B. rapa* grown under red and blue light. To test this, I'll grow seeds on paper towel in plastic bags to observe root architecture. I expect to observe increased length and number of lateral roots in plants grown under additional green light compared to red and blue light alone. If observed, these results would indicate that green light induces shade response symptoms in *B. rapa*.

MACHINE LEARNING FOR BRAIN TRANSCRIPTOMIC MEASUREMENTS ALIGNMENT

Marin Suzuki, Chenfeng He (Mentor)

Brain development is a dynamic process that requires crosstalk among various gene programs, during which the precise regulations between genes are essential. Disruption of gene regulations leads to neural disorders. We anticipate discovering biomarkers for neural diseases by identifying marker genes which differentially expressed between healthy and diseased brains. Specifically, we use machine learning to align transcriptomic measurements of brain development to understand the cause of neural diseases, and how and in what cellular contexts these differences occur. My task is developing web-based tool for visualizing how genes regulation changes across cell-types and time based on the data identified by machine learning. In this way, we can visually interpret the dynamic procedures of genes regulation as well as identify biomarkers for neural diseases.

IDENTIFICATION OF COLLAGEN PRODUCING CELL LINEAGES IN THE INFLAMED MOUSE PROSTATE

Jaskiran Sandhu, Chad Vezina (Mentor)

Lower urinary tract symptoms (LUTS), including incomplete bladder emptying and abnormally frequent urination, are prevalent in aging men. One predictor of LUTS is excessive collagen accumulation in the prostate, caused by intermittent infection and inflammation. To understand how collagen accumulates, this study identifies which prostatic cell lineages expand and which cell lineages produce collagen in response to inflammation. Genetically modified mouse strains harboring fluorescent proteins in potential collagen-expressing cell types were used and transurethrally infected with uropathogenic *E. coli* to drive prostatic inflammation. Immunostaining was performed to determine which cell types increase in abundance and which cell types express collagen in response to inflammation. This study and future research work toward the long-term goal of identifying drugs to block collagen production pathways and treat LUTS.

UTILITY OF AN ANIMAL PRODUCTION CO-PRODUCT AS A SOURCE OF NOVEL ANTIMICROBIALS

LINDSEY Weiss, Vanessa A. Leone, Ph.D. (Mentor)

Antimicrobial resistance is a global health concern. Natural, low-cost, and efficacious sources of novel antimicrobials targeting foodborne pathogens are urgently needed. Animal co-products classically discarded during slaughter, such as blood, could be a rich source of biologically active, antimicrobial molecules. Hepatic portal vein blood is enriched in microbially and host-derived small molecules with potential antimicrobial properties. We hypothesized that portal blood would have more targeted antimicrobial properties against a common foodborne pathogen, *Salmonella* spp., relative to peripheral blood with no appreciable antimicrobial action against *Lactobacillus* spp., a common commensal probiotic bacterium. Together, we examined how a source of naturally occurring antimicrobials from animal tissue could provide strategies to overcome antimicrobial resistance and minimize waste from animal production which could have broad environmental and health implications.

RECONSTRUCTING THE SHAPE OF A FRAGMENTARY HOMININ SKULL

Ngawang Namru, John Hawks (Mentor)

A common problem with fossil remains is that they are broken into pieces that may not fully represent their anatomy. When paleontologists study these, they must make some reconstruction of the overall shape. The purpose of this project is to find correlations in the structure of the craniums of humans and our primate relatives in order to identify the shape of a fragmentary skull. This will be accomplished by collecting landmark data from skulls of humans, chimpanzees, orangutans, gorillas, and gibbons and analyzing the variations in shape across species. The results will help place the hominin skull more accurately in the tree of relationships of known species. This dataset may be valuable in reconstructing other hominin skulls in the future.

CHARACTERIZATION OF CANDIDA ALBICANS HYPHAL INDUCTION BY CITROBACTER FREUNDII

Natalie Kielley, Alex Cheong (Mentor)

Candida albicans is the most common opportunistic human fungal pathogen, and lives as a yeast commensal on our skin and mucosal surfaces. However, interactions with other microbes such as the gram-negative bacterium *Citrobacter freundii* can induce hyphal growth, a virulence factor important for *C. albicans* pathogenesis. Here, we characterize *C. albicans* biofilm architecture phenotypes in co-culture with *C. freundii* in a chambered coverslip model to elucidate mechanisms of polymicrobial interactions. Using cell-free supernatants, hyphal induction by *C. freundii* was found to be contact-independent and pH-sensitive, suggesting that a secreted metabolite may be responsible for hyphal induction. Studying polymicrobial interactions that mediate *C. albicans* virulence is critical for understanding microbial behavior in the context of a microbial community.

SEX EDUCATION THROUGH THE ARTS

Cassidy Martin, Caleb Probst (Mentor)

Sex Education Through the Arts is a two-part project that asks: (1) How can the arts be used to teach a controversial topic like sex education? (2) What are the effects of using the arts to teach sex education rather than a traditional curriculum? Set in the South, "Evolution of Hickies" includes monologues, poems, visual art, and scene work between the author, her mothers, men, and peers. It depicts problems femme people face when sex education isn't introduced safely or generationally. This art piece will contribute to a series of lesson plans that teach fundamentals of sex education, such as consent, gender identity, and body image. The curriculum uses art as a way to teach sensitive concepts and generate art to demonstrate understanding, self-expression, and interpretation.

UNDERSTANDING THE INCEL COMMUNITY AS ANTIFANDOM: COMPREHENDING VIRTUAL HATE GROUPS

Kellen Sharp, Marie-Louise Mares (Mentor)

The Incel (Involuntarily Celibate) community is the most violent sector of the manosphere—digital spaces in which exclusively men's rights activism, social grievances, and anti-feminist rhetoric permeate. These men subscribe to a redpill ideology—in reference to *The Matrix* where the "pill" awakens one from the lies of a supposed misandrist society. We studied the forum incel.is looking at threads centered around community to understand better how Incels structure/discuss themselves as a group, theorizing that they function more as an antifandom of post-feminist rhetoric than any other organizational framework. Moreover, we argue that by framing Incels as an antifandom, existing literature can provide insight into how hate groups can form and propel themselves in digital spaces.

INVESTIGATING DESIGN THINKING AND MATERIAL CULTURE

Addyson Farias, Sarah Carter (Mentor)

Design is not merely about aesthetics but rather is how objects and systems give meaning and relevance to the human experience. "Design Thinking " is a set of methods used within various disciplines that generates creative solutions to complex problems. Utilizing such strategies allows individuals to sustain a human-centered attitude, with the design objectives of creative, transformative outcomes and experimentation. This creative project uses a historical lens to investigate the methodological roots and possible futures of design thinking at UW–Madison. Through the use of library research across a multitude of academic conventions, we can develop a greater understanding of the evolution of design thinking principles, leading to better our knowledge of implementing design thinking within our academic settings for improved products, services, and ideas.

THE ROLE OF SPATIAL ANXIETY IN SPATIAL PERFORMANCE

Valerie Buroker, Olivia Clauss, Peyton Nystrom, Percival Matthews (Mentor)

Spatial anxiety is prevalent among children. However, limited research exists describing the link between spatial anxiety and spatial performance, particularly investigating how working memory may contribute to this relationship. We hypothesize that auditory working memory mediates the relationship between spatial anxiety and spatial performance because anxiety occupies working memory resources, therefore decreasing resources available to complete spatial tasks and improve performance. Examining whether this relationship exists is valuable in better understanding how spatial anxiety contributes to spatial and math performance. To test this, we analyze self-reported spatial anxiety, working memory, and spatial relations performance of children ages 10–15 years old (n=111) from a larger longitudinal study. We hope to extend these findings to investigate how spatial anxiety could relate to math anxiety and performance.

PEOPLE, PARKS, AND THE PANDEMIC

Katelyn McVay, Samuel F. Dennis, Jr. (Mentor)

Our concept of perceived mental wellbeing and how we use public parks has been reshaped by the COVID-19 pandemic. With limited access to indoor gathering spaces due to pandemic restrictions, studies show significant increases in visits to public parks during the pandemic. Could the health benefits from these visits potentially outweigh the negative health effects attributed to pandemic-related stress? Intercept interviews performed at the University of Wisconsin–Madison Arboretum were quantitatively and qualitatively analyzed to investigate this question. People have used and reaped the benefits of public parks during this specific period of time, and this study's results will further our understanding of how the outdoors can be used as a coping mechanism and why visits to the outdoors during stressful life events are necessary.

MET INHIBITION ENHANCES THE EFFECT OF RADIATION IN MET MUTATED NON-SMALL CELL LUNG CANCER BRAIN METASTASIS PATIENT DERIVED XENOGRAFTS.

Shrey Ramesh, Randy Kimple (Mentor)

Non-small cell lung cancer (NSCLC) is the most common form of lung cancer in the world. In NSCLC, the mesenchymal epithelial transition factor (MET) can be altered through both mutation and amplification. MET exon 14 skipping, a specific MET mutation, occurs in roughly 3% of all lung adenocarcinoma. The most common MET mutation occurs in exon 14, leading to increased downstream signaling causing increased cell proliferation and survival. MET is involved in pathways that are associated with response to radiation therapy. Capmatinib inhibits the MET receptor which has shown positive results for improving treatment efficacy both in vitro and in vivo when acting as a single agent. There is limited knowledge regarding the mechanism behind the synergistic effect between radiation and capmatinib.

MOLECULAR CHARACTERIZATION OF HUMAN TELENCEPHALIC DOPAMINERGIC INTERNEURONS

Cade Hottman, Ashwin Debnath, Andre Sousa (Mentor)

Dopamine is a neuromodulator that is critical for high cognitive functions, including working memory and exploratory behaviors. It is well established that mammals possess dopaminergic neurons within the substantia nigra and the ventral tegmental area, which primarily project to the striatum and neocortex, respectively. Although this circuitry is well conserved across mammals, we found, using comparative single-cell transcriptomics, that the human telencephalon may also have dopaminergic inhibitory neurons. Here, we performed multiplexed single-molecule fluorescent in situ hybridization and immunofluorescence to better characterize these neurons. Using this methodological approach, we confirmed that this distinct interneuronal population has human-specific molecular features that allow dopamine production and transport, which might contribute to human unique cognitive abilities.

SCARLESS GENOME EDITING IN E.COLI FOR OCTANOIC ACID PRODUCTION

Sirinada Chanthachaiwat, Will Bothfeld (Mentor)

Genomic editing allows scientists to create biological pathways for the synthesis of sustainable materials and chemicals. Current editing methods leave scars, limiting the quantity of edits. Scarless editing methods using CRISPR-Cas 9 require additional editing components. We streamlined editing by creating one plasmid with cas9 and gRNA under tight repression. We inserted the kanamycin-FRT resistance gene into the chromosome to delete genes, then used CRISPR-Cas9 to remove the gene cassette. We utilized this method in editing *Escherichia coli* genes to improve octanoic acid production. We knocked out genes to direct flux away from the TCA cycle, overexpressed fatty acid biosynthesis genes to improve flux through this pathway, and targeted genes that improve product tolerance. Finally, we will test octanoic acid production in created strains.

NUCLEAR MICROREACTORS. PERFORMANCE SIMULATION USING ANSYS

Andrii Hopanchuk, Ian Jentz (Mentor)

Microreactors are a promising technology due to their flexibility and reliability: they are small, transportable, and are installed on-site. However, many concepts are still unproven and need further research. I designed a heat-pipe cooled microreactor. The goal of this design is to determine temperature distribution in the reactor core, determine the hotspots, operation limits, etc. The core geometry is created and meshed in ANSYS. All of the physics (Temperature, Conduction, Heat Flux) are modeled in ANSYS too.

TESTING THE ASSOCIATION OF NEIGHBORHOOD-LEVEL DISADVANTAGE WITH WHITE MATTER HYPERINTENSITIES

Emily Merkel, Gilda Ennis (Mentor)

Social determinants of health—the conditions where people live and work—have been shown to affect health, including increasing risk for cardiovascular disease (CVD). CVD risk is associated with white matter lesions known as white matter hyperintensities (WMH). WMH appear as distinctively bright regions on magnetic resonance imaging scans and are associated with increased risk for stroke and dementia. This study examined the relationship between neighborhood-level disadvantage and WMH volume in n = 804 participants enrolled in the Wisconsin Registry for Alzheimer's Prevention and Wisconsin Alzheimer's Disease Research Center Clinical Core, with thirty-three participants from the most disadvantaged neighborhoods. Regression revealed the association between neighborhood-level disadvantage and WMH volume was not statistically significant. Additional research with a greater number of disadvantaged participants in the sample is needed.

UTILIZING PMAXX TO DETERMINING VIABILE BACTERIA ON SKIN TREATED WITH ANTISEPTICS

Kayla Xu, Liz Townsend (Mentor)

Chlorhexidine gluconate (CHG) is an antiseptic that is used to treat wounds and disinfect areas of skin prior to various medical procedures. Due to CHG's positive charge, it is difficult to determine whether bacteria have survived after being treated with CHG via DNA based methods. The objective of this project is to determine whether bacteria have survived after being with CHG with the use of the propidium monoazide (PMAxx) dye. Here, we utilize samples of the skin microbiome from healthy human volunteers and an ex vivo porcine model to determine the optimal PMAxx parameters for assessing whether microbes have survived after being treated with chlorhexidine. These findings will allow greater insight into bacteria that will develop resistance to CHG antiseptic treatment.

OPTICAL METABOLIC IMAGING OF T CELL ACTIVATION

Angelica Lopez, Melissa C. Skala (Mentor)

T cells tailor immune responses to antigens with highly selective antibodies. Yet, current studies of T cell activation and metabolism have been limited by poor temporal resolution to monitor fast activation processes in T cells. There is a need for non-invasive methods to monitor T cell activation and metabolism. Two-photon fluorescence microscopy is a label-free, non-destructive imaging method that provides single-cell resolution. Two-photon fluorescence lifetime microscopy of metabolic co-enzymes nicotinamide adenine dinucleotide phosphate (NAD(P)H) and flavin adenine dinucleotide (FAD), or optical metabolic imaging (OMI), provides insight into cell metabolism. This study uses OMI to compare metabolic changes upon activation of mouse T cells immediately after removal from the spleen (ex vivo), versus activation after several days in culture (in vitro).

DOES SOCIAL MEDIA ACTIVITY CONTRIBUTE TO GRADE FAILURE IN ADOLESCENTS?

Abby Helm, Ellen Selkie (Mentor)

In a world that is dependent on technology, it is important to recognize the benefits and risks that social networking poses for adolescents. One potential drawback of spending time on social media is that it distracts students from prioritizing their education, which could contribute to failing grades. By analyzing data from a current study exploring social media and relationships among adolescents, the academic-related effects of spending certain amounts of time on networking sites can be explored. For this study, the directly observed posting behaviors of a sample of 22 adolescents who flunked a grade will be compared with those of a sample of 22 adolescents who did not flunk a grade. Possible confounding variables, including demographic factors and significant life events, will also be examined.

GESTURE PRODUCTION AND COMPREHENSION OF ABSTRACT MAGNITUDE: TIME AND NUMBERS

Zoe Howard, Martha W. Alibali (Mentor)

In this project, we look at how language, gesture, and graphical representations are integrated in TV news. Using the Red Hen dataset, a repository that compiles over 500,000 hours of US TV news, we search for keywords such as "graph" or "chart" to find specific clips that contain gestures accompanied by graphical representations. The database then provides us with all the instances where people uttered the words from 2019–2021. In these clips, we examine the semantics of the language that describes data, the form and function of gestures, and the type and variables of the graphs. The next milestone in the project aims to determine how the small changes in language and gesture found in TV may influence the subject's perception of graphical information.

DETERMINATION OF PYOM ACCESSIBILITY BY SOIL MICROORGANISM BIOASSAY

Elias Kemna, Timothy Berry (Mentor)

Pyrogenic organic matter is a carbon source making up a significant portion of the total carbon stored in fire affected soils. Due to its structural and chemical variability, the role that PyOM plays in the carbon cycle is poorly understood, especially the interactions between PyOM and soil microorganisms. Knowing what portion of PyOM is available to be mineralized by soil microbes into atmospheric CO2 has implications on how PyOM contributes to climate change. We propose the design of a bioassay capable of comparing CO2 production from PyOM treatments to defined carbon standards through a set of cultured soil microorganisms. This bioassay would not only be of use in our lab, but to any researchers looking to study the interactions between soil microorganisms and PyOM.

UNDERSTANDING HOW SIBLINGS AFFECT EACH OTHER

Rebekah Bonin, Jason M. Fletcher (Mentor)

In this research project, the goal is to find answers to gaps through a review of academic papers regarding levels of introversion and extraversion in relation to birth order among young adults, college students ages 18–25, within the United States through the utilization of a survey method. This will be assessed with the aspect of the possibility of being at risk of depression based and its possible correlation to levels of introversion. While there has already been much research done regarding this topic such as how birth order can affect the personality of siblings, looking at specifically levels of introversion and extroversion can help determine possible correlations between developing these traits and depression levels among those in this age group and attending college.

THE INFLUENCE OF CHRONIC GRAFT-VERSUS-HOST DISEASE ON PSYCHOLOGICAL AND PHYSICAL FUNCTION IN ALLOGENEIC HEMATOPOIETIC CELL TRANSPLANT PATIENTS

Jenna Hansen, Erin Costanzo (Mentor)

Chronic graft-versus-host disease (cGVHD) is an adverse effect of allogeneic hematopoietic cell transplantation used to treat hematologic cancers. This study compares psychological and physical function in patients with different cGVHD severity grades and cGVHD disease sites to those with no cGVHD. Participants with (n=57) and without (n=19) cGVHD completed measures of depression, anxiety, fatigue, insomnia, pain, cognition, and sexual function. Participants with grade 3 cGVHD reported more depression (t=2.13, p=.04, _d_=.67) and pain (t=2.12, p=.04, d=.72) than those without cGVHD. Participants with skin or GI tract cGVHD reported more depression, fatigue, and pain (all p<.05) than those without. Participants with other severities or disease sites had comparable function to those without cGVHD on most measures. Patients may benefit from interventions to optimize function.

INVESTIGATING THE ROLE OF HOX11 GENES IN ADULT SKELETAL MUSCLE

Angelo Madruga, Deneen Wellik (Mentor)

Hox genes are evolutionarily conserved transcriptional regulators that are essential for proper patterning of the axial and appendicular skeleton. Posterior Hox genes (Hox 9-13) are critical for the patterning of the proximodistal axis of the limb. Loss of Hox11 function leads to severe disruption in muscle patterning, with muscle defects in Hox11 mutants independent of skeletal patterning. Recently, our lab demonstrated that Hox11 genes are continuously expressed from embryonic to adult mouse stages in skeletal stem cells. We also have evidence that Hox11 expression is maintained through postnatal and adult stages within muscle stromal cells. I plan to investigate the role of Hox11 and Hox11-expressing cells at postnatal and adult stages during homeostasis and in response to skeletal muscle injury.

PROGNOSTIC DIAGNOSIS OF PROSTATE CANCER VIA BLOOD LIQUID BIOPSY TO IDENTIFY CIRCULATING TUMOR CELLS IN THE BLOOD

Reshma Alla, Joshua Lang (Mentor)

Metastatic prostate cancer remains largely incurable despite multimodal therapies such as conventional therapy, antiandrogen therapy, and immunotherapy. Thus, this multidisciplinary study's purpose is to develop individualized targeted cancer treatment by personalizing treatment plans for patients based on their specific biomarkers that are identified via DNA and RNA extraction from the rare circulating tumor cells using new blood tests as microfluidic technologies. Also, the project involves other techniques such as cell culture, nucleic acid extraction, performing PCR and other molecular biology techniques that ultimately aid in the process. Consequently, this research project will provide oncologists, researchers, students, and professors in the field knowledge to understand the newly developing methods, making the current multimodal methods more efficacious and efficient, to avoid resistance to conventional cancer therapies.

DATA AND LANGUAGE EQUITY FOR COUNTY HEALTH RANKINGS AND ROADMAPS

Claudia Delgado, Christine Muganda (Mentor)

Individual and community health affects all humans in profound ways. The purpose of this project is to use purposeful language to describe groups of people and the indicators of their health. The overarching goal is to identify problematic language, disassemble it, and rebuild it to be clear, intentionally challenging, equitable, and representative of all groups. This is achieved by building off the main indicators of health from the County Health Rankings and Roadmaps website: Health Behaviors, Clinical Care, Social and Economic Factors, and Physical Environment. Through data analysis and literature reviews, we strive to critique and reshape communication of health markers in communities for improved impact. This allows us to inform the broader public of key health markers in order to influence future community wellbeing.

INVESTIGATING MICROTUBULE DYNAMICS IN HUMAN STEM CELL-DERIVED PHOTORECEPTORS

Madalynn Welch, Timothy Gomez (Mentor)

Photoreceptor (PR) loss through injury or disease leads to numerous forms of incurable blindness, and PR transplantation is a promising treatment solution. Restoring vision by cell transplantation requires a better understanding of how PRs migrate and project to their synaptic partner during development. Rho GTPases are central regulators in cellular processes such as migration and adhesion. Therefore, we hypothesize that PR integration requires coordinated Rho GTPase activities and downstream cytoskeletal effectors. To investigate this, photoreceptor reporter human embryonic stem cells are differentiated into retinal organoids to generate tdTomato-expressing PRs. Dissociated PRs are live imaged before and after application of inhibitors. This research tests the hypothesis that young PR motility is reduced by inhibiting Rho GTPases and downstream effectors suggesting their involvement in PR cytoskeletal dynamics.

EVALUATING THE CMS DETECTOR PERFORMANCE BY ANALYZING THE Z BOSON DECAY TO LEPTONS USING CMS RUN II DATA AT THE LHC

Elias Mettner, Abdollah Mohammadi (Mentor)

Data from the Compact Muon Solenoid (CMS) at the Large Hadron Collider (LHC) at CERN has been invaluable in advancing the world's understanding of modern particle physics. The objective of this project is to utilize CMS Run II data to identify the production of Z boson particles from the proton-proton collisions at the 13 TeV Center of Mass at the LHC. The Z boson is an unstable particle that can promptly decay to a muon-antimuon or electron-positron pair. The ratio of these events is drawn over the CMS data-taking periods. Any deviation from a flat trendline could indicate a problem in either the muon subdetector or electromagnetic calorimeter performance, which is sensitive to the Z to muon pair or Z to electron pair multiplicity respectively.

THE EVOLUTION OF GALACTIC DISKS

Quynh-Anh Le, Ellen Zweibel (Mentor)

Through observational astronomy, it has been observed that disk galaxies have exponential brightness profiles. However, observational astronomers have not yet been able to determine when these profiles formed, due to the absence of telescopes that can look far back in the universe at high redshifts with high resolution. Within this study, the Illustris-TNG50 cosmological simulation is used to determine the redshift at which the exponential brightness profiles of disk galaxies begin to form. Through graphical analysis of disk galaxies at different redshifts within Illustris-TNG50, we determine the redshifts at which disk galaxies' exponential profiles form. Results from this study will help aid understanding of the evolutional processes of disk galaxies and pave way for a more in-depth analysis of how these profiles might have formed.

THE EFFECT OF MICROFINANCE ON WOMEN'S ECONOMIC EMPOWERMENT: THE CASE OF ISRAEL

Morgan Snyder, Marwa Shalaby (Mentor)

Increased access to economic opportunity is necessary to lead women towards full empowerment. Today, the Middle East and North Africa (MENA) has the lowest rate of female economic participation in the world. One way the region has been working to economically empower women is through microfinance. Israel is one of MENA's countries that has employed this strategy to elevate the status of women. This project explores how microfinance has impacted the empowerment, specifically the economic empowerment, of women in Israel. I will conduct a detailed analysis of a microfinance nonprofit in Israel through staff interviews, questionnaires, and internal data to understand how the program functions, how national and local staff operate within the program, and how their services impact clients.

FUNCTIONAL SIGNIFICANCE OF POLO-LIKE KINASE 1 PHOSPHORYLATION OF T68 CENP-H

Caleb Carlsen, Roshan Norman (Mentor)

Understanding the mechanisms of mitosis helps prevent the generation of chromosome instability. Polo-like kinase 1 (Plk1), the master regulator of mitosis, is essential in several steps of mitosis. Its inhibition leads to chromosome misalignment and segregation errors; however, its spatial roles are not fully mapped out yet. Predictive-based calculations indicate potential Plk1 phosphorylation on CENP-H, a subunit of the constitutive centromere-associated network (CCAN)—an inner kinetochore complex that maintains the structural integrity of the kinetochore-centromere axis. We propose that Plk1 phosphorylates the T68 residue of CENP-H. To test this hypothesis, we performed in-vitro kinase assays and tested its functional significance in mitosis. This will provide evidence for Plk1 phosphorylation of the CCAN complex and its effects on the structural integrity of the kinetochore.

THE ELECTRODIAGNOSTIC FEATURES OF LATE-ONSET LARYNGEAL PARALYSIS IN LABRADOR RETRIEVERS

Ryan Anderson, Susannah Sample (Mentor)

Late-onset laryngeal paralysis (LOLP) is a life-limiting disease resulting from a peripheral neuropathy which commonly affects Labrador Retrievers. Paralysis of the larynx causes airway obstruction and degeneration of peripheral nerves leads to general weakness. The specific neuropathologic features of LOLP are unknown. Our goal is to quantify the peripheral nerve disease pathology through nerve conduction velocity and electromyography studies. We hypothesize that Labradors with LOLP will exhibit electrodiagnostic features indicative of generalized age- and length-dependent peripheral axonopathy. We undertook an electrodiagnostic study on motor nerves in the fore- and hindlimbs of affected Labradors and age- and size-matched controls. This study will assist in classification of the neurophysiologic abnormalities resulting in LOLP in Labradors and may provide a means for preclinical diagnosis and disease severity quantification.

STRUCTURAL PROBING OF POLY(UG) REPEAT RNA

Jarod Moyer, Samuel Butcher (Mentor)

Poly(UG) repeat or "pUG" RNA sequences are binding sites for proteins involved in the regulation of pre-mRNA splicing. Expansions of pUG sequences have been implicated in numerous human diseases. Recent data from the Butcher lab shows that transcripts with 12 or more UG repeats fold into an unusual left-handed RNA G-quadruplex (G4) involved in RNA silencing. In this project I have investigated the formation of pUG structures in the context of two different RNA fragments corresponding to the sequences found in the human genes CFTR and HMOX1. The enzyme reverse transcriptase (RT) is known to stall at G4 structures but has not been tested against pUG sequences. My data indicate that RT can indeed be utilized to map pUG G4 formation in RNA.

ELECTROPHYSIOLOGICAL ARRHYTHMIA CHARACTERIZATION OF STRESS-INDUCED IDIOPATHIC VENTRICULAR FIBRILLATION (SI-IVF) IPS-CMS USING FLUORESCENT OPTICAL MAPPING

Manasa Kalluri, Lee Eckhardt (Mentor)

Idiopathic ventricular fibrillation (IVF) is a clinically challenging disease entity, as phenotypic characteristics are lacking. We studied induced pluripotent stem cell-derived cardiomyocytes (iPS-CMs) from a patient with an undefined stress-induced IVF (si-IVF) to better understand the arrhythmia mechanism. Calcium-mediated electrophysiological responses were monitored in si-IVF, non-diseased control, and previously characterized LQT iPS-CM lines via optical mapping, while applying electrical pacing and administering isoproterenol (ISO). Compared to control, si-IVF demonstrates longer calcium transient duration and time to peak that further prolongs with ISO. There are also differences between si-IVF and LQT. This demonstrates essential capabilities of creating patient-specific iPS-CMs and performing optical mapping with clearly defined distinctions between si-IVF, control, and comparison study groups. This methodology can help uncover mechanisms for undefined arrhythmias and test therapeutics.

THE ROLE OF N-ACETYLCYSTEINE IN MAINTAINING ARTICULAR CARTILAGE FOLLOWING TRAUMATIC LOADING

Greta Scheidt, Corinne Henak (Mentor)

There is a known connection between single-event traumatic loading of cartilage and the development of osteoarthritis (OA). OA is currently treated retroactively in response to chronic joint pain or weakening. Treatment often consists of joint or cartilage replacement, but little to no disease-modifying OA drugs (DMOAD) are used clinically. The development of DMOADs could transform the approach to treating OA into a method that acts preventatively rather than retroactively. Experimental and clinical evidence suggest that N-Acetylcysteine (NAC) has an anti-inflammatory, protective effect on cartilage cells. This project investigated the ability of NAC to restore levels of metabolic processes in articular cartilage to a normal baseline following traumatic loading, with the goal of expanding knowledge on the cellular processes that are indicative of progression to OA.

CONNECTING POLYNOMIALS TO SYMMETRIES OF POLYGONS

Lina Liu, Jose I. Rodriguez (Mentor)

We learn about polygons and polynomials in grade school. In this talk, I will describe Galois groups and how they serve as a bridge between polynomials and polygons. My research question relates the understanding of how polynomials can connect to a polygon, which is part of a greater problem called the Inverse Galois Problem.

ANALYSIS OF FACTORS CONTRIBUTING TO INCREASED PROBABILITY OF NEONATAL SEIZURES

NABA Rao, Melisa McCau (Mentor) l

This study explores the mechanisms that serve as contributors to the onset of neonatal seizures in babies. By observing specific aspects of the brain, such as the neuroelectric, neurophysical, and behavioral outcomes like EEG, MRI scans, and clinical studies, I can describe the characteristics that increase the likelihood of seizures in babies. Characteristics that serve as biomarkers are brain injuries such as hypoxic ischemic encephalopathy, intraventricular hemorrhage, prematurity, sepsis, maternal drug abuse, and other congenital birth defects. With patient data access obtained from UW Health, I can perform a retrospective chart review to observe the overall factors that lead to neonatal brain seizures. This study is of interest in order to manage cognitive disabilities the patients may have for an overall better quality of life.

TIME MACHINE

Sanyam Jain, Suman Banerjee (Mentor)

Ideas on past viewing time machine, including both the research topics and proposals. Combination of psychology, computer science, and artificial intelligence simultaneously play important roles in it. Working of mind with use of present technology and their advancements which needs research can lead us to a past viewing time machine in future. A brief dicussion on black holes, mind and present some technologies used by the world, specially a device invented at MIT which will play and important role in it named Alter Ego.

CULTIVATING EQUIVALENCE

Nicole Stigler, Andrea Marquardt Donovan (Mentor)

Mathematical success has long been thought to stem from a relational view of the equal sign, which is the notion that both sides of the equal sign are "the same." The equal sign provides the foundation for algebra, which in turn is the gatekeeper for higher level math. Recent evidence highlights the importance of a different dimension of relational understanding: a substitutive view. In this online study, participants (N=146, Grades 4 and 5) received a lesson about the equal sign focused on either a singular view (Sameness), a dual view (Sameness + Substitutive), or a control. More students in the sameness + substitutive condition produced substitutive definitions of the equal sign after the lesson (67%) than in the sameness (16%) or control (2%) conditions.

FXS PATIENT DERIVED NEURONS SHOW INCREASED LEVELS OF NO AND MITOCHONDRIAL FRAGMENTATION

Natalie Wolkoff, Minjie Shen (Mentor)

Fragile X related protein 1 (FMR1) is the causative agent for fragile X syndrome (FXS), the most common form of inherited intellectual disability. Individuals with FXS display impaired cognitive functions, behavioral deficits, and impaired neuronal development and function. How FMRP deficiency leads to these phenotypes remains poorly understood. Our previous studies have shown that FMRP-deficient immature neurons exhibit fragmented mitochondria, impaired mitochondrial function, and increased oxidative stress in mouse neurons. In the present study, we aim to determine whether FXS patient derived neurons exhibit mitochondrial impairment. Our current data shows altered mitochondrial morphology as well increased levels of nitric oxide (NO). These findings are critical for translating findings from mice to humans and yields important data for potential therapeutic studies.

RECOGNIZING EXTRACELLULAR PROTEIN INTERACTIONS USING A SWITCHABLE DNA NANOCATALYST

Hassan Alkhunaizi, Jeffrey Martell (Mentor)

Extracellular protein-protein interactions (PPIs) play a crucial role in multiple biological processes, such as cell-to-cell communication. However, one of the challenges in studying PPIs is investigating the complex environment they are embedded in. To overcome this, my strategy is to activate a switchable DNA nanocatalyst directly at the sites of extracellular PPIs. Unlike proximity ligation assay technique which merely enables PPI detection via fluorescence, my method enables tagging of the PPI interactome by creating reactive intermediates at the site of a PPI. The reactive group tags nearby proteins on the cell surface for downstream applications such as mass spectrometry analysis or affinity-based cell isolation.

TUMOR MICROENVIRONMENT DIFFERENCES BETWEEN SUBCUTANEOUS AND ORTHOTOPIC MOUSE MODELS OF HEAD AND NECK CANCER.

Carlene Kranjac, Mari Iida (Mentor)

Head and neck squamous cell carcinoma (HNSCC) 5-year survival rates have remained at 50% for years. Immunotherapy has become more common in HNSCC patients, as the Food and Drug Administration approved the use of checkpoint inhibitors. Checkpoint inhibitors allow T-cells to keep functioning and to destroy all the cancerous cells of a tumor. Immunosurveillance confirms that HNSCC is a good target for this therapy, but low response rates have suggested the need to understand the tumor microenvironment. This study aims to characterize the differences between subcutaneous and orthotopic mouse models and to determine predictive biomarkers of the tumor cells. We hope to translate our findings into a better therapeutic strategy for HNSCC patients in the future by comparing our results to human HNSCC signaling.

EVOLUTION OF SPIROPLASMA IN THE ALPINE GROUND BEETLE NEBRIA INGENS SPECIES COMPLEX AND SYMPATRIC NEIGHBORS

Robert Hall, Sean D. Schoville (Mentor)

Does a newly discovered symbiotic bacteria play a beneficial or pathogenic role in its insect host? Here we aim to understand the role of *Spiroplasma* sp. NR, in their host, the *Nebria ingens* species complex, by scanning the prevalence of infection, genetic diversity, and degree of co-distribution with their host. There is a relatively high (57%) and geographically widespread infection rate throughout the *Nebria ingens* species complex. Both host and *Spiroplasma* populations show a similar trend of gradual genetic divergence across space, but *Spiroplasma* appears to have longer dispersal distance. Our ongoing research utilizes population genomic variation of both species, including the beetle mitochondrial DNA, to identify inheritance patterns and assess the ecological role of *Spiroplasma* in this insect host.

ENGINEERING THE PROTEIN ACE2 FOR IMPROVED THERAPEUTIC USE

Evelyn Okal, Philip Romero (Mentor)

In this project, we developed a high-throughput droplet microfluidics screening platform to engineer angiotensin converting enzyme II (ACE2) to have increased activity for converting angiotensin-II, a vasoconstrictor, to a vasodilator, angiotensin(1-7). Using this platform, we intend to obtain deep mutational scanning (DMS) information about an ACE2 mutagenesis library. With that data, we will design strong candidates for improved ACE2 catalytic activity, and screen them for activity, with the ultimate goal of discovering an ACE2 variant that has increased activity and specificity towards cleaving angiotensin-II over other ACE2 substrates. This will make ACE2 a more valuable therapeutic tool for increasing blood flow by generating a vasodilator, with less side effects from other substrate turnovers.

EFFICACY OF BCI-FES INTERVENTION ON OUTCOME MEASURES OF HAND MOTOR FUNCTION IN STROKE SURVIVORS

Thomas Hosseini, Vivek Prabhakaran (Mentor)

Stroke motor impairment can be improved by non-invasive electroencephalographic (EEG)-based brain-computer interfaces (BCI). We sought to determine whether BCI+functional electrical stimulation (FES) improves motor function. 35 stroke survivors (f = 16, age = 61.69±13.07, chronicity at baseline = 33.15±41.84 months) with motor impairment completed 4-32 hours of BCI-FES intervention. Group averages of hand grip strength (HGS) and nine-hole pegboard test (NHPT) were compared at baseline and completion. Participants showed positive change from pre-intervention to post intervention in measures of hand function (HGS: PRE 16.07±19.67 lbs, POST 19.31±21.47 lbs, p = 0.01) (NHPT: PRE 184.65±128.91 seconds, POST 183.66±129.51 seconds, p = 0.92). Results indicate that BCI-FES intervention can improve post-stroke hand function.

"WE ARE POLITICAL:" RESPECTABILITY POLITICS IN THE ERA OF "WAP"

Shreya Bandyopadhyay, Sarah E. Frank (Mentor)

In August 2020, Cardi B and Megan Thee Stallion released their single, "WAP," quickly generating a political response, including both applause and backlash from pundits, politicians, and commentators. While political agents have fought back and forth about the song's merits, no legitimate legal action has been taken and the First Amendment has been largely omitted from the conversations surrounding the censorship of the song or the artists who created it. This content analysis investigates the utilization of "WAP" by political actors to either demonize or empower Black women in the media. The article uses data from prominent conversations around the song "WAP" from actors including Ben Shapiro, Candace Owens, James P. Bradley, as well as from the artists themselves, Cardi B and Megan Thee Stallion.

UNIVERSITY STUDENT SEX TRADING FOCUS GROUPS

Maria del Carmen Rosales, Lara Gerassi (Mentor)

The extent to which university students trade sex to support their education in the U.S. is critically understudied. The purpose of this project is to explore the perceptions of sex trading among U.S. university students and elicit feedback on a preliminary multi-item sex trading measure. To date, we have conducted three focus groups (two more are planned). Preliminary findings suggest that students have diverse perceptions of how they view sex trading and identified key websites (that facilitate the sex trade), compensation types, and virtual/in-person sexual acts. Participants hold different interpretations of keywords used to assess third-party involvement in facilitating sex trading acts. Findings will contribute to a larger study that will identify the prevalence and characteristics of U.S. university students who trade sex

EFFECT OF DECREASING PH ON ENZYME ACTIVITY OF BIOPLASTIC PRODUCTION IN ENGINEERED E. COLI

Hailee Morrison, Erica L.W. Majumder (Mentor)

Petroleum-based plastics are degradation recalcitrant and harmful to the environment. Polyhydroxy-alkanoates (PHAs) are a potential alternative as a biodegradable polymer, but industrial application is hindered by high production costs. By utilizing waste streams as substrate, such as acid whey, this cost can be lowered. We observed that PHA biosynthesis was inhibited earlier on acid whey than pH neutral substrates. In this study, we compared the activity of enzymes related to PHA production from substrates, including acid whey, in an engineered PHA-producing *E. coli* to establish a link between enzyme inhibition and PHA production shutdown. We found that PHA enzyme activity and biosynthesis decrease together with pH over time. Based on these results we are currently optimizing enzymatic regulation for PHA production.

INVESTIGATION OF MYELIN CONTENT DIFFERENCES BY AMYLOID STATUS AND GENDER IN ALZHEIMER'S DISEASE

Nicholas Schulz, Barbara Bendlin (Mentor)

Myelin abnormalities in Alzheimer's disease is understudied. Here, we investigated whether myelin content differed by gender, amyloid status, and age. Ninety-five participants were selected for completion of multicomponent relaxometry (mcDESPOT) imaging and assayed cerebrospinal fluid (CSF) data. Amyloid positivity was determined based on a predetermined CSF cutoff (Van Hulle et al, 2020). Myelin content was quantified using mcDESPOT-derived myelin water fraction maps. Multiple regressions examined the relationships between myelin content, gender, and age. We observed no gender differences or amyloid by gender interactions on myelin content. Age was associated with myelin content in most white-matter tracts, but not in the forceps major and inferior longitudinal fasciculus. These null findings suggest that these two white-matter tracts are more resistant to degeneration with age.

ELECTRICAL PROPERTIES OF 2D MATERIALS AND DEVICE FABRICATION

Fabian Clarke, Ming-Wei Lin (Mentor)

We report on two dimensional materials (2D materials) and device fabrication to study their intrinsic properties. In addition to graphene, other 2D transition metal dichalcogenide (TMD) materials such as MoS2, MoSe2 will be focused on and study their properties by analyzing physical, chemical, and electrical results. The potential applications of 2D materials associated with filed transistors, photodetectors, sensors and flexible electronics via Is based processing will also be discussed.

QUANTITATIVE SOFTWARE FOR CHARACTERIZING CELL AND TUMOR MICROENVIRONMENT INTERACTIONS

Heqiao Zhu, Kevin Eliceiri (Mentor)

Collagen fibers are a major component of the tumor microenvironment, and its interactions with tumor cells play an important role in cancer metastasis and patient survival. However, cell information is typically not considered by currently collagen fiber quantification tools. The goal of this project was to incorporate cell segmentation and morphology analysis to widely utilized collagen analysis tool "CurveAlign" developed by the Eliceiri Lab at the UW–Madison. Specifically, state-of-the-art deep learning-based whole cells/nuclei segmentation methods were tested, evaluated, and adapted. Cell-based automatic tumor region annotation and fiber quantification were developed as well as a graphical user interface. The resulting software is freely available and enables cancer researchers to quantitatively investigate the role of cell-fiber interactions.

THE LIVED EXPERIENCES OF PREGNANT MOTHERS DURING COVID-19

Abbie Schaefer, Morgan Schaefer, Michaela Kihntopf, Tuyen Huynh (Mentor)

This phenomenological study aims to explore mothers' pregnancy experiences during COVID-19. A total of N = 28 mothers participated in semi-structured interviews about their subjective experiences of pregnancy during the Coronavirus pandemic. Thematic analyses were conducted after interviews were transcribed. Coding of the interviews resulted in central and subthemes that best represented the participants' experiences. The central themes concluded from our thematic analysis included: (1) lack of COVID Information; (2) types of support received; (3) mothers' mental wellbeing; (4) experiences with childcare; (5) COVID restrictions; and (6) isolation. During pregnancy, the mothers' prenatal wellbeing is critical to mother and child wellbeing during postpartum. Additional research is needed to understand ways to better support mothers during pregnancy.

ADAPTING A WEB-BASED RESPONDENT-DRIVEN SAMPLING (RDS) METHOD FOR USE IN SOCIAL NETWORK RESEARCH WITH TNB POPULATIONS

Danika McCumber, Elliot Tebbe (Mentor)

Traditional RDS methods have been used previously within transgender and nonbinary (TNB) communities for social network research. However, as Internet-based relationships increase and people spend more time online, developing webRDS methods will be crucial to contemporary social network research. Therefore, this study will determine the efficacy of webRDS methods to recruit a representative sample of Midwest TNB adults for social network health research. Data will be collected from the TNB population in southern Wisconsin using a self-administered questionnaire and a Zoom interview. We anticipate the webRDS model will produce a sample that is representative of the population. This result would indicate this method could be expanded for use in social network research in the nursing field.

CHARECTERIZATION OF IP3R AS A POTENTIAL NEW TARGET FOR P70 RIBOSOMAL S6 KINASE

Hawra Aljawad, Corinna Burger (Mentor)

The exposure of aged rats to environmental enrichment (EE) triggers sustained phosphorylation of p70-ribosomal S6 kinase (p70S6K), a protein involved in dendritic protein translation of genes central to memory formation. Using stimulated emission depletion (STED), we found that animals exposed to EE displayed increased co-localization of activated p70S6K (p- p70S6K) with endoplasmic reticulum inositol triphosphate receptor isoform1 (IP3R1) when compared to controls, 30-min post-half train of theta burst stimulation. IP3R is involved in the regulation of Ca2+ release from the ER and dysregulation of Ca2+ release has been associated with age-related neurodegeneration. Thus, we hypothesize IP3R1 is a phosphorylation target for p70S6K. Co-immunoprecipitation will be performed on HEK293 cells with wildtype or mutated IP3R1 at the 2642 amino acid site of rat IP3R1.

CIRCULAR ECONOMY CALCULATOR

Saanvi Malhotra, Styliani Avraamidou (Mentor)

This project focuses on creating a circular economy calculator. A circular economy is the concept of an economic system of closed loops in which raw materials, components and products lose their value as little as possible. Currently, there is not much consensus on how to standardize the calculation of how circular an economy is. We focus on creating a calculator that standardizes this. The task I'm assigned with is building a website from scratch for the circular e sconomy calculator that is being built. Promoting a circular economy also promotes sustainability and less waste is produced from companies.

THE EFFECTS OF FISHING ON HERBIVORY AROUND PATCH REEFS IN A BELIZEAN MARINE RESERVE

Luis Manuel Abreu-Socorro, Catherine Woodward (Mentor)

Herbivory is the biological process of primary focus in this research study. My study took place in the conservation/general use zones of the Glover's Reef Atoll, Belize. The conservation zone is a marine protected area with set restrictions on fishing activities. The general-use zone has few restrictions on fishing activity. Previous studies in coral reef ecosystems have shown that fishers typically target larger piscivorous species, lowering the abundance, densities of predatory fish. Predators also affect the distance that herbivores are willing to travel to feed. Study sites were patch reefs within the Glover's Reef Atoll. Patch reefs are surrounded by sand beds where predators hunt for prey: the sand beds are shaped like a halo. My study aims to determine whether there is a significant difference in herbivory rates between the general-use and conservation zone and whether predation influences herbivory rates as distance increases from the patch reef halos. Seagrass assays and the program ImageJ were used to calculate herbivory rates, measured as the percentage of seagrass consumed. Non-parametric tests were used to determine significance. Results indicated a more significant amount of seagrass consumed in the conservation zone. There was no significant difference in the amount of seagrass consumed as the distance from the patch reef increased.

ENHANCING THE PROPERTIES OF GRAPHENE NANORIBBONS VIA DIRECT GROWTH OF GNR/H-BN LATERAL HETEROSTRUCTURES

Celeo Matute Diaz, Michael Arnold (Mentor)

Graphene nanoribbons (GNRs) have risen to prominence in the last decade because of their potential applications in the semiconductor industry. While graphene has exceptional electrical properties, it is metallic and thus lacks a bandgap. This hinders its applications in semiconductors as bandgaps are needed to fabricate devices. GNRs, on the other hand, possess a bandgap which allows them to behave as semiconductors. Hexagonal boron nitride (h-BN) is another 2D material that acts as an insulator instead. Lateral heterostructures have been created growing h-BN out of graphene edges. However, the same process using GNRs instead of graphene sheets has not been studied enough. This GNR/h-BN heterostructure is of interest as it can be used as a semiconductor and would help preserve the electrical properties of GNRs.

OVARIAN FOLLICLE QUANTIFICATION IN A NON-HUMAN PRIMATE MODEL OF PCOS

Jacob Blanchar, Savannah Knaak, David Abbott (Mentor)

This study hypothesized that the knockdown of the estrogen receptor alpha (ERalpha) in the mediobasal hypothalamus (MBH) in adult female rhesus macaques would produce an ovarian phenotype similar to that found in polycystic ovary syndrome (PCOS). This phenotype is characterized by an abnormal abundance of small antral follicles. To provide insight into ovarian changes after ERalpha knockdown (n=6), the proportions of healthy and atretic follicles were calculated to compare with controls (n=5) and normals (n=7). We aimed to determine how ovarian morphology was impacted, due to the ERalpha knockdown, through proportional analysis.

ISOLATION AND CHARACTERIZATION OF A SUPPRESSOR MUTATION RESTORES METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS BETA-LACTAM RESISTANCE

Student/mentor: Danny Hill, Caroline Grunenwald (mentor)

Staphylococcus aureus is an important human pathogen and the rise of methicillin-resistant strains (MRSA) is a critical threat to public health. Understanding how MRSA avoids antibiotic-mediated killing is essential for developing new therapeutics. Stk1, a highly conserved serine/threonine kinase, is essential for resistance to beta-lactam antibiotics; however, how Stk1 regulates antibiotic stress responses is unclear. To uncover genes that contribute to Stk1-dependent beta-lactam resistance, we performed a suppressor screen using a defined transposon library treated with the Stk1 inhibitor GW779439X. Ninety-three mutants that restored resistance to beta-lactam antibiotics when Stk1 is chemically inhibited underwent secondary screening and 7 putative suppressor mutations were identified. Future studies will focus on uncovering the mechanisms by which these suppressor mutations restore resistance to antimicrobials in the absence of stk1.