Undergraduate SYMPOSIUM

2023 ABSTRACT BOOK

**Celebrating research,
creative endeavors,
and service learning**

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We are very pleased you are joining us for the 25th 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 25th year is an extraordinary milestone demonstrating our steadfast commitment to 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 2023 MENTORING AWARD WINNERS

Marina Emborg, Professor, Medical Physics

Marina Emborg is a Professor of Medical Physics and the director of the Preclinical Parkinson's Research Program at the Wisconsin National Primate Research Center. Dr. Emborg has mentored over 80 undergraduate students, in addition of graduate students, postdocs, and junior faculty. Many of her undergrads stay in her lab from freshmen to graduation and create long-lasting relationships. They work in mini-teams, with trainees of all levels and paths of life, learning to support each other and take leadership roles to solve challenging scientific questions. Dr. Emborg aims to nurture her students' creativity and critical thinking and provides them with the tools to succeed in the next stage of their development and beyond.

Jelena Diakonikolas, Assistant Professor, and Shiv Venkataraman, Assistant Professor, Computer Sciences

Jelena Diakonikolas and Shivaram Venkataraman are Assistant Professors in the Department of Computer Sciences. Jelena and Shivaram launched the WISCERS (Wisconsin Science and Computing Emerging Research Stars) program in 2021 to build undergraduate learning communities in Computer Science and match students with faculty research mentors, summer internships, and more. In addition to helping undergraduate students to navigate the challenges of research, they are dedicated to supporting underrepresented groups within computer science fields and fostering an inclusive environment firmly rooted in strong peer-peer and mentor-mentee support.

Stephanie McFarlane, Graduate Student, Botany

Stephanie McFarlane is a PhD candidate in the Department of Botany. Stephanie weaves role modeling, striking a balance between work and personal life, and juggling competing demands into her mentoring of undergraduate students in the Department of Botany. In addition to her work with undergraduate research and mentoring in the classroom, Stephanie has successfully guided students through the funding application process to win awards such as the Sophomore Research Award and Hilldale Award. She endeavors to create spaces in which all students feel a sense of belonging and empowered to pursue a career in science.

Sean Schoville, Associate Professor, Entomology

Sean grew up with a love of the outdoors and became fascinated with the diversity of life and how species overcome challenges in the natural world. Starting as a graduate student, he has worked with more than 70 high school and undergraduate students through mentored research and outreach projects, hoping to inspire them to successful careers in science. Research mentoring enhances engagement, critical thinking, and skills development of both the mentor and mentee, teaching us how to collaborate and solve scientific problems effectively.

Shih-Heng Su, Scientist, Genetics

Shih-Heng is Assistant Scientist in the Laboratory of Genetics. Su not only mentors undergraduate research in the lab, but also contributes to breaking down barriers to careers in STEM by working with underrepresented high school students through the PEOPLE program. Her approach to mentoring involves holistic attention to student well-being in addition to progress on student research and takes great care to adapt her mentoring approaches to best support her mentees by meeting their unique needs.

Molly Willging, Graduate Student, Primate Research Center

Molly Willging is a PhD candidate in the Endocrinology and Reproductive Physiology (ERP) Graduate Program. Molly's approach integrates teaching and mentoring into her work with undergraduate students and fosters a collegial environment based in collaboration and mutual support that creates a community wherein students feel comfortable sharing their ideas and pushing the boundaries of scientific research. In addition to seeking out a direct role in mentoring students over the course of her graduate studies, Molly has actively pursued additional training and other campus resources to hone her mentoring craft.

SELF-BALANCING TWO-WHEELED ROBOT (WEEBLEBOT)

Vasvi Agarwal, Allie Willhite, Hongyuan Qi, Mark Xia
Mentor: Peter Adamczyk

The field of study focused on two-wheeled balancing robots has the potential to become the primary mode of movement for robots in the future. This project focuses on building a 1.2-meter-tall upright balancing robot which can help in moving a particular amount of load from one place to another. The robot does not need stability control to maintain its upright posture; the absence of control sets it apart from conventional robotic technology. The dynamics of the robot were decided using mathematical methods. An embedded computer provides motor speed and steering control. The robot can become the new future of locomotive technology to help in making robots that work in human-friendly spaces more efficient and simpler.

BENIGN PROSTATIC HYPERPLASIA THROUGH SPATIOTEMPORAL PROTEOMIC ANALYSIS COMPLEMENTED BY IMMUNOHISTOCHEMISTRY

Lydia P Agnew
Mentors: William Ricke, Lingjun Li

Benign prostatic hyperplasia is an age-associated disease with underlying mechanisms that are not yet fully understood. It is, however, known that changes in the steroid environment as men age are a contributing factor. Mouse models recapitulate this change. Novel tools and technology are necessary for identifying new biomarkers and targetable pathways. Mice were implanted with steroid hormone pellets for eight weeks. Tissues were collected, then analyzed using a Bruker RapifleX MALDI Tissuetyper TOF Mass Spectrometer. For immunohistochemistry, we stained for e-cadherin and estrogen receptor beta. Initial data supports MALDI-MSI as a robust method for identifying spatial and quantitative data about proteins of interest in a higher throughput manner than traditional methods.

VASHE IS LESS CYTOTOXIC THAN CHLORHEXIDINE GLUCONATE ON HUMAN SKIN WOUNDS

Rabia Ahmed
Mentor: Angela Gibson

Chlorhexidine gluconate (CHG) is used in patients to prevent infection, but is cytotoxic with diminishing antimicrobial activity over time. Using an ex-vivo human skin model with excisional wounds, the cytotoxicities of CHG, Vashe, and PBS were compared using lactate dehydrogenase (LDH) staining and an MTT viability assay. On LDH, the percentage of non-viable tissue increased for CHG and decreased for PBS and Vashe over time. The percentage of non-viable to total tissue depth was 100% for CHG, while PBS and Vashe were less than 50% at 7 and 14 days after treatment. On the MTT assay, CHG had significantly less viability compared with PBS and Vashe at all time points ($p<0.0001$). These studies suggest that PBS and Vashe are less cytotoxic than CHG.

COMPARING ALGORITHMS FOR REAL-TIME TOE-OFF AND INITIAL CONTACT DETECTION IN PROSTHETIC TECHNOLOGY

Sofya Akhetova
Mentor: Kieran Nichols

We are conducting research to create an adaptive algorithm that utilizes an IMU on the shank for real-time gait phase determination, with the objective of accurately identifying initial contact (IC) and toe-off (TO) events in different walking patterns. Our algorithm tracks swing and stance cycles by monitoring peak and timing information, then calculates adaptable thresholds based on this data. The algorithm necessitates a calibration phase and dynamically modifies thresholds while the individual is walking to accommodate variations in walking speed and pattern. We will evaluate our algorithm by replicating an experiment conducted by two established algorithms in literature and comparing our delay to theirs.

ROLE OF HYPOTHALAMIC ESTROGEN RECEPTOR ALPHA KNOCKDOWN ON NEUROPEPTIDE S AND BLOOD HORMONE LEVELS IN ASSOCIATION WITH ENDOMETRIOSIS DEVELOPMENT IN ADULT FEMALE RHESUS MONKEYS

Lauren Allegretti, Alexandra Ho
Mentors: David Abbott, Dan Uhlrich

Endometriosis is an extremely detrimental estrogen-dependent condition of the pelvic organs in which endometrial tissue develops outside of the uterus. Current treatment options are not curative and can be invasive. Recent investigations have found a link between a gene variant coding for Neuropeptide S Receptor 1 (NPSR1), over-expression of NPSR1 and endometriosis. Another study found blocking estrogen activity in the hypothalamus using estrogen receptor alpha (ERa) knockdown in adult female rhesus monkeys provokes a high rate of endometriosis when compared to control monkeys. In previous years, students found expression of NPS in the monkey hypothalamus. This investigation quantifies NPS and will provide a greater understanding concerning the association of endometriosis with NPSR1 overexpression.

CAN WE FIND CHEMICAL NETWORKS THAT PROMOTE THEIR OWN SYNTHESIS?

Esau Allen
Mentors: David Baum, Tymoffi (Tym) Sokolskyi

The question of how simple chemical reactions were able to develop into complex life remains unresolved. A prevailing theory suggests that a significant step was autocatalysis, where chemicals promote their own production through mutual catalysis. In the same way that a food broth will remain sterile until seeded with a few bacterial cells, our experiment explores the possibility that different chemical seeds, when introduced into a food solution, can sustain their own production. This will be shown if chemical complexity is retained after serial dilution in seeded samples, but not controls. We screened twenty-eight candidate seeds in a simple food mix using serial transfer with dilution and analyzed the twentieth generation. Our data were inconclusive, suggesting the need for purer food solutions and more replicates per seed in future studies.

ASSOCIATIONS BETWEEN VERBAL FLUENCY MEASURES AND ALZHEIMER'S DISEASE BIOMARKERS

Esmma Almousa
Mentor: Kimberly Mueller

This project determines the association between abnormal protein accumulation status and the animal speech fluency patterns in a population enriched with a family history of Alzheimer's Disease. Participants, who come from the Wisconsin Registry for Alzheimer's Prevention Cohort, were asked to complete an animal fluency task during each of their visits. 274 participants with positive or negative Amyloid status and 198 participants with positive or negative Tau status were assessed. The speech fluency patterns of these subjects were analyzed with the following verbal fluency measures: Age of Acquisition, Word Frequency, Intrusions, and Perseverations. A linear mixed effects model was used to determine an association between the interaction of Amyloid and/or Tau status and each of the verbal fluency measures.

IMPACTS OF IMPOSTER PHENOMENON AND SENSE OF BELONGING IN UNDERREPRESENTED HONORS STUDENTS

Sarah Almutawa, Isa Butz
Mentors: Anna Kowalkowski, Janet Batzli

Sense of belonging is crucial for undergraduate success, yet honors programs may decrease sense of belonging and unintentionally promote imposter phenomenon (IP) despite promoting success. Biocore is UW-Madison's honors biology program; it is a cohort-based, High Impact Practice learning community spanning four semesters. Prior research demonstrates Biocore promotes high sense of belonging among students. We hypothesized that community aspects in Biocore counteract the prevalence of IP and promote academic achievement among underrepresented groups in STEM. Our results suggest that community strategies can minimize IP and also benefit students from underrepresented backgrounds.

VARIABILITY OF SAWTOOTH CRASH EVENTS WITHIN TOKAMAK PLASMAS IN THE MADISON SYMMETRIC TORUS

Xander Alvarez
Mentor: Noah C Hurst

During the study of tokamak plasmas within Madison Symmetric Torus, magnetic probe data reveals variations in quasi-periodic kink instabilities known as sawtooth crashes. Our goal is to better understand the similarities and differences of these events in a more quantitative way, as it may open the door to more streamlined analysis methods in the future. In this project, probe data of many crash events are assessed and categorized based on properties such as period, duration, amplitude, and wave activity. This work will help to build a data set for future efforts to train a machine learning algorithm for identifying, predicting, and characterizing sawtooth crash events.

INVESTIGATING COMORBIDITY OF HEREDITARY SPASTIC PARAPLEGIA AND TOXOPLASMOSIS

James Alvin
Mentors: Molly Lettman, Laura Knoll, Jon Audhya

The diverse set of neurodegenerative disorders known as hereditary spastic paraplegias (HSPs) are heritable and have been linked to myriad mutations, including the p.R106C mutation in TRK-fused gene (TFG), a protein involved in the secretory pathway. We have demonstrated that Sprague Dawley rats with the TFG p.R106C mutation exhibit disease phenotypes consistent to those observed in HSP patients. We have infected a group of these animals with the parasite Toxoplasma gondii, which can independently cause similar symptoms in humans; 30-50% of the global population is estimated to carry a chronic (often asymptomatic) T. gondii infection. Our preliminary data indicate that T. gondii infection in our animal model of HSP results in an accelerated disease course, suggesting that infectious disease may contribute to neurodegenerative disease heterogeneity.

SPEECH ADAPTATION IN COCHLEAR IMPLANT USERS

Katla Anderson
Mentors: Caroline Niziolek, Agudemu Borjigin

Auditory feedback is an individual's perception of the noise they make, which is used to monitor and make corrections to speech. Cochlear implants are assistive devices that deliver auditory input to deaf individuals, but they strip away the fine details of auditory feedback that typical hearing individuals can perceive. The current study assesses how successful cochlear implant (CI) users are at adapting their speech in response to altered auditory feedback. We altered the auditory feedback of control and CI participants' speech as they verbalized to cause a change in their perception of vowel sounds. Typical hearing participants were more effective than CI users at adapting their formants, or the resonant frequencies of the vocal tract, showing that cochlear implants still require improvements for speech perception.

THE UTILITY OF PARTICIPATORY PHOTOMAPPING TO ADVANCE CLIMATE JUSTICE AND PUBLIC HEALTH

Kathryn Anderson
Mentor: Jessica LeClair

The global climate crisis is an immediate local public health threat that causes a range of disparate and inequitable health impacts across different populations. Climate justice is a growing human rights movement that uplifts and empowers populations in the frontlines of climate change. Participatory Photomapping (PPM) is a methodology that can be used to understand research participants' public health perspectives and lived experiences. Through maps, photos, and storied accounts, participants can relate where experiences occurred, what they looked like, and how they happened. This poster presentation introduces PPM and provides an example of how we utilized it to study the climate justice perspectives and experiences of public health nurses and their community partners. Finally, we discuss implications for public health research, education, advocacy/policy, and practice.

UNDERSTANDING HUMAN NEUTROPHIL EVASION BY CANDIDA AURIS

Brody Andes
Mentor: Jeniel Nett

Emerging pathogen Candida auris is the first fungus to be labeled a public health threat. The species displays multi-drug resistance to existing antifungals. The ability of C. auris to evade innate immune responses in humans demands further research into its poorly understood pathogenesis. Of particular importance is the lack of engagement between C. auris and neutrophils, which engulf invasive microbes. The Nett group hypothesizes that this bypassing effect is due to a lack of surface-level recognitions between neutrophils and the fungal cell wall. We propose that the cell wall of C. auris displays unique mannan polysaccharides that decrease the ability of neutrophils to engage the organism. By genetically disrupting N-mannans, we demonstrate that the altered C. auris is more susceptible to neutrophilic engagement and killing.

ENHANCEMENT OF A SURGICAL SIMULATOR FOR PERIACETABULAR OSTEOTOMY FOR ORTHOPEDIC SURGICAL TRAINING

Joshua Andreatta
Mentors: Joshua Roth, Andrea Spiker

Orthopedic surgery training curricula lack sufficient opportunities for trainees to develop and practice specialized surgical skills. Simulation is a promising approach to provide more opportunities for trainees to learn and practice new skills. I developed a surgical simulator for periacetabular osteotomies (PAOs) to aid orthopedic trainees in surgical skills development and fluoroscopic image interpretation. The simulator, which mimics actual patient positioning during a PAO, incorporates simulated fluoroscopic images and immediate feedback on performance. In this Hilldale project, I investigated the effectiveness of the simulator by determining how errors in acetabular repositioning and speed of the PAO improved over repeated uses. Moving forward, I plan to explore how this technology may also enhance pre-operative planning and intraoperative checks for PAOs and related orthopedic surgeries.

FOOD NOW: EXPANDING FOOD ACCESS IN NORTHEAST MADISON

Samantha Angelina, Akshay Kalra
Mentor: Lori Diprete Brown

Food NOW: Increasing Food Access in Northeast Madison works alongside the River Food Pantry (The River) to provide after-hours food access to people experiencing hunger. Because The River is usually open during business hours, clients who have commitments during the day cannot easily obtain food or personal goods. Building off existing strengths and community identified needs, Food NOW allows people to come on-site and access a locker full of food by filling out a simple electronic form. This allows them immediate access to basic necessities and also reduces the workload of the hard-working and busy River staff. This model is easily scalable with plans to share an operational guide with other food pantries to give more autonomy to users and flexibility to the pantries.

MACHINE LEARNING HYDRODYNAMIC PHYSICS IN COSMOLOGY

Abhiram V Annaluru
Mentor: Moritz Müchmeyer

To perform cosmological data analysis, large realistic simulations are required. While simple so-called dark matter simulations can be run quickly, fully realistic hydrodynamic simulations are computationally difficult to produce. In this project, we evaluate whether a convolutional neural network of U-net type can be used to upgrade simple dark matter simulations to full hydrodynamical simulations at a fraction of the computational cost of the original approach. A U-net neural network is a Convolutional neural network that is a “fully convolutional network” where the usual pooling layers are replaced by up-sampling and down-sampling operators. The cascading up-sampling and down-sampling layers form a “U” shape, hence “U-net.” Rather than for image segmentation purposes, this U-net utilizes regression to predict the hydrodynamic simulations.

RELATIONSHIPS BETWEEN A MEDITERRANEAN-STYLE DIET AND ALZHEIMER'S DISEASE BIOMARKERS: A BRIEF NARRATIVE REVIEW

Lauren Auleciems
Mentor: Kimberly Mueller

Alzheimer's Disease (AD) has quickly become a major public health concern. AD is characterized by brain atrophy, increased levels of beta-amyloid plaque and neurofibrillary tangles. Up to 50% of all AD cases can be traced back to modifiable risk factors including obesity, diabetes, and hypertension; the Mediterranean Diet (MEDdiet) has been shown to improve these conditions. This review explores the relationship between MEDdiet adherence and AD biomarkers. Through a systematic search, we obtained 10 articles that examined the relationship between AD biomarkers and MEDdiet. These studies showed that the MEDdiet is related to AD biomarkers including total brain volume, PiB retention, and cerebral metabolism; however, these relationships are not definitive. Gaps in the research highlight the need for longitudinal studies to support this association.

ASSOCIATIONS BETWEEN SLEEP QUALITY AND COGNITIVE FUNCTIONING IN ADULTS WITH DOWN SYNDROME

Olivia Avery
Mentors: Sigan Hartley, Milton Yoon

Down syndrome (DS) is a developmental condition, affecting 1 in every 700 live births in the United States. Individuals with DS are at a higher risk for sleep disorders, like obstructive sleep apnea syndrome (OSAS). OSAS is characterized by blockages of the throat while sleeping, limiting oxygen supply to the brain. This disorder may manifest into delays in cognitive performance. The objective of this study was to examine the demographics, including biological sex and age, associated with OSAS in adults with DS, and explore correlations between variables of sleep quality and cognitive functioning in this population. We hypothesize that lower sleep quality will be associated with lower cognitive performance. Our understanding of this association may have important implications for cognitive interventions in this population.

NATURALLY OCCURRING HIGH TESTOSTERONE IN PREPUBESCENT NONHUMAN FEMALE RHESUS MACAQUES OFFERS INSIGHT INTO ORIGINS OF POLYCYSTIC OVARY SYNDROME

Natalia Badillo, Anna Just
Mentor: David Abbott

Polycystic Ovary Syndrome (PCOS) affects 18% of women of reproductive age worldwide. The leading cause of female reproductive and metabolic dysfunction, PCOS and its accompanying morbidities go underdiagnosed despite its high prevalence. Similar to humans, female rhesus macaques give insights into the origins and pathogenesis of PCOS as they similarly naturally exhibit high testosterone (T) levels, a symptom of PCOS. The examination of T levels and PCOS symptoms of female rhesus macaques allows for insights into the origins of PCOS in women and how PCOS may arise during prepubescent and adolescent ages. Increased clitoral volume in 2 of 3 high T female rhesus macaques indicated exposure to high T before menarche and drives hypotheses surrounding heritability of PCOS from mother to child.

DO YOU WANT TO GO TO THE ZOO? INFANTS' EXPERIENCES WITH ANIMALS' INFLUENCE CATEGORY TYPICALITY

Fatima Badjo
Mentors: Jenny Saffran, Haley Weaver

Infants must learn language to describe categories like animals. The development of categories is impacted by experience in the environment. In this experiment, we explored whether infants' experiences with different animal categories affected what was a typical or atypical (normal vs. strange) animal for them. Parents filled out a survey and rated the typicality of 24 animals for their child; 86 parents completed the survey. An additional 41 adults filled out the survey and in general rated the typicality of the animals. We predicted that experiences that involve outside activities would make an animal more typical for a specific child, that experiences that involve indoor activities would be atypical, and that adult's ratings of typicality will be related to the infant ratings.

COSTUMES OF DANCE IN THE BLACK AND ASIAN DIASPORA AND THEIR SIMILAR PHILOSOPHIES

Selena Baker
Mentor: Denzel Taylor

On the surface, the values between cultures within the Asian and African diasporas might seem wildly different. However, upon closer examination we may instead find many significant commonalities. The research project of "Costumes of Dance in the Black and Asian Diaspora and their Similar Philosophies" examines those commonalities within the unique origins, development, and cross-directional influence of Hip-Hip in the Black, Chinese and Korean cultures, with special attention to fashion and costuming. This research seeks to further acknowledge performance as a choice of expression of larger values adopted via the influence of pre-existing traditions. This adoption and remixing of values continues across the world as social media continues to expand. This research will be conducted via documented history, literary research, visual examination, and sample labs.

BIOMATERIALS-BASED PROBIOTIC ENCAPSULATION: ENHANCING BACTERIOTHERAPY FOR INFLAMMATORY BOWEL DISEASE

Allie Barrett
Mentors: Yixin Wang, Quanyin Hu

Novel bacteria-assisted therapeutics have demonstrated the capacity to reduce gut dysbiosis and inflammatory mediator production in inflammatory bowel disease. Still, probiotic bacteriotherapy can fall victim to the harsh conditions of the gastrointestinal tract, limiting retention time in the intestine and reducing the probiotic colonization and proliferation required to elicit therapeutic effects. By utilizing a layer-by-layer electrostatic assembly strategy, we encapsulate E. Coli Nissle (EcN) 1917 bacteria in glycol chitosan and hyaluronic acid layers to both protect the EcN cells from degradation in the GI tract and improve adhesion to the intestinal mucosa. Our chosen chitosan and hyaluronan encapsulation materials may also accelerate intestinal epithelial regeneration and promote the selective release of N-acetyl-glucosamine, a precursor for epithelial glycosylated protein attachments to the protective mucin layer.

CREATION OF NANOPOROUS METAL OXIDES BY OXIDATIVE DEALLOYING OF MOLYBDENUM ALLOYS

Josh Baston
Mentor: John Perepezko

Nanoporous materials are an essential component to many chemical reactions and energy production where catalysis is needed. Their high surface area per volume gives the largest reactive surface ratio with a low density. Currently, these nanoporous meshes are made by a variety of chemical dealloying processes where traditionally strong acids and other corrosive liquids are needed to dissolve select elements, usually silver, away from a premade alloy. Research conducted in Fall 2022 has found that these materials can also be made by high-temperature corrosively dealloying of Molybdenum alloys in an atmospheric environment. In these conditions, Molybdenum reacts with oxygen and forms a volatile oxide above 500C which sublimes off, leaving the alloyed elements behind in nanoporous ligament structure.

AGE OF THE LOS CHOCOYOS TUFF, THE LARGEST QUATERNARY VOLCANIC ERUPTION IN CENTRAL AMERICA

Alec Baudry
Mentor: Brad Singer

The largest Quaternary eruption in Central America produced the 320 km3 Los Chocoyos tuff (LCT), and the Atitlan Caldera. LCT is an important chronostratigraphic marker horizon, but its age remains uncertain. Its position in marine sediments suggests an astronomical age of 84,000 years, however recent U-Th/He dating suggests an age of 75,000 ± 2,000 years. The latter overlaps the Younger Toba tuff, thus it has been hypothesized that this pair of super-eruptions may be responsible for a global cooling event 74,000 years ago. Our 40Ar/39Ar dating of plagioclase and U-Th disequilibrium dating of zircon yield an age of 110,000 ± 7,000 years. This precludes the link between LCT and global cooling 74,000 years ago and has implications for interpreting Central American sedimentary and volcanic records.

NET2D AND TIP GROWTH: GROUNDING OUR UNDERSTANDING OF ROOT HAIR DEVELOPMENT

Lucas Bauer
Mentors: Simon Gilroy, Sabrina Chin

The tip growth mechanism of cell development is responsible for the creation of elongated
structures which emerge from the external layer of plant cells, including root hairs and pollen tubes. This mechanism is characterized by the transport of resources along a complex F-actin network towards the site of active growth within the cell. The role of Networked 2 family gene NET2D on actin filament network organization is confirmed in pollen tube growth and suggested in root hair development. In order to better understand the role of NET2D in root hair tip growth, we characterized the morphology of root hairs in NET2D knockout Arabidopsis mutants, examined the effect of NET2D on F-actin structure, and performed spatiotemporal characterization of NET2D during root hair development.

THE IMPACT OF APP C-TERMINAL EDITING ON ENDOSOMAL AND MITOPHAGY DYSFUNCTION IN DOWN SYNDROME FIBROBLASTS

Mackenzie Beam
Mentors: Krishanu Saha, Kirstan Gimse

Individuals with Down Syndrome (DS) exhibit a higher risk of developing Alzheimer's disease (AD) as compared to the general population due to a triplication of the APP gene. Studies have shown that APP-b-C terminal fragments (APP-bCTFs) may play a key role in the development of endosomal and mitophagy dysfunction in AD and DS. Our lab has previously shown that knockout of the APP C-terminal region downregulates APP-bCTF production. I hypothesized that this editing strategy could ameliorate endosomal and mitophagy dysfunction in DS fibroblasts. To test this hypothesis, I compared the number and size of endosomes and levels of reactive oxygen species in edited DS, untreated DS, and control fibroblasts. Results of this study will help to elucidate early pathological mechanisms in DS and AD.

THE MOLECULAR MECHANISMS OF IBRUTINIB RESISTANCE IN DIFFUSE LARGE B CELL LYMPHOMA (DLBCL)

Samantha Bebel
Mentor: Lixin Rui

B cell malignancies, including several types of lymphoma, can be treated by targeting B cell receptor (BCR) signaling pathways via tyrosine kinase inhibitors. Ibrutinib's, a BTK inhibitor's, potential as a treatment for lymphoma is diminished by primary and acquired ibrutinib resistance. I investigated the mechanism of ibrutinib resistance in diffuse large B cell lymphoma (DLBCL). My preliminary data revealed increased oxidative phosphorylation in the mitochondria of ibrutinib-resistant cells. I hypothesized that drug resistance-related mutations, metabolic reprogramming, and activation of alternative signaling pathways contribute to ibrutinib resistance in DLBCL. To investigate my hypothesis, I used CRISPR/Cas9 to generate activated B-cell (ABC) DLBCL cell lines, OCI-Ly10 and TMD8, that stably express BTKC481S and applied similar RNA-sequence and metabolic analyses.

OVARIAN FOLLICLE POPULATION IN ADULT FEMALE RHESUS MACAQUES WITH NATURALLY OCCURRING HIGH TESTOSTERONE

Danielle Bellino
Mentor: David Abbott

In a pedigree of adult female rhesus macaques, we have identified those that have naturally occurring high testosterone levels (>0.31 ng/mL), similar to women with polycystic ovary syndrome (PCOS), and normal testosterone levels (<0.31 ng/mL). To gain insights into the impact of testosterone on ovarian follicular development, we quantified the ovarian follicle population in adult female rhesus macaques with naturally occurring high testosterone (n=4) and normal testosterone (n=4) that were pair matched in terms of age and weight. We hypothesized that there will be a greater proportion of growing follicles, indicative of polycystic ovaries, in the rhesus macaques with naturally occurring high testosterone compared to those with normal testosterone.

DETERMINING THE ROLE OF ENERGY SOURCE ON MAMMARY GLAND UTILIZATION OF PLASMA AMINO ACIDS

Amara Benn
Mentor: Sebastian Arriola Apelo

Our lab investigates nutritional strategies in dairy cows to stimulate signaling pathways that regulate milk protein synthesis. The mTORC1 pathway shows promise as it coordinates nutrient and environmental cues to stimulate anabolism. We hypothesized that glucogenic energy stimulates insulin secretion, potentiating AA activation of mammary mTORC1 and increasing uptake of AA. 20 cows were used in a 4x4 repeated Latin square design with four 28-d periods and four treatments arranged as a 2x2 factorial. Treatment factors were energy source: glucogenic or ketogenic and AA: 10% deficient or sufficient. Blood was collected during the last 2 days of each period. Plasma was isolated and mixed with isotopically labeled AA for AA analysis by LC-MS. Mammary extraction efficiency, uptake, and uptake to milk output ratio were calculated.

EXPLORING THE MICROBIAL LANDSCAPE OF OSSEOINTEGRATED AMPUTATION PROCEDURES: A COMPREHENSIVE LITERATURE REVIEW OF STOMA COLONIZATION, CHALLENGES, AND INTERVENTIONS

Mitchell Benyukhis, Michael Sohn
Mentor: Aaron Dingle

Over 2,000,000 people with amputations in the USA undergo treatment methods that do not confer adequate functionality. Osseointegration (OI), direct skeletal attachment of a transcutaneous implant, is a propitious alternative whose limited research prevents its clinical use. Thus, we performed a comprehensive literature review on its capabilities and limitations, and while findings support OI as a viable alternative, we have found bacterial colonization on the stoma, the implant exit site, to be a frequent challenge which can be mitigated via precise porous coating of 50-400 micropores, effective material choice of titanium alloy, and soft tissue manipulation allowing for drainage of the implant cavity. These promising findings establish credibility for OI-centered clinical trials specifically focused on the materials and procedures that mitigate bacterial colonization.

THE EFFECTS OF A NOVEL GUM FEEDER ON THE BEHAVIOR OF CAPTIVE COMMON MARMOSETS

Ethan Bernt, Lucine Yen
Mentor: Peter Pierre

Environmental enrichment is implemented to promote species-typical behavior and welfare in captive non-human primates. In this study, we will observe the interactions of pair-housed common marmosets (n=20) with a wooden "gum feeder" that delivers gum, a diet staple for common marmosets, in a similar manner to natural sources. Using an ethogram, we will measure the frequency and duration of foraging and other interactive behaviors. We hypothesize that, by providing gum in a method more akin to naturally occuring plant exudates, we will see an increase in species-typical behaviors and a decrease in stereotypical and agonistic behaviors. With these results, we can refine how we deliver enrichment opportunities to this species in a manner that invites interaction and sustains engagement.

LABORATORY MEASUREMENT OF THE EFFECT OF SURFACE WAVES ON THE SETTLING VELOCITY OF MICROPLASTICS

Kaan Beyduz
Mentor: Nimish Pujara

Understanding the environmental effects of ocean and Great Lakes pollution requires knowledge about transportation and the accumulation of microplastics. Previous experiments and theory suggest that particles will settle faster in surface waves than in still water. In this research, using the still water data previously collected, I intend to experimentally investigate the settling velocities of microplastic particles under surface waves for different densities and geometries. I will combine particle image velocimetry (PIV) method with the dropping mechanisms to collect images of the particles. Using MATLAB image processing tools, I will extract the centroid data from each image to calculate velocity from the displacement between frames. Modeling settling velocities of microplastics under surface waves provides a basis for predicting microplastic motion in waters.

GENDER DIFFERENCES IN FORMS OF REFERENCE AND ADDRESS TO POLITICIANS

Harmon Bhasin
Mentor: Stav Atir

Despite equal qualifications, women are underrepresented in high-power roles. Gender bias in how people speak about and to professionals contributes to this state. Previous research found a gender bias in referring to politicians, using last names more for men than women. Last name references are tied to perceptions of fame, eminence, and deservingness of awards. However, addressing politicians and professionals based on their gender when speaking to them is less understood. Using a dataset of responses to politicians' posts on Facebook, I explore the American public's direct access to politicians through social media. I test whether and in what ways responders address male and female politicians differently through natural language processing. I examine if gender-biased forms of address predict election outcomes and politician popularity.

DECREASED OUTFLOW FACILITY AND SCHLEMM'S CANAL DEFECTS IN A MOUSE MODEL OF GLAUCOMA

Samer Bilal
Mentor: Colleen McDowell

Previously we identified B6.EDA+/+ mice, which constitutively express the EDA isoform of fibronectin, as a novel mouse model that presents with elevated intraocular pressure (IOP) and trabecular meshwork damage. Here, we expand on our previous findings by measuring aqueous humor outflow facility and analyzing the integrity of the inner wall of Schlemm's canal. As expected, B6.EDA+/+ mice had significantly elevated IOP and decreased outflow facility compared to C57BL/6J controls. In addition, B6.EDA+/+ mice had significantly increased expression of the adherens junction protein, VE-cadherin by the inner wall endothelium of Schlemm's canal. These data suggest that in addition to trabecular meshwork damage, there are changes in Schlemm's canal in B6.EDA+/+ mice that lead to aqueous outflow dysfunction and ocular hypertension.

READING WOOD WITH qPCR

Luna Bitar
Mentor: Alex C. Wiedenhoeft

The objective of this project is to validate a field deployable qPCR protocol for forensic DNA identification of the wood of Norway spruce (Picea abies), specifically separating it from North American spruce species. In partnership with the American Lumber Standards Corporation (ALSC), the mission is to master the protocol for on-site qPCR-based wood identification tests to facilitate wood inspection processes. The ALSC conducts wood inspections to guarantee that the lumber used in construction meets safety standards for building codes; Norway spruce is excluded from this group of construction woods. Developing proof-of-concept for this qPCR technology for spruce is the first step to transforming forensic-level field testing of wood, not only used in construction, but also across borders where illegal log trading can be detected and combated.

EFFECTS OF CIRCULATING ESTRADIOL LEVELS ON UTERINE ENDOMETRIAL DEPTH IN MONKEYS

Jacob Blanchar
Mentor: David Abbott

Optimal uterine endometrial depth (UED) is essential for female reproductive health. We quantified UED employing digital calipers on images obtained from trans-abdominal ultrasonography of female rhesus monkeys. Monkey groups (1) were depleted of ovarian estradiol (VEH), (2) were deleted of ovarian and extra-ovarian estradiol, or (3) had ovarian estradiol maintained (E2). Since UED is responsive to changes in circulating estradiol levels, we hypothesized the following UED values for each treatment group: E2>VEH>LET. If these results are found, it would be the first time extra- ovarian estradiol has been shown to regulate UED. Extra-ovarian estradiol may thus play an unsuspected role in maintaining optimal UED.

THE EFFECTS OF DECREASED ESTRADIOL ACTION IN METABOLIC REGULATION OF WHITE AND BROWN ADIOCYTE LIPOLYSIS AND THERMOGENESIS IN FEMALE NONHUMAN PRIMATES

Benjamin Bochenski
Mentor: Molly Willging

Estradiol action regulates adipocyte lipolysis and thermogenesis via ER-a and ER-b, but the mechanism as to how estradiol does so is currently being researched. Additionally, there has been an increased onset of obesity in women after menopause. No clear relationship between estradiol action and adipocyte cell morphology in female nonhuman primates has been established. In past studies, total knockdown of ESR1 gene expression contributes to hypertrophy of white and brown adipocytes in rodent models. We tested whether decreased ESR1 gene expression in the ventromedial hypothalamus induced change in adipocyte structure. Results indicate a significant decrease in adipocyte area and circumference in response to the ESR1 knockdown treatment. Therefore, we suggest that adipocytes undergo hyperplasia, not hypertrophy, due to lack of estradiol action.

WHITE MATTER MICROSTRUCTURAL ANALYSIS: PERCEPTUAL REASONING COMPARISON OF AUTISTIC AND NEUROTYPICAL INDIVIDUALS

Elizabeth Bond
Mentor: Douglas Dean

Autism Spectrum Disorder (ASD) is a heterogeneous neurodevelopmental disorder notably recognized by deficits in social communication and interaction, specifically including multisensory processing. The neural processes underlying sensory perception are understood in neurotypical individuals. However, there is a lack of knowledge about cognitive patterns relating to sensory perception across the diverse community of autistic individuals. This project uses magnetic resonance imaging (MRI) to conduct a white matter microstructural analysis of three white matter tracts involved in perceptual reasoning in order to address this gap in knowledge and cognitively compare the correlation between perceptual reasoning in autistic and neurotypical individuals. Defining neurobiological aspects of disorders, such as autism spectrum disorder, is critical for creating target therapies and implementing early interventions for neural substrates of behavioral problems.

HONONEGAH: MASCOT, MAIDEN, MEMORY

Axell Boomer
Mentor: Matt Villeneuve

My research reveals the discrepancy between the city of Rockton, Illinois' presented desire to honor Indigenous people and the region's racist attitude towards Native Americans. Through the local high school, Rockton alters and manipulates the understanding of the region's Indigenous inhabitants and their imagined spirit not as historical agents, but as sports' mascots. This relationship can only be fully understood by analyzing how the school viewed itself as the culmination of settlement. The recent addition of a statue portraying an Indigenous woman praises her for providing early settlers' comfort. The statue is a celebration of a completed settlement and presents an archetype for a consentingly conquered people. The local historic district utilizes reenactors as a final act of colonialism by rewriting the region's Indigenous history.

PREDICTING PATIENT LOAD FOR DOCTORS IN MUMBAI

Katherine Breen
Mentor: Justin Boutilier

India is a tuberculosis (TB) high burden country, carrying one-fourth of the global burden. The government of India developed the National Strategic Plan that looks to eliminate TB by 2025, and private sector engagement (i.e., engaging and supporting private practitioners) was highlighted as a key strategy in their plan. This project is part of a larger collaboration with the health equity charity PATH's program that engages private practitioners to improve diagnosis and treatment of TB (e.g., through training or funding). To determine which practitioners to engage in their program, PATH must determine which practitioners serve the most patients. This project creates methods for predicting patient load for the doctors that are a part of PATH's program. To do this, we implement spatial machine learning models to forecast patient load.

TREE ARCHITECTURE AND WOOD ANATOMY IN PODOCARPACEAE

Sadie Brenneman
Mentor: Rafael E. Arévalo B.

Understanding tree growth habits is key to conceptualizing biomechanical responses of forest ecosystems to climate change. The study of tree architectural models provides the framework for knowledge of tree structure, growth, and other developmental habits, but the correlation between a tree's architecture and its wood anatomy has never been systematically investigated. Of the 23 models established, Conifers exhibit 4 of them providing a starting ground for research. By examining softwood anatomical features of several species of Podocarpaceae, we are able to compare the four models. While no visible pattern has been found, there appears to be some trends in variability. Because one architectural model is predominant over the others, more data must be collected on the other three for a viable comparison to be made.

THE ROLE OF DCMYB7 IN THE PRODUCTION OF ANTHOCYANINS WITHIN PURPLE CARROT (DAUCUS CAROTA L.) ROOTS

Dyllen Brewer
Mentors: Philip Simon, Michael Paulsmeyer

Purple carrots are characterized by large amounts of anthocyanins, which are beneficial to human health and serve as alternative food dyes. One of the most significant genes controlling the anthocyanin pathway is DcMYB7, which encodes several essential transcription factors. Through the use of phylogenetic analysis and candidate gene identification, 2 significant SNPs were identified among the clade of purple carrots; the SNP at site 295 fell within the exon and was responsible for an amino acid change. This SNP was identified as a genetic marker for which primers were designed to utilize in PCR. Moving forward this genetic marker will be used to identify the phenotypes of carrots before planting. Ultimately, this finding will be used to support alternative food dye production.

BRIDGING WISCONSIN PROGRAM: CONNECTING UW–MADISON AND THE ONEIDA NATION SCHOOL SYSTEM THROUGH SCIENCE TOPICS, COLLEGIATE EXPERIENCES, AND CULTURAL HUMILITY

Jonathan Bryan, Mai Chada Vang, Chao Xiong, and Andrew Yang
Mentors: Judith Simcox, Seth Pollak

The Bridging Wisconsin Program unites students from the Oneida Nation School System and community with undergraduates from the University of Wisconsin–Madison. The leading cohort will explore interactive science experiments with middle school students and discuss higher education and professional paths after high school graduation in order to demystify some erroneous ideas, specifically regarding science majors and occupations. Noting the varied interests of students, this program also promotes non-science-related opportunities. Bridging Wisconsin aims to form a mentorship connection between the Oneida Nation students and UW–Madison undergraduates, who can provide insightful knowledge about lived experiences on campus. Additionally, this program encourages diverse inclusivity of cultures in higher education and occupations. This partnership will be sustained through a pre-health, non-profit organization, Health Entrepreneurs and Leaders (HEAL).

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

Taylor Byington, Mihika Sathe
Mentor: David Abbott

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.

DEVELOPMENT AND INTEGRATION OF STATE ESTIMATION ALGORITHMS FOR AUTONOMY STACK

Stefan Caldararu
Mentor: Dan Negrut

This project presents a comparison between simulation and reality of a state estimation algorithm used on a scale autonomous vehicle. The research was conducted on the Autonomy Tool Kit (ATK) platform, which utilizes ART (a scale autonomous vehicle) and dART (its digital twin). This project consisted of development of an Extended Kalman Filter (EKF) using a 4 Degree of Freedom (DOF) motion model. This model was then tested in the CHRONO simulation engine, along with a novel noise model for GPS which is an improvement of the standard normal distribution noise model. Comparison of the filter's performance between simulation and reality is presented. Future work involves development of an EKF implementing an 8-DOF motion model and a comparison of the two models' performance.

STEREOTYPE PERPETUATION: HOW DO COMMUNICATORS INFLUENCE BELIEVABILITY OF RACIAL STEREOTYPES?

Shannon Carnahan
Mentor: William Cox

Stereotypes are perpetuated via interpersonal communication. While existing literature emphasizes benefits of intergroup contact for reducing prejudice, it is possible that stereotypes can be more believable due to the demographic of the communicator. The present work examines the extent to which people believe stereotypic messages more when they are communicated by a member of the stereotyped group. Participants read social media posts and rated their belief in stereotypes, in one of three between-subjects conditions. Posts presented either stereotype-irrelevant information, or depicted messages about the accuracy of stereotypes about Asian people, from either Asian or White communicators. Results demonstrate that the race of the speaker had less importance than anticipated; however, being exposed to stereotype-relevant information increased overall beliefs in the stereotype.

INVESTIGATING GENES INVOLVED IN GRAVITROPISM IN ROOT CAP CELLS

Megan Case
Mentor: Sabrina Chin

My project is part of the Gilroy Lab. Under Dr. Sabrina Chin, I am studying signaling in root gravitropism. On Earth, plant's roots grow downward following the gravity vector; however, when plants are grown in space with reduced gravity, the roots are more skewed and waved. The goal of this project is to understand how columella cells (the center of gravity sensing) in the root cap influence gravitational response in plants. Through lab techniques performed on a model organism, Arabidopsis, including DNA extraction, PCR, gel electrophoresis, and imaging, we are able to study the function of certain genes (previously identified in corn root cap cells) on gravity sensing. In observation of Arabidopsis plants with mutations in these genes, we can observe changes in how the roots bend according to gravity.

IMPACT OF BURN INTENSITY AND ASH ADDITIONS ON BOREAL FOREST SOILS

Hailey Cashmer
Mentor: Kelsey Kruger

Due to climate change creating drier conditions, high severity fires are becoming more common leading to longer, more active fire seasons. Fire can rapidly and dramatically shift soil pH, causing a wide range of effects on ecosystem recovery post-fire. This includes nutrient availability and microbial community composition. Soil samples taken throughout Wisconsin will be burned at temperatures ranging from 25°C to 750°C at 100 degree increments. These samples represent a gradient of pHs that can be seen throughout the state, and the temperatures represent low, medium, and high severity fires. After burning, pH is measured using a 0.1M CaCl2 solution mixed with soil at a 1:1 ratio. After the solution has settled, the supernatant is extracted, and the pH is tested. With this approach, we see how soil pH changes post-burn. We expect to see an increase in pH with higher temperature. These findings can help us understand how fires will affect our ecosystems under climate change.

PROBING THE MILKY WAY GALAXY DENSITY STRUCTURE THROUGH MOCK OBSERVATIONS

Dominic Catherino
Mentor: Rachel L McClure

During the evolution of Milky Way-like galaxies, disks can evolve from being relatively featureless to developing non-axisymmetric structures like stellar bars and photometric dark gaps. Without external observations of the Milky Way, we can’t directly observe these structures. Bars can change the distribution of stars and substantially affect a galaxy’s gas dynamics. We generate synthetic internal and external observations using our Milky Way-like N-body simulation. We use mock observations compared with real Gaia Milky Way observations of red clump stars to make predictions about the bar and dark gap’s properties. Based on these results, we use the red clump stars as standard candles to locate the dark gaps within the Milky Way.

MEASURING THE EXPRESSION AND CYCLICITY OF ALOPECIA IN BREEDING AGE FEMALE RHESUS MACAQUES (MACACA MULATTA)

Morgan Cazares
Mentor: Peter J. Pierre

Alopecia is a condition of substantial hair loss from parts of the body where hair normally grows. Alopecia is commonly observed during pregnancy, however the reasons for hair loss are not well understood. Past research has suggested over-grooming and stress responses as factors that contribute to alopecia; however, the strength of the relationship between the "stress marker", hair cortisol levels, and alopecia has been inconsistent. We evaluated 30 breeding age female Rhesus Macaques at different phases of pregnancy. Collecting coat images, we used contrast-based image analysis to evaluate variation in alopecia area and collected hair samples, for the potential development of alopecia biomarkers in this sub-population. We aim to describe and define the extent of alopecia to better understand the underlying factors that drive expression.

DEVELOPING A WEB-BASED TOOL MEASURING "CIRCULARITY"

Addison ChanSchatz, Ethan Park, Rashmi Edamula
Mentor: Styliana Avraamidou

Circular Economy (CE) is a model to help manage waste and extend the life of products efficiently. Historically, when trying to analyze the CE of entities, it has only been done at a national and regional level, but not at the company or product supply chain level. To reach this level, we are continuing to develop a web-tool calculator, which takes in different metrics and indicators to produce different data visualizations. The data visualizations of these different companies can be compared against each other with other entities in their respective sector. Companies having the ability to calculate their own circularity is vital to address the ever-increasing threat of climate change and social dilemmas these multinational companies create.

PREDICTING POPULATION'S INQUIRY OF CANNABIDIOL (CBD) PRODUCTS USING MACHINE LEARNING

Jingyu Chen
Mentor: Wan-chin Kuo

Cannabidiol (CBD) is a chemical of the Cannabis sativa plant, which has drawn significant attention over the past decade. Despite the fact that seizure is the only approved symptom for a CBD product (Epidiolex) under FDA regulation, the growing market of CBD products in the U.S. have outpaced the safety regulation issued by FDA. Consumers' interest in a novel product is volatile to commercials, storytelling, and consumer reviews. Yet, the prediction of population's interest in CBD products is challenging, because it involves the shift of health beliefs, safety concerns, legalization, and political movements in this industry. The goal of this project is to examine the precision of machine learning in predicting public inquiry of CBD products in the U.S. using Google Trends.

UNDERSTANDING THE STRUCTURE AND FUNCTION OF CELL DIVISION PROTEIN COMPLEX FtsLB

Mia Chen
Mentor: Samridhi Garg

Bacterial cells require a protein complex known as the divisome to divide into two daughter cells. FtsB is an essential protein to the divisome. Paired with FtsL, FtsLB is formed, which activates cell wall synthesis. The mechanism that FtsLB uses to regulate cell wall synthesis is not entirely known, because of challenges involved in determining membrane protein structure. Yet, based on computational models, we established that FtsLB is a possible 2:2 heterodimer. To confirm FtsB is a dimeric structure, we perform cysteine crosslinking in the native membrane to facilitate disulfide bridges between FtsB residues. Understanding the structure and functionality behind FtsB provides insight into regulating divisome activity in cell division and is applied to drug development and disease control.

GENERATION OF ATTENUATED IL-2-PRODUCING LISTERIA FOR CANCER IMMUNOTHERAPY

Emily Cheng
Mentors: Paul Sondel, Alexander Rakhmilevich

Sustained, local, and non-toxic delivery of immunotherapeutic agents to the tumor site remains an important area of cancer research. We have generated an attenuated form of Listeria that secretes interleukin-2 (LisIL-2) and analyzed levels of in vivo IL-2 expression by ELISA. Levels of IL-2 in homogenized B78 melanoma tumors were found to be highest on day 3 post LisIL-2 injection into the tumor. Moreover, when treated with LisIL-2 intratumorally, mice with B78 tumors exhibited delayed tumor growth compared to mice with untreated tumors. Together, these results support the further investigation of LisIL-2 as a cancer immunotherapy platform.

HOW SOUND AND EMOTION IN ANTI-VACCINATION TIKTOK VIDEOS INDUCE PSYCHOLOGICAL POLARIZATION

Hannah Cheren
Mentor: Kaiping Chen

Scientific communication is constantly evolving, especially in social media. Psychological polarization is a phenomenon brought out by social media. Researchers have found that features and affordances on these sites can contribute to this growing psychological polarization. As an extension of this work, which traditionally focuses on social media that regularly communicate scientific topics, such as Twitter and Facebook, I will explore this topic on TikTok. Specifically, how the Sound feature contributes to the psychological polarization environment associated with political and scientific content. We use pre-existing data on 1,013 anti-vaccination TikTok videos, a scientific topic often politicized, from 2021-2022. We see whether a video containing music versus not having music (just speech) affects how psychologically polarized each video is.

POST VERNACULAR NORWEGIAN LANGUAGE, CULTURE, AND TOURISM IN STOUGHTON

Seongjae Choi
Mentor: Joe Salmons

In the early days of Stoughton, a large population of Norwegians brought Norwegian language and culture, and it eventually became known as Little Norway. Today, Norwegian is no longer used for regular communication, but as a 'post vernacular' language to distinguish Stoughton as culturally Norwegian, and for commercial purposes like promoting tourism such as Syttende Mai. Drawing on Reershemius (2009) and many local historical sources, I trace how the decline in the Norwegian language in Stoughton correlates with the rise of post vernacular linguistic practices with connections to tourism in Stoughton.

DETERMINING THE ROLE OF THE PD-1/PD-L1 REGULATION PATHWAY IN POST-STROKE PATHOGENESIS

Peter A. Cismaru
Mentor: Zsuzsanna Fabry

Every 40 seconds, someone in the United States has a stroke. However, treatments for poststroke healing are limited. One contributor to stroke related brain damage is the secondary inflammatory response that occurs via the infiltration of peripheral leukocytes into the brain. One site of immune cell infiltration occurs at the choroid plexus (ChP), the primary CSF producing organ in the brain. Data generated from our lab indicates that, following induction of stroke, a subpopulation of ChP epithelial cells upregulates surface expression of PD-L1: a known checkpoint inhibitor molecule known to suppress T cell function. Here in this work, we attempt to characterize the PD-L1 expression on choroid plexus epithelial cells and outline a potential mechanism for its upregulation via the IFN-gamma signaling pathway.

REDUCTION OF METABOLIC BURDEN IN E. COLI THROUGH GENOME MINIMIZATION AND POOLED DELETION SCREENING

Ava Clark
Mentor: Will Bothfeld

Engineering microbes for chemical synthesis provides an alternative to conventional production with a reduced environmental impact. To compete with the petroleum industry, nonessential genes must be removed to redirect energy for high yields. We will validate a computational model predicting 32 genome knockouts with sizes up to 300 kb. Deletions will then be incorporated into a plasmid to add to other strains. This includes a deletion design library for development of millions of combinations in a reasonable timeframe and tracking which deletions were made. The strains can be tested for stress tolerance and protein production, and strains with the highest fitness in terms of health, growth, and production will be identified. This knowledge will be used for development of a strain for engineering any chemical.

THE CHANGE OF ADOLESCENTS' SELF-PRESENTATION ON SOCIAL MEDIA OVER THE TRANSITION FROM MIDDLE TO HIGH SCHOOL

Nicolas Cline
Mentor: Ellen Selkie

For adolescents, transitioning to high school is a turning point for adolescents' self-presentation to peers on social media. This study will look at a potential link between changes in self-presentation and the transition to high school with a focus on post deletion and profile pictures. This two-year longitudinal study includes 142 adolescents who started the study as middle schoolers in Time 1 (Mage = 13.6) and ended as high schoolers in Time 5 (Mage = 15.7). Every 6 months post deletion and profile photos changes were tracked on the participants' social media accounts for a one-month period. We will examine significant differences in deleted posts and profile photo changes before high school starts and after using t-tests and ANOVAS.

USE OF REPRESENTATIONS IN EARLY CHILDHOOD

Luna Cohen, Nur Hidayah Binti Rostam
Mentors: Martina Rau, Hala Ghousseini

Research has shown that students learn iteratively how representations embody concepts and ideas while using them to understand the content. However, research investigates this iterative process with older students and fewer kindergarteners. Hence, this research aims to examine (a) how kindergartners use and understand a variety of representations (b) what this reveals about their mathematical understanding. It also aims to understand how teachers support kindergartners' representational reasoning. Data collection methods include: initial interviews with teachers and students, and field notes of teachers' interactions with students about representations. We will transcribe all interviews and thematically analyze them for teachers' and students' representational conception. With this research, we hope to help teachers better support student learning.

COMMUNITY-DRIVEN ZONING IN CHICAGO: STEPPING STONE OR STUMBLING BLOCK FOR DENSE AND AFFORDABLE RESIDENTIAL DEVELOPMENT

Emma Coleman, Nina Aurelio
Mentor: Loren Peabody

In Chicago, a group of progressive alders have implemented a participatory democratic process called Community-Driven Zoning and Development (CDZD) to provide a means for community members to influence real estate development in neighborhoods affected by gentrification and the lack of affordable housing. This study will describe the spatial distribution of zoning changes in Chicago using an original dataset to determine if they are concentrated in areas where renters are more at risk of displacement. Next, it will use time series models to assess whether wards that adopted CDZD experienced unique changes in their approval of dense and affordable residential development. Finally, performing interviews with neighborhood leaders, community members, alders, and developers will test the effectiveness of CDZD in strengthening community participation and democracy.

"AS A FATHER OF TWO DAUGHTERS...": THE INFLUENCE OF HAVING DAUGHTERS ON POLICY MAKERS' REAL AND PERCEIVED GENDER EGALITARIANISM

Abigail Collins
Mentor: Stav Atir

Men in political leadership dictate policies that affect women's lives. When speaking about women-related policies, men sometimes invoke their relationships with women to self-credential, e.g., "As a father of daughters…". Is this effective, and should it be? In our experiment, participants read a speech from a (fictitious) U.S. male senator speaking on women's right to abortion where the politician either invoked being a father of daughters or did not. When the senator invoked his daughters, participants thought he was better credentialed to speak on the issue. However, a follow-up survey found that fathers of daughters were just as sexist as fathers of sons and held similar views on women-related issues. Thus, invoking relationships with women may be an effective but misleading tactic for self-credentialing.

BIOMEDICINE AND THE PRODUCTION OF NORMALITY

Sydney Collins
Mentor: Malachy Bishop

Current research and theory in the intersecting fields of medicine, anthropology, philosophy, disability studies, and sociology propose differing views of health based on perceptions and definitions of the concept, alongside notions of disorder and disease. Biomedicine revolves around the production of normality from statistical analysis and application. Through normality, biomedicine defines health utilizing discrete boundaries and employing technology to categorize and produce order within populations. While this approach is efficient, it excludes those who don't fit into established and accepted categories. The ambiguous definition of normality leaves much unresolved and creates realities which explicitly impact the lives of those within them. This has consequences for both disabled and non-disabled individuals, and begs the question, how do we move forward?

IDENTIFYING CARROT CULTIVAR RESPONSE TO DROUGHT STRESS

Page Comstock
Mentors: Philipp Simon, Sean Fenstemaker

The issue of water deficit is a significant threat to the carrot industry in the U.S., and selecting cultivars to maximize performance under these conditions will be crucial. To determine which physiological traits best predict this response, 16 carrot cultivars were analyzed for wilt levels, as well as 7 related physiological traits over the course of a water deficit treatment. Assessment of this physiological data alongside wilt measurements will provide insight into the most reliable physiological predictors of water deficit response, which can then be applied to select cultivars for geographical areas that are affected by drought.

INVESTIGATING FIRE TOLERANCE AMONG WISCONSIN'S SOUTHERN HARDWOODS: IMPLICATIONS FOR MANAGING FIRE DEPENDENT ECOSYSTEMS

Ava Copple
Mentors: Steven Augustine, Kate McCulloh

My research addresses the issue of fire suppression and mesification of Wisconsin's historically fire dependent forest systems. With my study, I am looking at how Wisconsin's southern hardwood species vary both in their tolerance and propagation of fire. Particularly, I am measuring bark thickness as an indicator of fire tolerance and leaf mass per area as an indicator of fire propagation. This data will provide insight into species-specific variation as well as broader patterns in variation between dry forest species and mesic forest species. This research could have an important impact on the management and restoration of Wisconsin's dry forest and savanna ecosystems.

SEX DIFFERENCES IN LOGICAL MEMORY DECLINE IN PRECLINICAL ALZHEIMER'S DISEASE

Douglas Cowman
Mentor: Kimberly Mueller

Using longitudinal data from the Wisconsin Registry for Alzheimer's Prevention, we examined the relationship between sex, cognitive status, amyloid positivity, and decline in logical memory and proper name recall in preclinical Alzheimer's disease. Using linear mixed-effect models, results showed that women had higher baseline scores than men on both cognitive tasks, but the rate of decline did not differ significantly between sexes. Cognitive impairment was associated with worse performance on both tasks regardless of sex. A significant interaction was found between sex and amyloid status on logical memory total scores, indicating a steeper decline for Aβ+ women compared to Aβ+ and Aβ- men, and Aβ- women. Future research should investigate the potential underlying mechanisms for the observed sex differences in logical memory decline.

ALTERNATIVE CIRCADIAN RHYTHMS AND SLEEP

Ethan Cui
Mentor: Jerry C.P. Yin

Circadian rhythms are an important biological process that regulates many behavioral activities and are regulated by core circadian molecules with oscillatory expression in the clock neurons. However, the effect of alternative lighting conditions on sleep is elusive. I measured flies' sleep under seven 24-hour-based light-dark cycles and three non-24-hour-based light-dark cycles. The result suggests that sleep under a 24-hour-based light-dark cycle is relatively conserved when the light-dark cycles are close to the normal LD cycle. However, sleep under a non-12-hour-based light-dark cycle does not demonstrate common sleep kinetics. This research demonstrates that sleep under alternative environmental lighting conditions is likely to be plastic only within a narrow range, whereas extreme perturbation will result in uncommon sleep kinetics.

BRIDGING SUSTAINABILITY AND MECHANICS IN FOAMED POLYPROPYLENE COMPOSITES: THE BIOCHAR AND MUCELL CONNECTION

Jackson Cyvas
Mentor: Pavana Prabhakar

Polypropylene (PP) is a common thermoplastic used in the automotive and packaging industries. PP is often foamed with supercritical fluid to optimize the properties and reduce the amount of required polymer; this process is known as MuCell. Biochar is a common industry waste product; wherein organic material is burned in anaerobic conditions, pyrolysis. Previously, MuCell has been combined with various additives as nucleating agents for better foaming. However, the size-effect of additives on the microcellular structure has not been studied. We incorporated different sizes of biochar in the PP to create foamed composites to elucidate their impact on the microstructure and mechanical performance. Our results show how biochar parameters can be combined with manufacturing parameters to create tunable and sustainable PP composites for automotive industries.

SURVIVING STRESS: A BACTERIUM'S GUIDE TO STRESS MANAGEMENT

Allison Czora
Mentor: Michael Wolfe

In response to hostile environmental conditions, bacterial cells activate a signaling pathway known as the stringent response. Through this pathway, bacteria reprogram their transcriptome and downregulate ribosome biogenesis to match the decreased translational need, allowing them to survive until conditions are more favorable. Transcriptional regulator CarD plays an important role in transcription initiation and is required for the stringent response in some bacteria. Here, we aim to understand how CarD may aid in the stringent response in Zymomonas mobilis—an ethanologenic bacteria with promise for biofuel production—by knocking out CarD expression while activating other signaling molecules of the stringent response. Under these conditions, we analyzed growth, survival, and ribosomal RNA expression to learn more about the transcriptional response to stress in this promising bacteria.

ENGAGEMENT WITH TIKTOK CONTENT AND MENTAL HEALTH AMONG ADOLESCENTS

Anish Damani
Mentor: Bradley Kerr

Mental health conditions affect almost 50% of adolescents. This cross-sectional study examined associations between TikTok use, engagement with specific content, and mental wellbeing and depression among adolescents. Adolescents were recruited via Qualtrics panels in fall 2021. An online survey assessed TikTok use frequency and content, mental wellbeing, and depression. Analyses tested correlations between TikTok use frequency and mental wellbeing and depression scores. T-tests compared mental wellbeing and depression scores based on common TikTok content. Among 2206 participants, TikTok use frequency was positively associated with depression scores ($r = .131$, $p < .001$) but not mental wellbeing. Engagement with humor was associated with lower depression scores ($p = .02$). Findings suggest that engagement with different TikTok content has varying associations with mental health outcomes.

ASSOCIATION BETWEEN BLACK ATHLETES' STEREOTYPE AWARENESS AND WELL-BEING

Alec Davis
Mentor: Morgan Jerald

Stereotypes of Black athletes' superior athleticism and inferior intelligence have been used historically to explain Black athletes' achievements. Previous research suggests that individuals who are more aware of stereotypes others may hold about their in-group report lower well-being than less aware individuals. The current study uses an online survey to examine the relationship between Black male athletes' awareness of this stereotype and their well-being. We also investigate the moderating roles of racial, student, and athlete identity. We hypothesize that participants with high awareness of group stereotypes will report lower levels of well-being, and that higher importance assigned to racial and student identities will amplify this relationship. These findings may help clinicians identify populations that are especially vulnerable to negative mental and physical health outcomes.

DIRECTOR EXPERTISE

Alejandro De La Torre
Mentor: Yaron Nili

In the past decade, shareholders and consumers have placed increasing pressure on companies to elect directors to the boards of publicly traded companies with specific expertise. Behind this pressure is the general notion that having directors present on boards with these skill sets will allow companies to make more informed decisions, thus resulting in better outcomes for companies, which existing literature has yet to explore. This project aims to develop a hand-collected, comprehensive dataset of all S&P 500 and 600 companies from 2016 to 2021-22 to effectively trace the changes and growing developments of the skills disclosed in proxy statements. With this, this project will explore the effects of electing directors with particular skills on corporate governance.

A COMPARATIVE ANALYSIS FOR THE OPTIMAL MANAGEMENT OF PLASTIC WASTE

Shreyanshu Dekate
Mentor: Aurora del Carmen Munguía-López

In this study, we present a comparative analysis of various alternatives for recycling and managing different types of plastic waste (e.g., multi-layer films). Our focus is on assessing the economic and environmental performance of several methods, including innovative recycling technologies and end-of-life disposal methods (e.g., solvent-based processes and landfilling). Specifically, we analyze the operational expenditure (OPEX) and emissions of different methods to provide decision-makers with valuable insights for sustainable plastic waste recycling management. By comparing the performance of various alternatives, we aim to address the challenges and offer solutions for mitigating environmental impact while reducing costs. Furthermore, the costs and emissions data from our analysis can be used as inputs for optimization models to determine the optimal configuration of complex plastic waste management systems.

PARSING AND STANDARDIZING DATA UNITS FOR A VIDEO OBSERVATION STUDYING EPISODES OF LUCIDITY IN DEMENTIA

Ashley DeLaurelle
Mentor: Andrea Gilmore-Bykovskyi

Episodes of lucidity (EL) are generally characterized by a spontaneous and unexpected return of abilities in individuals with Alzheimer's disease and related dementias (AD/ADRD). Due to the transient and rare nature of ELs, longitudinal audiovisual observation of people living with AD/ADRD may prove invaluable to advancing research into the phenomenon. Provided the quantity of data, and utility of variable analytic techniques that operate at both micro (timed-event) and context dependent (segments of data across time) levels of analysis, approaches are needed to standardize segmentation of data in ways that retain salient contextual data and facilitate hierarchical and nested modeling. The objective of this study is to describe our methodology for parsing and characterizing audiovisual data of people living with AD/ADRD into Standardized Data Units (SDUs).

CELL-BASED DRUG DELIVERY FOR CANCER RESEARCH

Lauren Dempsey
Mentor: Zhaoting Li

Cancer is a deadly disease that has been researched for decades but not yet cured. This project uses new methods to combine cell therapy, immunotherapy, and personalized therapy to provide the most efficient treatment to fight cancer for patients. It is typically used to fight off any remaining cancer cells after a more aggressive treatment. Through culturing cells, extracting exosomes, and injecting them with drugs, the exosomes can then be tested using a broad array of devices. I focus on using cell therapy to create the best combination of cellular vehicles and drugs, as well as measuring exosome size and uptake for trials. This method has not been perfected yet, but is on its way there.

FORWARD GENETIC SCREENS TO CHARACTERIZE THE ATTINE ANT–PSEUDONOCARDIA RELATIONSHIP

Dev Desai
Mentor: Peter Burnham

Pseudonocardia produce antifungal compounds which inhibit a parasitic pathogenic fungus of the attine fungal garden, Escovopsis. Little is known about how Pseudonocardia is able to colonize their ant hosts. We investigated three distinct traits we hypothesized were necessary for Pseudonocardia colonization of attine ants: attachment, chemolithoautotrophic growth, and antifungal activity. Through a forward genetic approach using EMS mutagenesis and screens for each phenotype, we identified mutants with attachment, autotrophic growth, and antifungal defects. We whole genome sequenced these mutants and found SNPs in genes that may be necessary for chemolithoautotrophic growth. We are in the process of replicating and complementing these mutants by adapting and establishing genetic tools for environmental Pseudonocardia isolates.

DETERMINING THE SUBSTRATE SPECIFICITY OF OXYGEN SENSOR ADO

Samantha DeVillers
Mentor: Zachary Bennett

The enzyme cysteamine dioxygenase (ADO) catalyzes the oxidation of cysteamine (2-AET) to hypotaurine using molecular oxygen, a key step in the biosynthesis of taurine which is essential for neuroprotection. Furthermore, ADO has been shown to oxidize N-terminal cysteines demonstrating the enzyme's potential to function as an oxygen sensor. As ADO plays an important role in these pathways, it is critical to study how it binds to peptide and small molecule substrates. In order to achieve this, variants of ADO have been purified for characterization, including C120M, C120S, Y198F, and D192N. The variants C120S and C120M will assess how a putative oxygen channel affects the kinetics of the enzyme, while the Y198F and D192N variants will give insights into the forces influencing substrate binding and specificity.

CONVERSATIONS ABOUT THE CARCERAL STATE: AN UNDERSTANDING OF INDIVIDUALIZED CARCERAL MENTALITIES

Ria Dhingra, Anna Nelson
Mentor: Ingrid Drian

From its emergence in the 18th century as a moral stance against slavery to contemporary arguments against the prison-industrial complex, abolitionist discourse has, rightfully, been organized around removing, replacing and transforming unjust institutions. Such discourse tends to understate links which bind the carceral system to other social systems such as education, housing, and healthcare. The current project has reframed the aim of abolition in relation to these other systems. Adopting a holistic, ecological perspective on the social effects of the carceral system, this project examined policing and prisons as a symptom rather than the cause of larger, social problems. After one year of work, we now aim to move from theory to praxis in the form of establishing an abolitionist study group.

ANALYZING THE EFFICACY OF A FAP TARGETING ADC IN A MICROSCALE TUMOR MODEL

Khadijah Dhoondia
Mentor: David Kosoff

New therapeutic approaches are desperately needed for the treatment of prostate cancer, which remains the second leading cause of cancer-related death in men. Numerous studies have demonstrated that a stromal cell population within the prostate tumor microenvironment, CAFs, plays a critical role in prostate cancer progression and is a promising therapeutic target. CAFs express a surface protein, FAP, which represents a potentially valuable target for CAF-directed therapies. In this study, we utilize a novel microfluidic platform, Stacks, to evaluate the impact of a FAP-targeted ADC (B12) on the viability and gene expression profiles of tumor cells and fibroblasts in mono- and co-culture models. Our primary objective is to determine whether B12 has sufficient efficacy to warrant further evaluation in early phase clinical trials.

WHERE DOES THE WOLFFIAN DUCT EPITHELIUM GO IN THE ABSENCE OF Wnt9B?

Xueling Ding
Mentor: Fei Zhao

The Wolffian duct is the embryonic precursor for all male reproductive tract organs. To acquire male fertility, the Wolffian duct must be maintained. Here, we discovered that Wolffian ducts degenerate prematurely in the absence of epithelium-derived Wnt9B. This study aims to test the hypothesis that Wnt9b promotes Wolffian duct survival by enhancing proliferation and preventing apoptosis. By performing immunofluorescence staining of cell proliferation (Ki67) and apoptotic markers (cleaved PARP1) in control and Wnt9b knockout Wolffian ducts, we uncovered a significant increase of apoptotic epithelial cells and a significant decrease of proliferating epithelial cells in Wnt9B knockout mice. These observations demonstrate that Wnt9b serves as a local growth factor for promoting the maintenance of Wolffian ducts.

NEURAL STIMULATION IN DEVELOPING ZEBRAFISH PURKINJE CELLS CAUSES DEGENERATION DOSE-DEPENDENTLY

Julia DiSano
Mentor: David Ehrlich

Purkinje cells in the cerebellum are important for controlling movement, particularly for coordinated movements that combine muscles and joints. Using transgenic zebrafish expressing the TRPV1 receptor in Purkinje cells, we chemogenetically manipulated Purkinje cell activity during development upon exposure to the compound capsaicin. In doing so, we sought to compare different levels of stimulation and their effects on Purkinje cell morphological development. We found evidence of excitotoxicity as zebrafish Purkinje cells degenerated following chronic exposure to capsaicin. Not only was degeneration evident, we also found a positive correlation between capsaicin dosage and level of cellular degeneration. Many coordinated actions are learned early in life, activating Purkinje cells. Therefore, these findings could provide insight into potential developmental implications in cases of hyperactivity in the cerebellum.

PARENT MOTIVATIONS FOR ANTI-RACIST PARENTING PROGRAM COURSE ENROLLMENT

Linnea Drott
Mentor: Inés Botto

White parents often avoid conversations about race with their children, even though children conceptualize race and form biases from a young age. Early conversations may be particularly important for disrupting these patterns. The Anti-Racist Parenting Program was designed for parents with preschool-aged children covering topics such as race, racism, power, and privilege. Participating parents have many reasons for joining the course, including hopes for their children and themselves. Motivations include wanting to foster a different experience for their children than they had growing up, gaining skills to hold developmentally appropriate conversations about race, and continuing their current anti-racism journey. Utilizing the data from focus groups with course participants, this research aims to further understand parent motivations for participation in the Anti-Racist Parenting Program.

CHARACTERIZING THE REGENERATIVE CAPABILITIES OF HYDROXYL RADICALS IN VARIOUS FLUIDS AFTER BEING EXPOSED TO COLD ATMOSPHERIC PLASMA (CAP)

William Dunn, Mark Hurst
Mentors: Hau D. Le, Ha Nguyen

Cold atmospheric plasma (CAP) is a source of reactive oxygen species including hydroxyl radicals (OH•). OH species have known anti-cancer effects, however, their highly unstable nature creates a critical limitation in CAP's applications. To overcome this, determination of a biological solution that can regenerate OH• is necessary for systemic or indirect applications. The ability of several fluids to regenerate OH produced by a CAP Jet were compared. The amount of OH• produced by the helium CAP jet in each fluid was quantitatively determined by measuring the fluorescence of hydroxy-terephthalic acid. The results of this analysis suggest that the constraints of OH•'s instability can be overcome by using specific fluids to deliver OH• to distant targets via a systemic route.

MULTI-OMIC STUDY ON ALCOHOL-PRODUCING STRAINS UNDER ANAEROBIC CONDITIONS

Elliot Dunnwald
Mentor: Yun Su

Medium chain fatty alcohols are valuable chemicals extensively used in cosmetic and consumer products. In contrast to older, more invasive methods, microbial fermentation provides a new, sustainable way to produce these chemicals with high selectivity. The β-oxidation pathway, a process that exists in all types of life, is normally involved in the degradation of fatty acids into acetyl-CoA. By reversing this pathway through the expression of a trans-enoyl-CoA reductase, fatty alcohols of different lengths can be synthesized. Previous lab work has constructed a poorly growing Escherichia coli strain capable of producing alcohols under anaerobic conditions. In our study, we investigate the growth of this alcohol-producing strain through proteomic and metabolomic analysis, in hopes of improving cell growth and alcohol titer.

WHOLE BODY SEGMENTATION OF COMPUTED TOMOGRAPHY IMAGES

Divya Durgavarjhula
Mentor: Alan McMillan

Identification of different organs via segmentation of medical imaging datasets is a necessary step in the development of automated analysis methods that augment physician's capability to more quickly make accurate diagnosis and provide insights for personalized medicine. Artificial intelligence and deep learning approaches, such as convolutional neural networks (CNNs), have yielded promising results in segmenting computed tomography (CT) images with high accuracy, efficiency, and most importantly high speed. In this work, we describe a CNN approach for automated identification and segmentation of over 100 different body regions from whole body CT datasets via a deep learning method.

MUSCLE-SPECIFIC BET1K KNOCKDOWN INDUCES NEUROMUSCULAR DENERVATION AND MOTOR DYSFUNCTION IN ALS MODEL RATS

Adam S Eckardt
Mentor: Masatoshi Suzuki

Amyotrophic lateral sclerosis (ALS) is a neuromuscular disease characterized by specific loss of motor neurons. Accumulated observations support the idea that the degeneration at the neuromuscular junctions (NMJs), contributes to ALS pathology known as dying back. The Suzuki lab recently found the vesicle transport protein Bet1L to decrease concurrently with NMJ denervation in ALS model rats. My current hypothesis is that intramuscular injection of small interference RNA (siRNA) knocking down BET1L expression can promote active NMJ denervation and motor neuron degeneration. BET1L siRNA injection significantly decreased innervation and increased denervation in the hindlimb muscle of ALS rats. Further, Bet1L siRNA affected motor function in the injected hindlimbs. These results provide new evidence to support the potential of BET1L as a key molecule in ALS pathogenesis.

EVOLUTIONARY PATTERNS OF HABITAT USE IN HOLARCTIC, MONTANE GROUND BEETLES (CARABIDAE: NEBRIA)

Elizabeth Ehlert
Mentors: Jillian Schat, Sean Schoville

The purpose of this project is to add to the body of knowledge within the field of entomology by compiling physical data on a genus of mountainous ground beetle, Nebria. By creating digital silhouettes of the beetles' pronotum and elytra and using R to analyze/average those shapes, the project aims to test for a phylogenetic correlation pattern between the morphological traits and the preferred ecological niche of Nebria subspecies based on these compilations and the locations at which the beetle specimens were first found. If a phylogenetic correlation is not found, then the most likely alternative explanation is that of convergent evolution–species evolving similar traits in similar environments. It has the potential to show how much of an impact ancestry has on certain species.

SIGNAL OPTIMIZATION AND IMAGING OF 2D QUANTUM MATERIAL PROJECT

Belal Elsherbini
Mentor: Jun Xiao

To combat the poor quality data acquisition during 2D quantum imaging of samples that occurs as a result of temperature induced sample drift, we have developed an automatic imaging process that invokes the use of a feedback loop involving computer vision and repositioning of the sample. Two areas of drift are being dealt with: vertical drift and horizontal displacement. The vertical drift was minimized by using a Fast-Fourier-Transform and continuous refocusing. The horizontal displacement was dealt with via CV software and repositioning via a set of XY nanopositioners beneath the stage. The objective of this project is a fully remote and autonomous solution of high-throughput data acquisition to accelerate quantum materials research.

SOFTWARE PACKAGE DEVELOPMENT FOR SUSTAINABILITY MODELING AND ANALYSIS

Evan Erickson
Mentor: Victor Zavala

Plastics are a major pollutant impacting global ecosystems, but existing plastic recycling infrastructure is capable of processing only a small subset of total plastic waste produced. Newer technologies can “upcycle” plastic waste, producing virgin-grade polymers from a larger fraction of the waste material. Mathematical modeling frameworks can be used to study such new technologies, assisting researchers, government organizations, and policymakers in quantifying the technology’s economic and environmental impacts on existing supply chain economies. We present added visualization capabilities for a previously developed modeling package, along with a case study into the emerging waste management strategy of plastic upcycling and its potential for implementation on a national scale.

ANALYSIS OF FIBROBLAST MIGRATION DYNAMICS IN IDIOPATHIC PULMONARY FIBROSIS USING BIOMIMETIC MODELS OF THE EXTRACELLULAR MATRIX SCAFFOLD

Parker Esswein
Mentor: Paul Campagnola

In the United States, approximately 40,000 people die from idiopathic pulmonary fibrosis (IPF) each year, and the 40,000 cases diagnosed annually are steadily increasing. IPF is a chronic, irreversible, and progressive lung disease characterized by scarring that leads to respiratory failure and death. There is a limited understanding of IPF, specifically surrounding fibroblasts and their impact. Therefore, I tracked the migration dynamics of normal lung and IPF-derived fibroblasts seeded on biomimetic normal and IPF lung tissue scaffolds (collagen-based). Data collection and analysis established the migration properties of fibroblasts, helping determine the role of fibroblasts and migration in IPF and the mechanisms mediating IPF. This research can lead to earlier diagnosis and more effective treatment, improving the quality of life of those with IPF.

NEUROINFLAMMATION MEDIATES THE RELATIONSHIP BETWEEN WHITE MATTER HYPERINTENSITY AND GRAY MATTER VOLUME IN AGING

Grace Everitt
Mentor: Barbara Bendlin

Alzheimer's disease (AD) has been related to elevated neuroinflammation, higher white matter hyperintensity (WMH) lesions, and lower gray matter (GM) volumes. This study explores the inter-relationships between these processes. WMH volume was segmented from T2 FLAIR images, global gray matter was segmented from T1 weighted volumetric images, and neuroinflammation was measured via glial fibrillary acidic protein (GFAP). Linear regressions were estimated exploring the association between these variables, and a mediation model with non-parametric bootstrapped confidence intervals was tested to assess whether GFAP mediates the identified association between GM volume and WMH. Results indicated that all three metrics related to one another and further showed that GFAP played a mediating role therein. Results shed light on neuroinflammation's connection to age-related neurodegenerative processes.

REPRODUCTIVE RIGHTS IN WISCONSIN: AN INFORMATION ECOLOGY APPROACH

Lily Farber, Aideen Gabbai
Mentor: Michael Wagner

In the wake of the Dobbs v. Jackson decision, abortion has been pushed to the forefront of American politics. This research examines how individuals' engagement with their information ecology (where they get news, who they talk to about politics, and how they use social media) is related to their reproductive attitudes. Using an original survey of 3200 people in Texas, Ohio, Georgia, and Wisconsin—states with varying abortion policies—we examine how place, information, and psychological orientations affect reproductive policy knowledge and attitudes. As technological changes continue to affect how politics is practiced in the U.S., this project contributes to scholarly and public understandings of promoting democracy, liberty, and autonomy.

FINDING COMMON GRASS: COMPARATIVE GRASSLAND-BASED AGRICULTURAL POLICIES IN ILLINOIS, MINNESOTA, AND MISSOURI

Kailey Felch
Mentor: Adena Rissman

Grasslands, including prairie and pasture, have declined on private lands, with tremendous environmental and social costs. I asked how three midwestern states compare in their policy approaches for the support of grassland-based agriculture. As part of the Grassland 2.0 project, I conducted interviews and incorporated feedback from stakeholders to finalize policy profiles for Illinois, Minnesota, and Missouri. Nonwoodland pasture declined 35% in Illinois, 30% in Minnesota, and 25% in Missouri from 1997 to 2017. We found unequal federal financial support provided to rowcrops over managed grazing. The policy profiles are resources for decision-makers who want to support grasslands, which are critical for revitalizing native ecosystems, combating climate change, and meeting the needs of consumers and producers alike.

GEOGRAPHIC-BASED INCENTIVES FOR COCA-LEAF PRODUCTION

Emmanuel Figueroa
Mentor: Paul Castañeda Dower

Climate change is predicted to affect developing countries more than established countries, as they will be more prepared to face weather shocks and events. Many of El Salvador's farms will be affected by climate change, as taking care of crops will become an increasingly costly challenge. Changes in yields of legal crops can possibly incentivize farmers to grow a crop with a stable market price: coca leaf. Through the culmination of a literature review on farming practices and consumption trends in the global south, we give the context for the need to smooth consumption. We will also lay out the possible factors that can influence a family's decision to possibly plant coca. Finally, we will outline the limitation of this study that prevents its implementation.

IMPROVING VITAMIN A FIELD ASSESSMENT CAPABILITIES: STABILITY OF VITAMIN A IN CAPSULES AND ACCURACY OF INEXPENSIVE PIPETTES FOR DOSING

Molly Fjalstad
Mentors: Bryan Gannon, Sherry Tanumihardjo

The goal of this study is to improve the accessibility of more accurate vitamin A (VA) biochemical assessment methods. Objective 1 determined the stability of VA in capsules over time at different temperature and light conditions. Time, temperature, and light all influenced degradation. Storage at 4°C had 97% stability at 3 months which reduced to 93% at 11 months; -20°C had 100% stability at 11 months but degraded by 16 months. Objective 2 tested and compared the accuracy of VA dose delivery volume using inexpensive, single-use syringes compared to a positive-displacement pipette as the reference standard. Initial results have shown comparable accuracy between the two delivery methods. An ongoing experiment is evaluating accuracy among different technicians to provide more generalizable data for expected accuracy in field settings.

INVESTIGATING STRONG WINDS AT THE MOUTH OF LARGE CHANNELS ON MARS

Bridget Flannery
Mentor: Tim Michaels

The objective of this project is to determine whether strong nighttime/morning valley winds exist on Mars, as well as the location, cause, and effect of these winds. We evaluate the nature of these phenomena and what type of threat these winds may pose to future robotic or human missions. To investigate these phenomena we utilize MRAMS (Mars Regional Atmospheric Modeling System) simulations and spacecraft data. Our current focus is on Jezero crater, Gusev crater, and Ares Vallis. Model output is analyzed, plotted, and compared to landed spacecraft data using Python, while spacecraft imagery is analyzed using a Geographic Information System (GIS). This research will reveal important information about atmospheric and aeolian processes on Mars and how future missions to Mars should proceed.

THE FATTY ACID REGULATOR SREBP-1 CONTROLS RHINOVIRUS-B REPLICATION

Jeremy Fleck
Mentor: Judith Smith

Known to cause the common cold, human rhinoviruses (RVs) cost the United States billions of dollars annually and are implicated in the exacerbation of cystic fibrosis and childhood asthma. Despite this, antiviral treatment options remain absent for RVs. Previous studies examining other RNA viruses observed an overexpression of host protein, sterol regulatory element-binding protein 1 (SREBP-1), following infection. SREBP-1 leads to the synthesis and mobilization of lipids throughout cells. After knockdown of SREBP-1 in HeLa H1 and A549 cells, we observed a drastic decline in RV-B replication. Given this, SREBP-1 looks to play a critical role in determining the fate of RV-B replication. Interrogating the mode in which SREBP-1 regulates RV-B will grant new insight into RV-B host dependencies and may have future therapeutic implications.

EFFECTS OF CO-EXPOSURE TO POLYETHENE MICROPLASTICS AND SALMONELLA ENTERICA TYPHIMURIUM ON THE CECAL MICROBIOME OF BROILER CHICKENS

Allison Freedman
Mentor: Erica Majumder

The concentration of microplastics (MPs) in our environment has increased in recent years and is becoming a concern. MPs have been shown to act as vectors for pathogens to grow and form biofilms on. This is particularly important when discussing how Salmonella impacts poultry production and broiler health. Specifically, broilers are often asymptomatic for Salmonellosis but are fecal shedders of the pathogen. This project aimed to better understand the effects of this co-exposure on the cecal microbiome. The first two experiments, a biofilm quantification assay and an anaerobic cecal mesocosms trial, provided important information on the activity of Salmonella exposed to a microplastic environment. Results from this study will be used in future studies to further understand the effects of mixtures on poultry health.

THE ACCENT COLLECTIVE

Hayley Frier, Hali Jama
Mentor: Colleen Conroy

We are building a database for regional English accents to help actors perfect their roles. Our database will provide videos of native speakers demonstrating their accent, along with stories, specific words, and phrases to aid with learning the accent. Everyone has an accent, influenced by factors like past and current environment, geographic location, age, socioeconomic factors, and culture. We aim to collect and archive samples of accents from around the world to determine the characteristics of an accent, inclusive of key sound features, prosody, and oral posture. This resource will help accent coaches, actors, or anyone looking to learn a particular accent. Additionally, our research can enhance our understanding of speech, language, and the world around us.

POSTOPERATIVE OUTCOMES BETWEEN TRANSABDOMINAL PREPERITONEAL (TAPP) VS. TOTALLY EXTRAPERITONEAL (TEP) IN LAPAROSCOPIC INGUINAL HERNIA REPAIR

Kaitlyn M Fueger
Mentor: Anne Lidor

Inguinal hernia repair is one of the most commonly performed surgical procedures with two laparoscopic approaches (TAPP, TEP) utilized. Adult patients (n=1613), who underwent TAPP (n=770) and TEP (n=842) were evaluated, and postoperative readmission and reoperation within six months following surgery were measured. Baseline demographic and outcomes were compared. Postoperatively, 3.4% of TAPP patients and 1.7% of TEP patients underwent a readmission or reoperation ($p=0.04$). Patients who underwent TAPP were 1.9 times more likely to undergo a readmission or reoperation compared to those who underwent a TEP (OR=1.93, 95% CI [1.01, 3.67], $p=0.045$). Very few patients experienced a readmission/reoperation, although the TAPP approach had a higher rate of complications.

THE IMPACT OF PUBERTY BLOCKERS ON JUVENILE SOCIAL DEVELOPMENT

Salma Gadelhak
Mentor: Anthony Auger

Currently at the Auger Lab, we are working towards understanding how the puberty blocker Lupron affects the social development and mental health of adolescents by using a rodent model. This rodent model allows us to examine juvenile play behavior, test for anxiety-like and depressive behaviors in rats, while also giving us the ability to analyze how the puberty blocker affects various regions in the brain (hypothalamus, amygdala, hippocampus). Lupron is a puberty blocker that many transgender/gender diverse individuals (primarily adolescents) choose to use to temporarily suppress puberty. The broader goal of this study is to determine how the administration of Lupron would affect individuals simply looking to delay their puberty stage, both physically and mentally.

BICAUDAL C AND CNOT3 INTERACTION AND IMPORTANCE TO REGULATING mRNA PRIMARILY LOOKING THROUGH AMYLOSE PULLDOWNS TO DETERMINE THE QUALITY OF INTERACTION STRENGTH

Alex Gall
Mentors: Michael Sheets, Maya Walker

Bicaudal-C (Bic-C) is a crucial protein involved in early cell fate development, acting as a post-transcription repressor by binding to specific mRNA to prevent their synthesis. Although the mRNA targets of Bic-C are well-studied, its binding mechanism and effect on embryonic development remain unclear. Our study found that Bic-C has been found to associate with the CCR4-NOT complex through its interaction with the CNOT-3 complex, an activator of CCR4-NOT which is responsible for deadenylation of mRNA. This study found this through the use of direct binding between Bic-C and CNOT-3 through Amylose bead pulldowns and immunostaining of western transfers. This new insight furthers our understanding of the deregulation process of Bic-C and has shed light on its crucial role in early embryonic development.

FACTORS INFLUENCING FEEDING CHILDREN WITH BRONCHIOLITIS ON HIGH FLOW NASAL CANNULA

Miguel Garcia
Mentors: Madeline Kieren, Michelle Kelly

While High Flow Nasal Cannula (HFNC) is used in up to 50% of children admitted with bronchiolitis, there are no consensus recommendations for feeding children on HFNC. Our objective was to identify factors influencing feeding decisions for children with bronchiolitis on HFNC from a national sample of interdisciplinary care team members. We conducted semi-structured interviews with 27 care team members. Three researchers analyzed transcript data using directed content analysis. We found that nine factors influence the decision to feed children on HFNC: child/parent characteristics, care team experience, guidelines/protocols, culture of feeding, multidisciplinary workgroups, time of day, interventions to optimize feeding, assessment of clinical exam and feeding trial, and communication. Our findings suggest that feeding decisions are variable, and driven by child, family, care team, and institutional factors.

HAPTIC EXPERIENCES WITH MANIPULATIVES IN CHEMISTRY

Diana Garcia-Vidal, Katelyn Bailey
Mentor: Joel P. Beier

Manipulatives are interactive tools used to introduce abstract concepts in college-level STEM courses. Manipulatives can be designed to offer many experiences. However, it is unclear how students relate their learning experiences to various features of manipulatives. We address this gap with a bottom-up, grounded theory analysis of 1:1 tutoring sessions covering chemistry concepts with manipulatives. In our early analysis, we found that students grounded their explanations in (1) their visual experiences with manipulatives, (2) their tactile experiences with manipulatives, and (3) their conceptual knowledge. While not all manipulatives offer all these features, our findings suggest that they should be considered when deciding which manipulatives should be used in a lesson because students relate their learning experiences with manipulatives to all these types of experiences.

COMPARATIVE DISCUSSIONS OF CARE: EXPLORING SELF–CARE AND RADICAL SELF–CARE HASHTAGS ON INSTAGRAM REELS

Isabel Arya Garlough-Shah
Mentor: Maggie Bushman

In recent years, self-care has been increasingly associated with commercialization and beauty products. To combat this, activists have reclaimed the original intentions of self-care and created the term radical self-care. The purpose of this research study was to compare discussions of self-care and radical self-care content on Instagram Reels. This content analysis evaluated 50 Instagram Reels from each hashtag: #selfcare and #radicalselfcare. Variables like advertisement, engagement, internal care, and external care were used to investigate how these hashtags differ in content. Linguistic Inquiry and Word Count analyses were run on captions to gain insights on personal concerns, affective processes, biological processes, and drive words. Future research should explore how self-care and radical self-care content impact adolescents' self-esteem and mental well-being.

EXHAUSTED PARENTS: THE RELATIONSHIP BETWEEN CHILD MEDIA USE AND PARENTAL BURNOUT

Paolina Garro, Raiya Lewis, Anna-Victoria Richard, Katheryn Illis
Mentor: Heather Kirkorian

The study explores parental emotions, parenting choices surrounding media, and child media use. We believe there will be a relationship between parent mental well-being and child screen time motivation. Over a one-week period, parents (N=65) completed daily surveys on their feelings and the content, quantity, and motivation of their preschool aged children's media consumption. Results have found that parental burnout, including feelings of stress and overall connection to their child, is positively associated with their child's media usage for regulatory and engaging purposes. In a time when parents increasingly turn to screens for their child's entertainment, our findings recommend recognizing the potential associations with parental emotions and the possible subsequent effects on their parenting.

DETERMINING THE MOST SENSITIVE MEASUREMENT OF BRAIN INJURY IN PREMATURE NEONATES

Olivia Gibbs
Mentor: Melisa Carrasco McCaul

Quality improvement (QI) studies hold great promise for improving outcomes following premature birth. Periventricular leukomalacia (PVL) and hypoxia-ischemia are brain injuries associated with poor motor outcomes in premature children. Patients who suffer from these brain injuries are more likely to have evidence of brain pathology on imaging, including brain magnetic resonance imaging (MRI) or head ultrasound (HUS). The purpose of this QI study is to determine which imaging technique is more sensitive for characterizing brain injury in premature patients within UW Health. We hypothesize that brain MRI will better capture premature-related brain pathology. If so, data from this QI project will be utilized to implement an evidence-based protocol aiming to improve rates of earlier and more complete detection of brain injury in this vulnerable population.

IMAGE SUPERRESOLUTION FOR ARBITRARY DIMENSIONS

Michael Gira
Mentor: Kangwook Lee

We propose a framework for image superresolution that can scale to arbitrary image sizes. Using this framework, we train and evaluate a model to generate high-resolution images from low-resolution dark matter simulation results. These high-resolution images prove to be accurate and useful for visual inspection as well as numerical methods such as power spectrum analyses. Our method provides researchers with a cost-effective alternative to running high-fidelity physics simulations. Overall, this work contributes to the development of computer vision applied to cosmology and serves as a valuable tool for researchers to better understand the origin of the universe.

DUAL TARGETING FGFR1 AND MerTK AS A NOVEL THERAPEUTIC APPROACH IN TRIPLE NEGATIVE BREAST CANCER

Christine Glitchev
Mentor: Deric Wheeler

Triple Negative Breast Cancer (TNBC) is a form of Breast Cancer that is categorized by its lack of three receptors that are found in other Breast Cancers: estrogen, progesterone, and HER2 protein. Due to the absence of therapies for TNBC, not many therapeutic treatment options are currently available. In this study, we focused on two receptor tyrosine kinases–MerTK and FGFR1–showing strong expression in TNBC by Western Blot Analysis. FGFR1 expression was increased when MerTK was overexpressed in TNBC cell line Sum102 in comparison to vector cells. To explore the impact of MerTK and FGFR1 in TNBC cells, I treated MDAMB231 TNBC cells with siRNA (FGFR1 and MerTK) or small molecule inhibitors of FGFR1 (pemigatinib) and MerTK (MRX-2843), ultimately decreasing the cell proliferation.

STABILIZING SPINEL LiMn2O4 CATHODE WITH TRANSITION METAL DOPING

Elias Gomez
Mentor: Fang Liu

Spinel LiMn2O4 is a promising cathode material for lithium-ion batteries because it is a cheap and environmentally friendly alternative to LiCoO2 cathodes. However, it suffers from bad cycling efficiency, especially under extreme voltages and at high temperatures. Doping the cathode with transitional metal elements has shown promise to stabilize the spinel structure of LiMn2O4 with the goal of reducing degradation over time. Here, we studied the effects of different doping elements on the stability of spinel LiMn2O4 and investigated their different working mechanisms.

PREDICTING HUMAN SOCIAL EMOTIONAL ABILITIES AT 2 YEARS FROM BRAIN STRUCTURE AT ONE MONTH OF AGE

Patrik Goncalves Rodrigues
Mentor: Doug Dean III

The neurodevelopmental epoch from fetal stages to early childhood embodies a critical window of peak growth and plasticity in which differences believed to be associated with many neurodevelopmental and psychiatric disorders first emerge. However, due to technical and methodological challenges of pediatric brain imaging, the maturational timing of these critical neurodevelopmental processes underlying future behavioral skills remains poorly understood. This project addresses a critical gap in pediatric research and aims to utilize quantitative magnetic resonance imaging (MRI) to investigate how brain microstructure of healthy full-term infants at one month is related to social-emotional development at 2 years of age. This preliminary study may serve as a normative sample for future studies to identify structural alterations in infants who may be at risk for behavioral disorders.

EFFECTIVELY SEXING BARRED OWLS IN THE FIELD THROUGH TOE-PAD MEASUREMENTS

Hermary Gonzales
Mentors: Zach Peery, Danny Hofstadter

The expansion of barred owls (Strix varia) into the Pacific Northwest and California poses threats to northern spotted owls (S. occidentalis caurina) and western forest ecosystems. In response, studies are being conducted to better understand barred owl behavior, demographics, and to mitigate effects on western forest ecosystems. However, there is still a need for reliable methods for sexing barred owls in the field. We measured and analyzed the toe-pads of 172 barred owls that were lethally collected and had their sex confirmed in the lab. We found that females had larger toe-pads than males, with a cut-off around 65mm. Thus, we provide a reliable method of accurately sexing barred owls in the field.

TRENDS IN DIRECTOR EXPERTISE

Allie Gosenheimer
Mentor: Yaron Nili

Publicly traded corporations have a massive influence on the American economy. Every publicly held corporation has an elected board of directors. Recently, there has been a push for directors to have specific skill sets that are more technology, security, and ESG based. This project seeks to evaluate the effects of the increasing popularity of director expertise. To make this evaluation, we utilized proxy statements: government forms publicly held companies are required to file before shareholders can vote on the election of new directors. We used these forms to catalog the skills of the director nominees. This data was then compiled to a first of its kind dataset, which is being used to write a scholarly paper analyzing the trends in director expertise.

HANDS-ON OR HANDS-OFF? EMBODIMENT AND ITS EFFECT ON NOVEL WORD LEARNING AND GENERALIZATION IN CHILDREN

Olivia Goulette
Mentors: Haley Vlach, Melina Knabe

Children learn words through sensorimotor experiences in naturalistic settings, such as parent child interactions. Research using head-mounted eye-tracking has shown that children tend to hold and look at objects when they are named by a caregiver. However, research has yet to examine whether the degree to which children's learning is embodied affects the learning and generalization of words. Thus, for this between-groups experimental study, I will investigate how the degree of embodiment affects novel word learning and generalization in children by examining whether there are differences between holding an object vs. seeing an object. Participants will be assigned to one of three conditions: the embodied-proximal group (i.e., children hold and see objects), the embodied-distal group (i.e., children see objects being held by an experimenter), and the disembodied group (i.e., children see objects that are not held). Children will be taught novel words and then their memory of these words will be tested immediately after learning. I predict that children in the embodied-proximal group will have better word learning performance than children in other groups. The results of this study will elucidate the contribution of children's embodiment to their word learning in naturalistic settings.

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

Veronica Goveas
Mentors: Ei Terasawa, Erica Gelman

Puberty is a complex developmental process involving hormonal changes that lead to the acquisition of reproductive capacity. The hypothalamo-pituitary-gonadal (HPG) axis regulates the timing of puberty, and kisspeptin has been implicated in the critical role of this process. However, the precise role of kisspeptin in regulating puberty onset remains unclear. This study aims to investigate the effects of the kisspeptin agonist (KP10) on puberty in female Rhesus macaques. Three prepubertal females received hourly pulsatile KP10 infusion, whereas controls received no treatment. Pubertal development was monitored by measuring the nipple volume, sex-skin growth, body weight and height changes, and hormonal levels. Our findings will shed light on the role of kisspeptin in regulating puberty and will have implications for understanding the onset of puberty in humans.

VALIDATION OF AN ON-FARM DRY-CHEMICAL ANALYZER

Sophia Green
Mentor: Heather White

Rapid on-farm metabolite quantification of multiparous Holstein dairy cow blood is an important indicator of metabolic disorders which impact productivity and profitability. This project consisted of a field study using a new, on-farm dry chemical analyzer (DCA) that rapidly quantifies an array of metabolites associated with metabolic diseases using a single blood sample. The objective of this study was to validate the DCA by correlating results to laboratory assays. Metabolites were quantified on DCA slides at the time of collection and later quantified in the lab by colorimetric assay. All metabolites examined in this study had accuracies greater than 80%. Based on these results, the DCA can be used as an on-farm diagnostic tool for rapid veterinary diagnosis and care.

PREJUDICE AS A DRIVER OF RACIAL DIFFERENCES IN EMOTION REGULATION

Emma Grindle
Mentors: Ethan Harrod, Paula Niedenthal

Failing to successfully navigate social interaction carries a universal social cost. However, for Black Americans, that cost is amplified. Failed interactions can result in stereotype activation, prejudice, and discrimination. Thus, limiting failed interactions by effectively implementing emotion regulation strategies is especially important for Black Americans. The varying degree in which White and Black Americans must rely on emotion regulation to limit social costs may contribute to differences in emotion regulation ability and strategy preference. No existing literature provides a robust, direct racial comparison within these domains. The present study conducts an exploratory factor analysis using scales that encompass various dimensions of emotion regulation: cognition, behavior, skill, display rules, and social connectedness. We intend to provide a framework for future research involving prejudice and emotion regulation.

EFFECT OF CO-MORBID GLAUCOMA ON VISUAL ACUITY IN A MOUSE MODEL OF ALZHEIMER'S DISEASE (AD)

Emma Grindstaff, Rebecca Burkhalter
Mentors: Julie Kiland, Virginia Mathu

Glaucoma and AD cause blindness and dementia, respectively, and often co-exist in elderly patients. To determine if comorbid glaucoma-like and AD pathology worsens visual acuity compared to one condition alone, and normal aging we will use 5XFAD mice, a model of AD with amyloid beta plaques in the brain. Optic nerve crush (ONC) is induced in one eye of 24 wild-type and 24 5XFAD, with sham-treated controls. Utilizing optomotor response testing, visual acuity is detected through head tracking in response to moving stimuli at 12 weeks, prior to ONC, and at 9 months in ongoing studies. We hypothesize that the comorbid models will have lower visual acuity than all other conditions by 9 months. Understanding the link between these diseases may improve patient care.

PHYSICAL MANIPULATIVES IN CHEMISTRY: WHAT PARTS OF PHYSICAL MANIPULATIVES ARE MOST IMPORTANT TO STUDENTS?

Yifei Guan
Mentor: Joel Beier

Physical manipulatives play an important role in chemistry education because they help students visualize abstract concepts. However, it is unclear how physical manipulatives do this. To address this question, we randomly selected and interviewed 31 students after a lesson that involved physical manipulatives. We present a bottom-up grounded theory analysis of how students described their experiences with manipulatives. Early patterns show that some students report multiple features of the physical manipulatives to be important, while others do not find them useful at all. Students report that it is important to see, feel, or move the physical manipulatives. We hope to describe whether and how students found these features to be important. Our research will inform educators how different students relate their experiences to physical manipulatives.

AMMONIA RECOVERY FROM DAIRY MANURE IN A MICROBIAL FUEL CELL

Virginia Gulotta, Ava Petitjean, Rachel Hoetama
Mentor: Kenzie Burns

Increased agricultural activity to meet growing food and biofuel demands poses concerns for fertilizer production. Bioelectrochemical systems (BES) designed for ammonia recovery from dairy manure offer a potential solution by treating wastes and producing fertilizer. This research investigates the effects of different anode chamber conditions in a microbial fuel cell (MFC, a type of BES) on ammonia recovery from dairy manure. Conditions tested include supplemental nutrient and manure feeding, low-level aeration, and ammonium chloride supplementation. Results indicate that ammonia recovery in MFCs is a viable remedy to the increasing concerns of fertilizer supply and demand. Main findings include that anode chamber aeration has minimal effect on MFC performance, and more complex dairy wastewater slurry increases the time to treatment for similar nutrient removals.

Computationally Probing the Milky Way Galaxy Density Structure

Ziqi Guo
Mentor: Rachel McClure

Within the evolution of the universe, non-asymmetric photometric features within the galaxies occur, including dark gaps, the areas with a lower density within the galaxy. Red clump giant stars, with reliable measurable distances, can be used to identify such dark gaps. Analysis of the evolution of our Milky Way-like N-body simulation can be used to understand the interaction between the bar and the red clump giants to probe the formation of galactic bars and dark gaps. We utilize Tensorflow with Gaia observations to generate a model that predicts the stellar type given observed velocity and position to apply a stellar population distribution to our N-body galaxy simulation. We study the evolution process of the bars and photometric dark gaps in the resulting mock observations.

IMPACT OF HOME AUDITORY ENVIRONMENTS ON CHILDREN'S LANGUAGE DEVELOPMENT

Ananya Guruprasad, Nora Wali
Mentor: Carlos Benitez Barrera

Early exposure to noise leads to cognitive delays, particularly in children's ability to develop language. Using LENA devices, this study measures noise levels, speech-to-noise ratios (SNRs), and acoustic chaos in the home environments of children ages 3-5 years old. Children coming from a Spanish-dominant household were observed. The study assessed children's language abilities in Spanish and English and analyzed the data to identify the extent to which the predictors explained variability in the children's language skills. Children exposed to low quality auditory environments demonstrated poor language outcomes in both languages, suggesting that noise negatively affects language development. However, these negative effects can be counteracted by caregivers promoting access to language.

ASSOCIATIONS AMONG LIFETIME STRESSOR EXPOSURE, CORTISOL RESPONSES TO ACUTE STRESS, AND AMYGDALA AND HIPPOCAMPAL VOLUME

Clara Haeffner
Mentor: Stacey M. Schaefer

The hypothalamic-pituitary-adrenal (HPA) neuroendocrine pathway facilitates the stress response through the release of cortisol. Prolonged cortisol elevation affects the volume of HPA-axis regulatory structures, including the amygdala and hippocampus, eventually impacting subsequent acute stress responses. This study examined interactions between lifetime stress history, amygdala and hippocampal volume, and cortisol reactivity and recovery to acute psychosocial stress. Fifty-nine consenting adults completed the Stress and Adversity Inventory (STRAIN), a structural MRI scan, and had salivary cortisol collected during the Trier Social Stress Test (TSST). In line with our predictions, exposure to more severe stress was associated with smaller hippocampal and amygdala volumes and marginally flatter cortisol recovery slope from the TSST, but these relations were no longer significant after adjusting for overall head size with intracerebral volume.

GENETIC DISPERSAL OF SPIROPLASMA IN THE ALPINE GROUND BEETLE NEBRIA INGENS SPECIES COMPLEX

Robert Hall, Yi-Ming Weng, Sean Schoville
Mentors: Sean Schoville, Yi-Ming Weng

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.

INFORMATION WANTS TO BE FREE: HERMAN GOLDSTEIN, POLICING, AND THE WISCONSIN IDEA

Robert Hall
Mentor: Walter C. Stern

In the late 20th century, police departments embraced computation to accumulate criminal data and guide predictive policing. These programs expanded alongside racial profiling and the criminalization of the poor, coinciding with the prison system's growth and soaring national crime rates. My project examines scholars who aided the development of these policing and data technologies. Key among them was Herman Goldstein, UW-Madison legal scholar, who relentlessly pushed for policing reforms and crafted Problem Oriented Policing. I argue one result of such systems was "outsourced" carceral activity to the community who used available records to perpetuate indefinite criminal stigma. While criminologists spoke of "democratizing" police work and promoting "community policing" in general, Goldstein's work demonstrated how academia and policing were united under the auspices of the Wisconsin Idea.

SOUND SYSTEM OF L2 SPANISH SPEAKERS

Thomas Harb, Grace Ruo, Janae Adams
Mentor: Rajiv Rao

Previous research exists on the differences between the linguistic systems of different types of Spanish speakers, including monolingual speakers, Spanish-dominant bilinguals, heritage speakers, and those who learned Spanish in a classroom (i.e. L2 learners). This project is in line with these previous studies; it seeks to analyze the speech patterns of L2 learners, both in Spanish language classes and those living in the Spanish Language Community Residencia de Estudiantes. This is accomplished by using Praat, a phonological analysis software, to measure the intensity of three specific phonemes (i.e. /b/, /d/, and /g/) in previously acquired recordings from the different experimental groups.

ENVIRONMENTAL DRIVERS OF LEAF ANATOMICAL AND FUNCTION TRAITS IN THE CYCAD GENUS ENCEPHALARTOS

Anna Hasselman
Mentor: Christopher Krieg

Cycads are one of the oldest orders of seed plants and can provide insight into how seed plants evolved to cope with environmental stresses. In other plant groups, leaf hydraulic physiology has been shown to correlate with environmental factors, yet little is known about leaf hydraulics in cycads. To determine if this relationship exists in cycads, cross sections of over 200 cycad leaf samples from a common garden were imaged and the distance between leaf vein bundles (dx), leaf vein bundle and leaf surface (dy), and leaf thickness (LT) were measured. These values were used as inputs in published equations to empirically estimate leaf hydraulic conductivity. Habitat climate data was compared to these measures of leaf physiology to determine relationships that suggest evolutionary adaptations.

APPLICATION OF RADIOMICS TO DISEASE DETECTION IN CHEST RADIOGRAPHS

Tracy He
Mentor: Alan McMillan

COVID-19 is still a trending topic in the biomedical imaging field. We investigated radiomics, a tool to study the texture features of images, using a machine learning approach to train classifiers which are able to output whether the patients have COVID from chest radiographs. The application of machine learning to radiology and medical imaging can be used as a digital co-pilot to help radiologists perform their job more effectively. Compared to other artificial intelligence methods, radiomics allows a potentially more interpretable approach. We investigated random forest models to demonstrate the performance of chest radiograph COVID classifiers using a varying number of features.

ASSOCIATIONS BETWEEN PERCEIVED DISCRIMINATION ON EMOTION REGULATION AND TIME COURSE RECOVERY

Tia M. Hebbring
Mentors: Stacey Schaefer, Anna Finely

Discrimination is a social stressor that can influence emotional responses and is associated with adverse health outcomes. We examined whether perceived daily discrimination (measured with the Daily Discrimination Scale) is associated with differences in emotional recovery from negative stimuli (measured with corrugator muscle activity [EMG] during and after emotional images in a picture viewing task). Corrugator activity is triggered by the furrowing of the eyebrow and is correlated with negative emotions. Data were collected from two waves in the National Midlife Development in the United States (MIDUS), n = 384 participants (55.5% female, 33.6 % Black, age 26-84). Contrary to prediction regression analyses revealed no significant relationships between discrimination and recovery from negative stimuli. Implications for emotion regulation, health, and wellbeing will be discussed.

FARM2FACTS

Nolan Hegge
Mentors: Alfonso Morales, Edna Ledesma

Farmers' market organizers often deal with large sets of data making it hard to communicate this data, which in turn makes it difficult for them to acquire sufficient funding. Farm2Facts sets out to solve this issue by providing a reliable and easy-to-use three-step web application to collect, analyze, and report user-inputted data. With the use of this tool, large sets of data will be easily understood by market organizers. The importance of a tool like this is reflected by the market organizers who can efficiently manage their data, thus allowing for improved local farmers' markets. Farm2Facts.org is currently being used by markets in seven states and has plans of improving both reach and application functionality.

PERCEIVED COSTS OF THE COVID-19 PANDEMIC AND STUDENT PERSISTENCE IN STEM

Jenna Heinze
Mentors: Judith Harackiewicz, Sirui Wan

The metaphor of a pipeline is often used to describe students' persistence in science, math, engineering and technology (STEM) fields, where students often "leak" from the pipeline at particular time points. Perceived costs (i.e., the obstacles students confront while pursuing their goals) have been identified as an important factor in students' engagement and academic decisions and are particularly salient in the context of the COVID-19 pandemic. This study examines how students' perceptions of the costs related to the pandemic influenced their persistence in STEM using data from a large-scale, multi-site longitudinal study. Furthermore, the research investigates when perceived costs associated with the pandemic are most critical to persistence with goals and how this relationship differs for first-generation students.

UPREGULATION OF A NOVEL IMMUNE INHIBITORY PROTEIN (PIDO) IN A RAT KIDNEY DURING NEVKP USING A LENTIVIRUS VECTOR

Grace Heise
Mentors: David Al-Adra, Heather Jennings

The demand for transplantable organs is outpacing the current supply, leading to innovative methods to ensure organ longevity. In end stage kidney disease, transplantation is the best treatment option. Organ rejection occurs in up to 15% of kidney recipients within the first year after transplantation. To prevent immunorejection, the use of the novel fusion protein PIDO, consisting of the co-inhibitory protein PDL-1 and the indoleamine 2,3-dioxygenase (IDO) protein, was used to inhibit T cell activation. The kidney was perfused via normothermic ex vivo kidney perfusion with the lentivirus vector carrying the PIDO complex, transplanted into a rat for 2 days, explanted, and procured for imaging and histology. The imaging showed GFP, and RFP protein markers being expressed in the kidney, indicating PIDO transfection success.

COMBINATION OF TOLL-LIKE RECEPTOR AGONISTS AND T-CELL IMMUNE CHECKPOINT BLOCKADE WHEN GIVEN WITH AN ANTI-TUMOR VACCINE AUGMENTS MOUSE T-CELL ANTI-TUMOR IMMUNITY

Ethan Hill
Mentors: Douglas McNeel, Heron Jeon

Prostate cancer is a leading cause of cancer mortality in the U.S. The McNeel lab has developed a therapeutic vaccine for prostate cancer and found that co-administration of TLR agonists with vaccine further suppress tumor-growth by lowering PD-1 expression on CD8+ T-cells. The expression of other T-cell checkpoint receptors is retained. Therefore, we investigated whether combining vaccine and TLR agonists with immune checkpoint blockade targeting checkpoints other than PD-1 can further suppress tumor progression in a murine prostate tumor model. Mice treated with pTVG-AR, TLR agonists and aCTLA4 showed improved tumor suppression. Flow cytometry revealed increased CD8+ T-cell infiltration, specifically, effector memory cells and short-lived effector cells. This study implies possible benefits from combining TLR agonists and immune checkpoint blockade as cancer vaccine adjuvants.

THE WORKINGS OF SEX TRADING

Jason Hill
Mentor: Lara Gerassi

My project revolves around graduates and undergraduates who trade sex. It's important to note that these forms of trading can be done online, through clothing articles, or through different forms of companionship. There are 3 reasons why people involve themselves in sex trading, by choice, circumstance, or coercion. There are many stigmas and biases surrounding this line of work, which is one of the biggest reasons I decided to take on this project, even though I still find myself lacking in certain areas, it forces me to grow and reinvent my thinking. This is why I make sure when conversations surrounding sex trading and sex work are brought up, I keep as open of a mind as I can, and in some cases I find myself restating the same information to those who don't seem to be as open-minded as the people in my project.

OPTICAL COHERENCE TOMOGRAPHY IN INFANTS EXPOSED TO ZIKV PRENATALLY

Lauren Hlubek
Mentor: Emma Mohr

Congenital Zika virus (ZIKV) exposure may lead to development deficits in infants who were exposed in utero. Approximately one third of infants with congenital Zika virus exposure may develop visual deficits in early childhood, even when they lack the severe birth defects consistent with congenital Zika syndrome. We identified retinal layer defects in infant macaques with no apparent birth defects using optical coherence tomography (OCT). Infants who were exposed to ZIKV had a thinner outer plexiform retinal layer, and when exposed at an earlier gestational age, had thinner photoreceptor outer segments than control infants. The ability to non-invasively diagnose abnormalities in retinal structure may provide clinicians with a noninvasive diagnostic tool to identify infants at high risk for developing vision impairments.

INVESTIGATING BACTERIAL DIGUANYLATE CYCLASE REGULATION BY MAGNESIUM

Chandler Holschbach
Mentor: Mark Mandel

Cyclic diguanylate (c-di-GMP) inhibits motility and promotes biofilm formation in many bacteria, including the model beneficial symbiont Vibrio fischeri. V. fischeri encodes 50 proteins predicted to modulate c-di-GMP levels, suggesting that regulation of the molecule is important. Most of the 50 proteins exhibit a general motility phenotype when overexpressed. However, VF_0985 did not affect motility specifically in the presence of magnesium. VF_0985 encodes domains for both synthesizing and degrading c-di-GMP, as well as a CACHE small molecule sensory domain. I hypothesize that magnesium is interacting with the periplasmic CACHE domain to influence the c-di-GMP catalytic domains in the protein. I am testing this hypothesis through domain truncations of the c-di-GMP active site, the CACHE domain, and transmembrane regions.

MOTION CORRECTION MRI IN THE LUNG

Olivia Holsinger
Mentor: Zachary Miller

Image registration of time series with contrast dynamics have been explored in distinguishing between benign and malignant diseases. However, these images are often of poor quality as they are under-sampled. Several works have shown that integrating motion correction into image reconstruction significantly improves image quality, yet it is challenging to use traditional image registration algorithms on data with contrast dynamics. This is because typical loss functions are unable to distinguish between contrast change and motion, leading to poor image alignment. Through the use of a fully connected neural network and an external low dimensional signal, this study aims to explore motion correction of time series with contrast dynamics, where all motion field estimates come from signals completely independent of image contrast.

hERG1a/1b mRNAs INTERACT TO PROMOTE ION CHANNEL BIOGENESIS

Annabelle Hoth
Mentor: Lisandra Flores Aldama

The human ether-à-go-go-related gene (hERG) encodes the voltage-gated potassium channel, hERG1. Inherited mutations or unintended drug inhibition of hERG1 can lead to arrhythmia and other severe cardiac conditions. In cardiomyocytes, hERG1 channels are heterotetramers formed by hERG1a and 1b subunits. Proper subunit heteromerization is required for cardiomyocyte functioning as their imbalance promotes cellular proarrhythmic behavior. hERG1 assembly is mediated by the co-translational association of the encoding mRNAs. Here, we uncovered that 1a and 1b mRNAs form microscopic complexes and interact in vitro. We also found that changes in mRNA structure reduce the association between these two mRNAs. These findings suggest that the direct interaction between mRNAs might contribute to subunit co-translational association and that such interaction is structure-dependent.

DOWNREGULATION OF CBLN2 DURING PREFRONTAL CORTICAL DEVELOPMENT IN DOWN SYNDROME

Cade Hottman
Mentor: Andre Sousa

Multiple developmental processes go awry in Down syndrome (DS, trisomy 21), the most common cause of intellectual disability and arguably the most genetically complex multigene disorder. In DS, impaired neural plasticity underlies intellectual disability and is attributed to defects in the development of cortical neurons and their connections. Overall, the goal of the project was to gain mechanistic insight into decreased synaptogenesis, neuronal excitability, and impaired synaptic transmission in DS. I focused on a specific gene, Cerebellin 2 (CBLN2), which encodes a protein critical for synapse formation. The aim of this study was to establish preliminary data on the importance of the downregulation of CBLN2 in DS brain development compared to age-match controls and characterize cell types that express CBLN2 during prenatal development.

ELEVATED MAP1B IMPAIRS NEURONAL DEVELOPMENT AND SOCIAL BEHAVIORS

Sabrina Huang, Ezra Jarzembowski
Mentors: Xinyu Zhao, Kristy Guo

More than 2,000 copy number variants are associated with autism spectrum disorders (ASD), however functional impacts of affected genes are largely unknown. Here we investigated a small triplication in 5q13.2 (5q13.2trip) found in an ASD patient, encompassing only four genes. We discovered that elevated expression of the gene encoding microtubule-associated protein 1B (MAP1B) impaired development of both mouse and human neurons. Targeted activation of the endogenous Map1b gene in excitatory neurons of the prefrontal cortex leads to impaired social behaviors in mice. Genetic reduction of MAP1B rescues morphological and electrophysiological deficits of iPSCs-derived neurons from the 5q13.2trip ASD patient, indicating elevated MAP1B may contribute to ASD pathogenesis.

EFFECTS OF KISSPEPTIN 10 ON PUBERTY ONSET IN THE MALE RHESUS MONKEY

Val Hultgren
Mentors: Ei Terasawa, Erica Gelman

The neuropeptide kisspeptin in the hypothalamus is the most important upstream regulator for the release of GnRH (gonadotropin releasing hormone) neurons. To understand the relationship between kisspeptin and GnRH neuronal systems, we examine the effects of the kisspeptin agonist, kisspeptin 10 (KP10) on a pair of juvenile male monkeys. Results indicated that although KP10 stimulated the testicular volume for 5-30 weeks of KP10 infusion, it returned to pre-infusion levels after its cessation, whereas no testicular volume changes in the control during the same period. Importantly, the spontaneous pubertal increase in testicular volume in the KP10 treated monkey had 4 months delay as compared to the control. Thus, it appears that premature KP10 infusion would cause adverse effects on the timing of puberty.

LINKING PSYCHOLOGICAL STRESS TO PHYSICAL ACTIVITY AND PHYSICAL FUNCTIONING IN MIDDLE-AGED AND OLDER ADULTS DURING THE PANDEMIC

Karl Hummel
Mentor: Wan-chin Kuo

Social distancing during the COVID-19 pandemic restructured social interactions and stress experiences in older adults. Although evidence has demonstrated a negative association between psychological stress and physical activities and functioning, these studies have predominantly focused on the working-age population, instead of the aging populations, who are transitioning to their retirement and experience different stressors. In this project, we analyzed nationally representative data from the Health Retirement Study to examine the association between psychological stress and physical activity (PA) and physical functioning in middle-aged and older adults during the pandemic. We found that individuals reporting frequent co-occurrence of chronic stressors had lower levels of vigorous PA ($p=.008$), moderate PA ($p=.036$), light PA ($p=.028$), physical functioning ($p=.002$), balance ($p=.002$), and hand strength ($p<.001$).

SOCIAL PRAGMATICS AND CODE-SWITCHING IN BILINGUAL CHILDREN

Shaden Ibrahim
Mentor: Margarita Kaushanskaya

Social-pragmatic skills (social uses of language and social interactions) and code-switching (alternating between languages in conversation) are related for bilinguals (Bauer et al., 2002; Backus & Eversteijn, 2004). Bilingual children utilize social-pragmatics when processing their languages and code-switch between them. The Language Acquisition and Bilingualism Lab provided caregivers with the Children's Communication Checklist–2 (CCC-2; Bishop, 2006) and Language Mixing Questionnaire (Byers-Heinlein, 2012). The CCC-2 quantifies children's social-pragmatic skills and the Language Mixing Questionnaire captures children's code-switching exposure. Children also completed the Bilingual English-Spanish Assessment (BESA; Peña et al., 2018) to index language skills. Our project aims to investigate the relationships between social-pragmatics, code-switching exposure, and language skills for bilingual children. This research will provide evidence for bilingual children's use of social-pragmatic skills in diverse linguistic environments.

INVESTIGATING VENUS CLOUD COVER USING AKATSUKI DATA

Alexander Ignatiev
Mentor: Sanjay Limaye

While the complete chemical composition of Venus' atmosphere is unknown, Venusian clouds seem to absorb more light than their chemical profile suggests. In order to understand this phenomena, our team uses ultraviolet photographs of the planet, obtained from the Akatsuki telescope. We then digitally separate the images of clouds from the rest of the planet, through a process known as image normalization. By applying Minnaert Scattering Law to the brightness of each pixel of the photograph, we create a simulation of an evenly illuminated planet. The residuals between the normalized image and the actual image give us the unevenness of the planet's lighting which indicates atmospheric variation. This digital separation allows us to study the clouds on their own and observe trends in cloud motion.

SUPPORTING MARGINALIZED GROUPS: A MINDFULNESS APPROACH TO ENHANCING WELL-BEING IN BLACK MENTAL HEALTH PROVIDERS

Augusta Ike
Mentor: Daniel Grupe

Black mental health providers navigate disproportionate burdens when working with clients from marginalized groups. Secondary trauma can arise when working with clients who navigate adversity. This study investigated whether a mindfulness intervention addresses the disproportionate burden by reducing secondary trauma while enhancing well-being. A standardized questionnaire investigated the effects of a group-based mindfulness intervention provided within a practice of Black mental health providers to assess secondary trauma and well-being prior to and immediately after this eight-week intervention. It is crucial to investigate whether a mindfulness intervention for providers supports their self-awareness and improves ways to reduce internalizing trauma related to adversity. These findings can enhance mental health providers' knowledge of culturally accessible interventions to support the well-being of themselves and Black people.

NEARBY EXO-MARS SYSTEM DISCOVERED BY TESS

Elyse Incha
Mentors: Susanna Widicus Weaver, Andrew Vanderburg

In recent years, exoplanet detection has exploded due to space telescopes such as the Kepler Telescope and the Transiting Exoplanet Survey Satellite (TESS). TESS especially has been able to discover over 5000 exoplanet objects of interest since its launch in 2018. However, due to TESS's low photometric precision, it is difficult to discover planets Earth size or smaller. My work characterizes and validates one of these unique stellar systems, TOI 4307. TOI 4307 harbors a Mars-sized planet as well as a Super-Earth. This exo-Mars system is unique not only in discovery method but also in its location, as it is one of the only bright planetary systems within 125 lightyears of Earth.

LGBTQ+, MIDDLE EASTERN, AND REVOLUTIONARY

Reem Itani
Mentor: Katrina Daly Thompson

This project explores how LGBTQ+ individuals in the Middle East and North Africa have had a revolutionary presence in societies where it was/is not entirely acceptable to be LGBTQ+. This project first uses case studies of LGBTQ+ people in Ancient Egypt and the Ottoman Empire to show their revolutionary presence in literature and in daily life ("revolutionary" in this instance refers to their existence going against societal norms). This project then uses three modern-day case studies (the 2011 revolution in Egypt, the 2019 Lebanese protests, and the Israeli government's unfair treatment of Palestinians) to illustrate the revolutionary actions of LGBTQ+ individuals in contexts of dissatisfaction with the ruling body.

CIRCADIAN REGULATION OF HEART RATE AND BEHAVIOR IN DANIO RERIO (ZEBRAFISH)

Sania Jain
Mentors: David Ehrlich, Efrén Alvarez Salvado

Many living organisms exhibit physiological rhythmicity whereby circadian rhythms govern their sleep, hormonal, and cardiac activity. Perturbed sleep cycles are increasing in prevalence, causing health problems. Heart rate, a read-out of arousal, was used to measure the relationship between behavior and circadian rhythms in larval zebrafish. We built a novel apparatus that can record high-resolution videos showcasing the heartbeat of free-swimming fish through their transparent bodies. We trained an artificial neural network to identify different phases of the fish's heartbeat in tracked videos. They will be analyzed on MATLAB and compared for fish reared in opposing light cycles. We hypothesize that swimming speed is correlated.

A NEWLY TRIPLED SYSTEM: THE NEAREST, SMALLEST EXOPLANET YOUNGER THAN 500 MYR

Alyssa Jankowski
Mentor: Melinda Soares-Furtado

Young planetary systems (<500 Myr) are invaluable for exploring the formation of stellar systems by giving constraints to theories of planetary evolution and development into late stage systems. We present HD 63433d, an exoplanet orbiting a young (414±23 Myr), nearby (22.4035±0.0225 pc) solar analog (0.99±0.03 M⊙) and member of the Ursa Major co-moving group. After performing an analysis of the host star's TESS light curves and Gaia DR3 stellar parameters, we calculated a radius of 1.102±0.045 R⊕ and orbital period of 4.209 days. HD 63433d is the third and closest planet detected in the system. To date, HD 63433d represents the nearest, smallest exoplanet younger than 500 Myr and is an excellent candidate for follow up observations.

SHORT-TERM SYNAPTIC PLASTICITY OF PARVALBUMIN INTERNEURONS IN MOUSE CORTEX

Anna Jansson
Mentors: Meyer Jackson, Kate Scheuer

Parvalbumin interneurons are an abundant and specialized type of fast-spiking inhibitory interneuron that play a role in many social and memory related cognitive processes. For additional insight into circuitry driven mechanisms behind parvalbumin interneuron activity we evaluated their electrical responses and cortical functionality in layers II/III, IV, and V in the adult mouse somatosensory barrel cortex. Paired pulse stimulation was applied to evaluate their short-term synaptic plasticity using a hybrid voltage sensor (hVOS). With intervals between paired stimuli of 20-, 50-, and 100-ms, parvalbumin interneurons displayed paired-pulse depression in all cortical layers tested.

AN ANALYSIS OF RADIO AGN PLASMA AGES CALIBRATED USING MAGNETO-HYDRODYNAMIC JET SIMULATIONS

Will Jarvis
Mentors: Eric Hooper, Marsha Wolf

Radio AGN (RAGN) commonly include radio jets that distribute energy throughout their host galaxy, potentially quenching star formation. Jet activity timescales are difficult to ascertain. We present a novel technique to date plasma in the jets by their spectral energy distribution which encodes information about how high energy particles lose energy as they exit jets. We compare numerical simulations of AGN with both active and inactive jets with a sample of observed RAGN in various phases of AGN activity to calibrate the observed ages. We simulate a range of jet powers and environmental conditions that match the envelope of our observational sample. The calibrations help determine systematic uncertainties in our age results to correct the observation-derived ages. We present the age analysis of the simulations.

INVESTIGATING STRESS-INDUCED BEHAVIORAL CHANGES VIA Kat6a UPREGULATION

Ezra Jarzembowski
Mentor: Xinyu Zhao

Stress triggers natural physiological responses in our bodies to help maintain homeostasis; however, chronic levels of stress are associated with neurological disorders such as depression and post traumatic stress disorder. Repeated stress treatments on mice have been shown to induce depression-like and anxiety-like behavioral deficits, but the molecular pathways behind these effects have yet to be identified. Prior research in my lab suggests a link between chronic stress and elevated lysine acetyltransferase 6A (KAT6A) expression in parvalbumin interneurons (PVIs) of the medial prefrontal cortex (mPFC). In our current research, we have demonstrated that upregulation of KAT6A in PVIs of mouse mPFCs leads to depression-like and anxiety-like behaviors. We will continue investigating if these deficits can be rescued through inhibition of KAT6A activity.

MET INHIBITION ENHANCES THE EFFECT OF RADIATION IN MET DYSREGULATED NON-SMALL CELL LUNG CANCER MODELS

Saahil Javeri
Mentor: Randy Kimple

In non-small cell lung cancer (NSCLC), the Mesenchymal Epithelial Transition (MET) receptor can be altered through either mutation or amplification which occurs at frequencies of roughly 3-4% and 1-6% respectively. The most common MET mutation occurs in exon 14 and leads to amplified downstream signaling causing increased cell proliferation, survival, and invasion. Recent studies have shown that inhibition of MET increases the effectiveness of radiation when treating NSCLC. Capmatinib is a selective inhibitor of the MET receptor which has shown substantial anti-tumor effects when used as a single agent. However, little is known regarding capmatinib's synergistic effect with radiation as well as the mechanism of this synergy. We will conduct both in vitro and in vivo studies to investigate capmatinib's radiosensitizing effect on NSCLC cells.

SUPERCONDUCTING QUANTUM COMPUTING

Tiberius Jean-Remy
Mentor: Spencer Weeden

The idea of quantum computing is slowly but consistently being transformed into reality. The McDermott Lab utilizes the properties of superconducting integrated circuits cooled to temperatures near absolute zero in order to produce quantum arrays. The objective of this project is to design, simulate, fabricate, and measure the properties of quantum bits known as “qubits.” In particular, my project focuses on using powerful simulation software to predict the properties of these superconducting circuits. Once fabricated, these qubit properties can be experimentally measured. Relevant properties include relaxation time and quantum coherence. Once relaxation time and coherence reach the necessary threshold, then they could be used to do actual quantum calculations and possibly be used to construct a computer. Such a feat could allow certain problems, like quantum simulation or finding prime factors, to be solved much more efficiently than today's best supercomputers.

DETERMINING THE PERCENT POWER CAPACITY OF A NUCLEAR REACTOR FROM CHERENKOV RADIATION

Asher Jewell, Devin Cerutti, Gerson Garcia, Quintan Lynne, Benjamin Reilly, Nick Tierney
Mentor: Adrien Couet

Knowing the percent power capacity at which a nuclear reactor operates is useful for calibrating the reactor's power level for experiments. We determined the University of Wisconsin Nuclear Reactor's (UWNR) percent power capacity by designing and fabricating a device that measures the intensity of Cherenkov radiation from a steady-state reactor operation. Cherenkov radiation is radiation, including blue light, that charged particles emit when they move through a medium faster than light in that medium. In our device, a lux sensor detected Cherenkov radiation from within the reactor pool; the reading was sent to a computer above the pool. We calibrated the device by measuring intensity from two operations of known percent capacity, then determined an unknown percent capacity from another operation's intensity.

IMPROVING CERVICAL CANCER SCREENING THROUGH NUCLEAR STAINING INTENSITY ANALYSIS

Chrystal Ji
Mentors: Kaitlin Sundling, Joshua Faulkes

Improving cervical cancer diagnosis has the potential to impact both patient care and public health. We aim to show how nuclear staining intensity varies among cervical cancer screening diagnostic categories. ImageJ will be used to measure the intensity of nuclear staining on images obtained from the publicly available Bethesda Cervix Web Atlas. To adjust for variations in staining between cases, epithelial cell nuclear intensity will be normalized to nuclear intensity of neutrophils within each case. In progress data will be presented. Next steps of the project will include application of the workflow to additional images and preparation of a high-quality image dataset for future image analysis, including using artificial intelligence techniques.

FINAL /z/ AND /s/ IN WISCONSIN IN THE 1970S AND NOW

Tong Jiao
Mentor: Joe Salmons

Final obstruent laryngeal neutralization in Wisconsin English is changing, so that his and hiss can be pronounced the same. This study reveals how current speakers and speakers from the 1970s differ in this regard. Comparing recordings from the 1970s (fieldwork recordings) and today (Wisconsin Public Radio), today's speakers tend to use less final obstruent neutralization post-vocalically. Previous research shows fortis sounds (like /s/) are typically longer than lenis sounds (like /z/), helping distinguish /s/ and /z/. But this may not hold in my data: /z/ is not significantly shorter than /s/.

ABERRANT SWALLOW BEHAVIORS IN A RAT MODEL OF CHEMOTHERAPY AND RADIATION

Bonnie Jin
Mentor: Michelle Ciucci

We are assessing how combined radiation and chemotherapy treatment for head and neck cancer (HNC) affects swallowing and potential improvement with tongue exercise intervention in a validated rat model. Radiographic imaging was used to characterize the presence of dysphagia through aberrant swallowing patterns. We hypothesized rats treated with chemoradiation+tongue exercise intervention would show less aberrant behaviors vs rats who did not complete the intervention. In this repeated methods design, rats were randomized into two groups: chemoradiation without exercise and chemoradiation+exercise. Dependent variables were analyzed from videofluoroscopic studies: presence/absence of 1) stasis, 2) extraneous head movement, and 3) coughing/gagging (binary outcomes). Statistics will be performed with McNemar's Test. Translational investigation is crucial to establish mechanisms of how exercise-based prevention of negative swallowing outcomes in HNC treatment.

ANALYSIS OF StAR RNA SPLICING AND LIPID DROPLETS COMPOSITION IN MA10 CELLS UNDER DIFFERENT STIMULI

Teresa Jing
Mentor: Colin Jefcoate

Steroidogenic acute regulatory protein (StAR) is a transport protein which plays a key role in steroidogenesis. Different pathways can activate StAR transcription. cAMP activates PKA which phosphorylates CREB. PKA also inhibits SIK1 which allows CRTC2 to bind to p-CREB and activate transcription. Differently, HG9 inhibits SIK forms which activate CRTC2 and allow it to bind to non-phosphorylated CREB which promote transcription. In this project, we were exploring how StAR post-transcription, especially splicing, is regulated under different media conditions and stimuli and how the composition of lipid droplets changes with different stimuli over time. We found that the lagging is prolonged with HG9 stimulation compared to Br-cAMP stimulation and the increase of lipid droplets are much more substantive with Br-cAMP compared to HG9.

48 AND ME: A GENEALOGICAL STUDY OF ANDEAN LANDRACE POTATOES

Alyssa Johnson
Mentor: Sean Fenstemaker

Molecular tools can improve the way germplasm collections are managed. 12,953 SNP markers were used to evaluate genetic diversity, population structure, possible hybrid origin, and duplicate samples in 20 sampled individuals from 20 Solanum tuberosum L. subsp. andigenum Plant Introductions (PI) from the US potato Genebank. STRUCTURE analysis identified four populations. All individuals from PI 280890 (Argentina), PI 280987 (Bolivia), PI 243446 (Colombia), and PI 281250 (Peru) clustered together with 100 percent bootstrap support. The hybrid origin of PI 365347 (Peru), PI 161348 (Peru), and PI 258884 (Bolivia) was corroborated by our analysis. Finally, PI 197932 (Colombia) and PI 229894 (Ecuador) were determined to be duplicate accessions. These results have practical implications for germplasm management and provide a framework for understanding inter- and intra-accession relatedness.

COGNITIVE AND MOTOR PERFORMANCE OF 1-YEAR-OLD RHESUS MACAQUES PRENATALLY EXPOSED TO ZIKA VIRUS

Dean Johnson
Mentor: Karla Ausderau

Previous studies have shown that up to 30% of congenital Zika-exposed infants express late-onset development, speech, and/or cognitive delay. It is unknown why some infants express deficits while others do not. The purpose of this study is to use a rhesus macaque model to compare the cognitive and motor abilities of 1-year-old prenatally exposed Zika macaques to a mock-injection group using a puzzle feeder task. The cognitive abilities will be measured by the highest level achieved on the puzzle and fine motor skills will be assessed by finger isolation to retrieve and move the treat through the puzzle feeder. Results will provide insight into the severity and timing of deficits in a non-human primate model of prenatal Zika exposure.

THE DNA DAMAGE SENSOR MRE11 REGULATES EFFICIENT REPLICATION OF AUTONOMOUS PARVOVIRUS MINUTE VIRUS OF MICE

Isabella Jones
Mentor: Kinjal Majumder

Parvoviruses are single-stranded DNA viruses that utilize host proteins to replicate in the nucleus of host cells. The autonomous parvovirus Minute Virus of Mice (MVM) forms viral replication centers in the nucleus that are adjacent to cellular DNA damage response (DDR) sites, but do not activate a canonical DDR signal on their genome. We have discovered that the DDR sensor protein MRE11 binds to the replicating MVM genome, remaining independent from its other complexing proteins, RAD50 and NBS1. MVM replication is attenuated in the absence of MRE11 and ectopic expression of wild-type MRE11 in CRISPR knockout cells rescued virus replication. Our findings suggest a new model utilized by autonomous parvoviruses to usurp local DDR proteins, crucial for viral pathogenesis.

THE INFLUENCE OF COLD TREATMENT ON ANTHOCYANIN ACCUMULATION IN HEMP (CANNABIS SATIVA L.)

Azura Jorda
Mentors: Shelby Ellison, Sean Kim

Anthocyanins have been shown to prevent damage to photosynthetic tissue caused by solar radiation via a stress induced response. It has been shown that certain stressors, such as cold temperatures, will help induce the production of anthocyanins in some plants. For this reason we are studying the effects that cold temperatures have on anthocyanin accumulation in cannabis. We will examine four cold treatments to observe how different temperatures affect the purple pigmentation accumulation within flowers. Anthocyanin production will be visually assessed by a 0-3 scale. Visual scores can introduce bias so we are also developing a quantitative assay using a microplate reader to test absorbance levels. Absorbance readings and visual scores will be compared and differences in pigmentation between cold treatments will be presented.

EXTRACTING MATERIALS FROM THE OCEAN USING VARIOUS METHODOLOGIES

Esh K
Mentor: Ziyan Wu

The ocean's increasing pollution with waste products poses a significant environmental threat. This project proposes using Raman spectroscopy to study and understand the composition of these waste products in order to identify their molecular structure and potential impact on marine life. The collected data will be used to create visualizations and graphs to inform policies and initiatives aimed at reducing waste in the ocean. The project aims to develop strategies to mitigate the impact of waste products on the environment through innovative and intricate measures.

OPTIMIZING FISH FOR THE QUANTIFICATION OF CLOSTRIDIOIDES DIFFICILE IN DROPLET COMMUNITIES IN AN ULTRAHIGH-THROUGHPUT WORKFLOW

Huixin Kang
Mentor: Ophelia Venturelli

Clostridioides difficile, a bacterial pathogen that could be life-threatening, is a public health threat in the U.S. While antibiotics are the first line of treatment for Clostridioides difficile infection (CDI), new treatments are needed due to increased antibiotic resistance. Although current fecal transplantation (FMT) brings the hope for recurrent CDI, we hope to explore defined communities that inhibit the growth of C. diff. In a high-throughput workflow, we screened for desired communities after a period of growth in millions of microfluidic droplets and collected data using flow cytometry for model construction. We proposed that target bacteria could be selectively quantified using fluorescence in situ hybridization (FISH) probes, and both agarose and PEG hydrogels were tested to optimize the FISH protocol in droplets.

FBF BINDING ELEMENTS IN THE gld-1 3′UTR AND THEIR ROLE IN GERMLINE STEM CELL REGULATION

Deep Kapadia, Hezouwe Walada
Mentor: Sarah Crittenden

PUF (Pumilio and FBF) proteins are key stem cell regulators in the C. elegans germline. The PUF proteins FBF-1 and FBF-2 are RNA-repressing proteins responsible for the self-renewal of stem cells. FBF represses gld-1, a differentiation factor, in stem cells by binding to the gld-1 3'UTR through binding sites called FBEs (FBF Binding Elements). FBE single mutants exhibit a wild-type, fertile phenotype, however, double FBE mutants exhibit a sterile phenotype. The double mutant sterile phenotype is characterized by a decrease in stem cells and production of sperm only. FBE mutants also result in higher than normal levels of GLD-1 in stem cells consistent with the idea that FBF is important for keeping GLD-1 levels low in stem cells.

DEEP LEARNING DENOISING FOR MAGNETIC RESONANCE IMAGES

Mahathi Karthikeyan
Mentor: Alan McMillan

The goal of this research is to improve the quality of medical images using deep learning methods. This is achieved by an algorithm designed to compare the original image with its degraded version (by injecting synthesized noise to the original image) and minimize the loss in quality between the two images. Specifically, MR images will be synthesized to generate three types of noisy images (salt & pepper noise, Gaussian noise, and Rician noise). A convolutional neural network will be used to develop improved quality images.

INVESTIGATING THE CLOUD COVER OF VENUS FROM AKATSUKI ORBITER DATA USING PYTHON

Soumya Kataria
Mentor: Sanjay S. Limaye

The purpose of this study is to analyze the thermal infrared images of Venus obtained by the Akatsuki orbiter to obtain the average properties of the cloud cover. One of the goals is to obtain r limb darkening of Venus. The released data are available as NetCDF files depict the global cloud cover observed by the Ultraviolet Imager (UVI) and the Longwave Infrared Radiometer (LIR) instruments on the Akatsuki orbiter. Using the Python Jupyter Notebook, we have processed the Akatsuki images accessing the geometry data about the images and converted latitude-longitude maps into solar longitude relative maps. Averaging all the images enables the investigation of day-night differences in the cloud top temperatures.

EFFECT OF MUSICAL TRAINING ON SPEECH-IN-NOISE PERCEPTION IN CHILDREN

Mira Katz-James
Mentor: Carlos Benítez-Barrera

Children often have to interpret speech in loud environments, such as their teacher's voice in a noisy classroom. The literature suggests that musical training has the potential to enhance speech-in-noise perception (SPIN), which is the ability to make out words or sentences in a sonically busy environment (e.g. Coffey et al. 2017). There are mixed results as to whether children with musical training retain an advantage when the speech and noise are collocated in a SPIN test (Strait et al. 2012, Benitez-Barrera, 2022). This study will examine whether the "musician advantage" in SPIN skills is present in children when the location of the speech and noise is varied.

STUDYING SEVERE WEATHER AND CLIMATE WITH THE APPLICATION OF NASA AND NOAA SATELLITES

Nathan Kavan
Mentor: Mayra Oyola Merced

Hurricanes are costly and deadly threats that affect global coastlines year after year. Especially as global warming continues to intensify global weather patterns, improving our radar technology and studying hurricanes will continue to be important. This project seeks to improve this problem by using radio occultation to calculate tropopause height using four different methods, resulting in the creation of new datasets. Using data from IMERG (Integrated Multi-satellitE Retrievals for GPM) and GOES (Geostationary Operational Environmental Satellites), this project can add new datasets where no databases based on observations currently exist. This data can provide more clarity on the evolution and strength of hurricanes and will prove very useful in the analysis of future storms.

HOW DO INFANTS LEARN TO UNDERSTAND OWNERSHIP: THE ROLE OF OLDER SIBLINGS

Caroline Kerper
Mentor: Jenny Saffran

Ownership is a complicated concept that infants successfully understand at a very young age. Understanding ownership has implications for not only language development, but positive social behavior as well. Prior studies found that possessive pronouns can help 12-month-old infants track possession of objects. In addition, there is evidence that siblings affect language learning by younger children within a household. My study will investigate whether the ability to track possession improves when an infant has an older sibling. The current study will use eye-tracking to see how quickly and accurately infant participants can identify particular objects based on ownership. I hypothesize that infants with older siblings will identify the correct objects more accurately and efficiently than infants without older siblings because they will have more experience tracking ownership within their household.

THE PUTATIVE ROLE OF SHORT-CHAIN FATTY ACIDS AND BDNF IN INTERMITTENT FASTING-INDUCED ISCHEMIC TOLERANCE

Bori Kim
Mentors: Raghu Vemuganti, Soomin Jeong

Accumulating evidence of the gut microbiota-brain axis supports a pivotal role of major microbial metabolites, such as short-chain fatty acids (SCFAs), that are altered in stroke patients. Lifestyle factors, including diet restriction or exogenous supplements, robustly impacts SCFA formation and release. Intermittent fasting (IF) induces ischemic tolerance by modulating inflammation, excitotoxicity, and oxidative stress; however, none of the studies have yet assessed its role in gut dysbiosis and synaptic plasticity. We are evaluating if SCFAs and synaptic plasticity-related genes are altered in order to play a role in IF-induced ischemic tolerance in experimental stroke. IF regimen significantly elevated levels of butyric acid and propionic acid as well as expression levels of brain-derived neurotrophic factor and Ca2+/calmodulin-dependent protein kinase II-α.

INVESTIGATING THE BDWDL GENE FAMILY FUNCTION IN BRACHYPODIUM DISTACHYON

Fiona Kinney
Mentor: Marie Keith

Plant root tips of Brachypodium distachyon (Brachypodium) oscillate as they grow downward, allowing the root to move around obstacles and towards nutrients. Currently, many of the molecular mechanisms which dictate root growth behaviors of Brachypodium, including root oscillatory growth, are poorly characterized. Previously, the WAVE DAMPENED2 (WVD2) gene family in Arabidopsis thaliana was characterized to contribute to cellular processes such as cortical microtubule arrangement and cell expansion that contribute to root growth. We identified five orthologs of the WVD2 gene family in Brachypodium (BdWDL1-5) and generated a plasmid for Cas9-mediated genome engineering. We also analyzed differential gene expression at different periods of curvature and across accessions with varying oscillation amplitude, to further determine if BdWDL1-5 has a regulatory effect on the root tip oscillation mechanism.

ROLE OF GLUTAMATERGIC CRF NEURONS IN PFC-DEPENDENT COGNITION

Jenna Kiraly
Mentor: Craig Berridge

The prefrontal cortex (PFC) supports higher cognition. PFC cognitive dysfunction is associated with multiple disorders. The neurobiology of PFC-dependent cognition is currently limited. Corticotropin-releasing factor (CRF) is a neurotransmitter present in the PFC. Recent studies demonstrate PFC CRF neurons impair both working memory and sustained attention. However, these actions involve different pathways: local release for working memory and distal release for sustained attention. We recently observed that 85% of PFC CRF neurons are glutamatergic projection neurons (distal release) while 15% are GABAergic interneurons (local release). Moreover, GABAergic CRF neurons were observed to impair working memory and not sustained attention. The current studies demonstrated that chemogenetic activation of CRF glutamatergic neurons robustly impairs sustained attention. These studies advance our understanding of the neurobiology of higher cognitive function.

EPSTEIN-BARR VIRUS INDUCES THE REORGANIZATION OF CELLULAR CHROMATIN (ROCC)

Elijah Kirschstein
Mentor: Bill Sugden

We have uncovered how Epstein-Barr virus induces the reorganization of cellular chromatin (ROCC), where host chromatin is compacted and marginated within the nucleus. We tested the role of EBV lytic DNA amplification in driving ROCC and learned that inhibiting it supports chromatin compaction but blocks margination. We favor two steps for ROCC: EBV first mediates a cellular response leading to global chromatin compaction, and second, viral DNA synthesis drives margination of cellular DNA. We asked if histone-associated simian virus 40 (SV40) DNA synthesis could substitute for EBV-mediated synthesis and found that EBV's ROCC is incompatible with SV40 DNA replication. We conclude that EBV blocks all forms of DNA synthesis requiring histones to be loaded onto newly synthesized DNA.

SATURDAYS WITH DAD: FINDINGS FROM IN-PERSON VISITS BETWEEN CHILDREN AND THEIR INCARCERATED FATHERS

Jillian Klener, Annie Hedges
Mentor: Pajarita Charles

Approximately 1.7 million children have an incarcerated parent, resulting in widespread harm and family disruption. Dane County Jail recently implemented child-friendly, in-person visits for children and incarcerated fathers, a visitation strategy that allows physical contact and supports family bonding. While parent-child contact is associated with positive outcomes, little is known regarding participants' experiences. This study assesses incarcerated parents' and caregivers' views of child-friendly visits, and their perceptions of how visits affect their children. Data from approximately 20 incarcerated fathers and caregivers will be analyzed to understand their visiting experiences, recommendations for changes, and views on how in-person visits compare to other approaches (e.g., video chat, telephone). This study will have important implications for the future use of contact visits in Dane County Jail.

WHY AREN'T THERE MORE WOMEN IN GOVERNMENT? AN ANALYSIS OF THE 2018 STATE MIDTERM PRIMARIES

Nicholas Klopp
Mentor: Cullen Cohane

Despite comprising half the national population, women make up barely a quarter of the US Congress and slightly less than a quarter of state legislatures. However, past studies of the factors behind the lack of female politicians have almost exclusively focused on national races. By analyzing the success rate of female politicians in the 2018 state primaries, this project provides crucial insight into the possible origins of this disparity at a local and national level. We expected to see a significant increase in the success of female politicians in Democratic primaries compared to previous elections. Our preliminary analysis supports this hypothesis, displaying that female candidates performed significantly better in Democratic primaries relative to their campaign expenditure, but no such effect was seen in Republican primaries.

PREVALENCE OF POLYCYSTIC OVARY SYNDROME (PCOS)-LIKE OVARIAN MORPHOLOGY IN ADULT FEMALE RHESUS MACAQUES WITH NATURALLY OCCURRING HIGH TESTOSTERONE

Savannah Knaak, Suzanne Oriel
Mentor: David Abbott

In a pedigree of adult female rhesus macaques at the Wisconsin National Primate Research Center, we have identified those with naturally occurring high testosterone (T) levels and those with normal T levels. To gain insight into the impact of high T levels on PCOS-like ovarian morphology in women, we quantified ovarian follicle populations in adult female rhesus macaques with naturally occurring high T (n=4) and adult female rhesus macaques with normal T (n=4). The two groups were pair-matched in terms of age and weight. We hypothesize that adult female rhesus macaques with high T will have PCOS-like ovarian morphology compared to normal T female monkeys. Such findings would suggest that high T levels induce PCOS-like ovarian pathology.

THE U.S. SUPREME COURT: AN EGREGIOUSLY UNDEMOCRATIC AND ILLEGITIMATE INSTITUTIONs

Kaitlin Knocke
Mentor: Sarah Frank

The end of the 2022 U.S. Supreme Court term left Americans puzzled by conflicting constitutional interpretations and the overruling of long-standing legal precedents. Sexual assault allegations during judicial appointments, conflicts of interest in justice participation, and contradictory legal arguments question the legitimacy of the Supreme Court as a trustworthy institution of the United States justice system. In this legal analysis piece, I analyze the procedures of judicial appointment, judicial identities, recusal, and the inconsistent interpretations of stare decisis in recent Supreme Court decisions and their historical roots. I ultimately argue that the U.S. Supreme Court, in its practices and policies, is an egregiously undemocratic, tyrannical, and illegitimate institution that undermines the conceptual framework of American governance.

THE IMPACT OF BACKGROUND TELEVISION ON CHILDREN'S MOVEMENT

Charlie Koepp, Aileen Jiang, Cassie Liu, Sam Garabedian, Yining Zhao
Mentor: Heather Kirkorian

Previous research has demonstrated that background TV has a disruptive effect on children's ability to sustain attention during play (Schmidt et al., 2008). The goal of this study is to determine if background TV also affects a child's movement during play. Children ages 3-5 will be free to play while being exposed to three levels of background TV: child TV, adult TV, and no TV in a varying order. We expect that the child's movement will decrease in response to background TV, particularly with child-directed TV. Our findings will help us understand how background TV influences children's level of activity.

RACISM AS A BARRIER TO CARE AFTER EXPERIENCES OF VIOLENCE AMONG INDIGENOUS WOMEN: A LITERATURE REVIEW

Anna Kolman
Mentor: Jeneile Luebke

Intimate partner violence (IPV) is a significant public health concern that disproportionately impacts Indigenous women in the US. This review aims to provide insight into the help-seeking behaviors of Indigenous women who experience violence. We conducted a literature review, and seven articles were identified and included. We identified several ways in which racism impacts help-seeking behaviors, including intergenerational violence, distrust in law enforcement, lack of culturally safe care, fear of losing children to social services, and relationship dynamics with non-Indigenous partners. This review reveals the gap within current research: a lack of representation in nursing-specific research and the inability to determine whether experiences vary by country. More research is needed to determine consistency between countries and to better inform nursing practice.

BOTH INTERNEURONAL AND PYRAMIDAL CELL α5-GABAARs ARE NECESSARY FOR MODULATION OF LTP INDUCTION THRESHOLD

Sai Komanduri
Mentor: Robert Pearce

We studied the mechanisms underlying the control of memory by measuring the long-term potentiation (LTP) of excitatory synaptic strength, a commonly used cellular model of memory. In this model, LTP at hippocampal CA1 Schaffer Collateral (SC) synapses corresponds to memory formation. It was previously established that α5-subunit-containing GABAARs (α5-GABAARs) modulate the threshold of LTP induction. Here, we tested whether pyramidal neurons, interneurons, or both are responsible for this effect, by measuring LTP in hippocampal slices from interneuronal and pyramidal α5-GABAA-KO mice. We found that a5-GABAARs from both cell types are essential. Since LTP is a neural correlate for memory formation, classification of the cell populations that modulate LTP allows for a deeper understanding of the mechanisms of memory formation and its modulation.

UNSUPERVISED LEARNING IN PHYLOGENETICS

Yibo Kong
Mentor: Claudia Solís-Lemus

A phylogenetic tree is a branching diagram showing evolutionary relationships between different species. By studying the tree, biologists can learn the evolutionary relationships between species. Our project is dedicated to developing easy-to-use computational and machine learning tools for biologists to cluster phylogenetic trees based on similarity. In this project, we have completed 1) an embedding algorithm for converting phylogenetic trees into Euclidean space, 2) integrated functions for processing phylogenetic tree data and performing unsupervised learning, 3) functions to visualize the clustering patterns, 4) extensive testing to prove the reliability and accuracy of the functions. Our main functions are developed in Julia, and the code is open-source (https://github.com/solislemuslab/ml-phylo-trees).

VALIDATION OF INERTIAL MEASUREMENT UNITS AND ACHILLES TENDON TENSIOMETRY TO QUANTIFY ANKLE CONTROL IN HUMAN LOCOMOTION

Kate Konieczka
Mentor: Peter Adamczyk

Biomechanics research has shifted towards wearable sensors and testing in real-world environments to obtain a more holistic representation of everyday movement patterns. We investigated inertial measurement units (IMUs – movement sensors) and tendon tensiometers (tendon force sensors) to validate their ability to quantify ankle control in human locomotion. Two subjects underwent running and walking wearing both sensors. IMU movement data were analyzed through a human body model to estimate ground reaction forces, and tensiometry measurements estimated ankle moment. These were combined to evaluate dynamic mean ankle moment arm (DMAMA), a measure of ankle control. Results from the wearable sensors showed trends across speed that were comparable to a previously validated laboratory method. These results will allow researchers to expand quantification of human movement beyond the laboratory.

A BILINGUAL APPROACH TO REDESIGNING NEUROCOGNITIVE TESTING

George Kostas
Mentor: Kimberly Mueller

Neuropsychological tests are necessary to address the dementia crisis and detect cognitive decline in bilingual individuals. We conducted a longitudinal study using propensity score matching with participants from the Wisconsin Registry for Alzheimer's Prevention. We compared picture and generative naming between bilinguals and monolinguals, and also examined differences across cognitive status. We used t-tests to analyze item-level responses to determine differences between the groups in terms of language status and naming mono- and polysyllabic words between language status groups. We found no significant differences between the groups in terms of naming words. However, bilingual individuals with Mild Cognitive Impairment produced more monosyllabic words than monolinguals with the same diagnosis. Our findings suggest that neuropsychological tests can be modified to suit the linguistic abilities of bilinguals.

INFLUENCE OF CYANOBACTERIAL ADHESION ON MICROPLASTIC SETTLING VELOCITY

Azul Kothari
Mentor: Erica Majumder

Certain cyanobacterial species modulate their buoyancy to position themselves in the water column based upon light and nutrient availability. Cyanobacterial adhesion to microplastic pollutants may affect their environmental fate — potentially causing plastics with adhered cyanobacteria to settle to lakebed bottoms or eventually disperse into oceans. We aim to investigate these interactions by culturing two cyanobacterial species, Microcystis aeruginosa and Anabaena variabilis, and newly enriched microbial communities from Lake Superior and Genesee River environmental samples individually with polyethylene, polypropylene, or cellulose fibers. Through 16s rRNA sequencing and electron microscopy, we will assess which microbial species adhere to microplastics and assess their resulting biofilm structure. Cultures with the strongest microplastic-cyanobacterial interactions will be cultured in a turbulence tank to assess biofilm influence on microplastic settling velocity.

VpsR SUPPRESSES COLONIZATION IN A HIGH c-di-GMP STRAIN IN VIBRIO FISCHERI

Ketan Kotla
Mentor: Mark Mandel

Cyclic diguanylate (c-di-GMP) is a signaling molecule that regulates motility and biofilm formation in many bacteria, including Vibrio fischeri, the symbiont of the Hawaiian bobtail squid (Euprymna scolopes). We previously reported that a strain with constitutively high c-di-GMP levels has a host colonization defect, likely due to altered symbiotic biofilm composition. A genetic screen revealed that the transcriptional regulator VpsR activates cellulose production, and deletion of vpsR rescues colonization by the high c-di-GMP strain. To understand the role of VpsR during host colonization by the high c-di-GMP strain, we used transcriptome sequencing to identify 499 genes regulated by VpsR, including an uncharacterized exopolysaccharide locus and type IV pilus locus. This work suggests a role for VpsR in regulating symbiotic biofilm composition.

ACCURACY OF THE REAL-TIME GOES-R XRS SOLAR FLARE LOCATION DATA PRODUCT

Brooke Kotten
Mentors: Michael Maseda, Janet Machol

Solar flares impact high-frequency radio communications on Earth and can be correlated with geoeffective, or Earth-directed, coronal mass ejections which cause a variety of terrestrial space weather effects. To assess these risks, the X-Ray Sensors (XRS) instrument on Geostationary Operational Environmental Satellites - R Series (GOES-R) monitors solar X-ray irradiance to provide early warnings of solar flares. Additionally, XRS quadrant photodiode measurements are used to determine accurate real-time flare locations. Both the X-ray irradiance and the flare locations data products are used operationally by SWPC. This talk will discuss the flare location algorithm and an upcoming background correction revision that results in a 50% improvement in the location accuracy of the second flare of two consecutive flares.

A VIKING AGE BEAD COMPARISON: THE SHAPES OF CARNELIAN AND AMBER BEADS

Jacob Kracke-Bock
Mentor: Jonathan Kenoyer

A comparison of Viking carnelian and amber beads found in Sweden was conducted to determine chronological changes in form and color. The absence of carnelian sources in Scandinavia indicates the beads were probably acquired through raiding/trading with regions connected to the source areas in Anatolia and South Asia. The shapes of amber beads were compared with carnelian beads to see if the introduction of carnelian beads influenced amber bead styles. Replications of amber beads were undertaken to provide insights into how amber may have been processed to replicate carnelian bead styles. Experiments with heat treating amber were conducted to understand heat's effect on color. Preliminary results suggest that carnelian beads may have influenced the later shapes and colors of amber beads in the Viking world.

ASSESSING MORPHOLOGICAL DEVELOPMENT OF HUMAN NEURONS WITH MBD1 MUTATION

Sebastian Krebsbach
Mentors: Xinyu Zhao, Yu Gao

Studies have shown that knocking out of methyl-CpG binding protein 1 (MBD1), an epigenetic gene regulator, in mice (MBD1-/-) leads to autism-like behaviors. In humans, MBD1 mutations have been found in a small number of patients diagnosed with autism. We found that neurons in MBD1-/- mice and MBD1-E339K mice, the mouse model of human autism E315K mutation, exhibit abnormal dendritic spines. Whether MBD1 mutations in humans lead to similar deficits remains unknown. We have created a human MBD1-E315K mutant stem cell line using CRISPER gene editing. We found that human MBD1-E315K neurons have no significant difference in dendritic complexity. Investigation of dendritic spines and electrophysiology of human MBD1-E315K neurons is underway and will help us better understand how MBD1 mutation leads to ASD in humans.

MEASURING THE NEUTRAL ATOMIC HYDROGEN ROTATION CURVE OF THE MILKY WAY GALAXY

Achintya Krishnan, William Jarvis, Jeff Ye
Mentor: Snezana Stanimirovic

Using the 2.3m Small Radio Telescope (SRT) located in Pine Bluff, WI, we probed emission from the 21-cm line of atomic hydrogen across the Milky Way's disk. The 21-cm line allows for sampling of important galactic characteristics, including the rotation curve and mass distribution. We observed atomic hydrogen at 3° intervals between the galactic longitudes of 28° to 82°; each measurement was repeated at galactic latitudes of +3° and -3°. The tangent-point method was applied to the measured spectra, yielding the orbital velocities of molecular clouds at various galactocentric distances. The resulting rotation curve agrees with those from similar studies by larger observatories. Velocities remain high near the edge of the galaxy, implying the presence of dark matter.

PURPOSE IN LIFE IS ASSOCIATED WITH LARGER HIPPOCAMPAL VOLUMES

Lauren Krist
Mentor: Stacey Schaefer

Purpose in life is a feeling or belief that there is meaning and direction to one's life. Higher purpose is associated with a reduced risk of cognitive decline, Alzheimer's disease (AD), and mortality. Hippocampal volumes generally decline with age, are often reduced in AD, and smaller volumes have been found in those who have experienced trauma and PTSD. Purpose in life has been assessed at multiple time points in the national, longitudinal Midlife in the U.S. (MIDUS) study. When adjusting for sociodemographics and intracranial volume, higher purpose in life was significantly associated with larger hippocampal volumes in the MIDUS Refresher sample, and similar relationships were found in preliminary analyses of the MIDUS Core sample, suggesting purpose in life may have protective effects on the brain.

"MY UNDERSTANDING IS CRITICAL CONDITION": HOW PROVIDER COMMUNICATION INFLUENCES SURROGATE PARTICIPATION IN END-OF-LIFE DECISION MAKING CONVERSATIONS

Eric Kubash
Mentor: Kristen Pecanac

Soliciting input from surrogates (designated patient care decision-makers) is crucial to ensure goal-concordant care and support surrogate comprehension. We aimed to determine how provider communication influences surrogate participation in end-of-life decision-making conversations. We audio-recorded 19 provider-surrogate conversations for adult patients in one academic medical center and one community hospital. Using conversation analysis, we analyzed how providers invited surrogates into the conversation and their responses. We saw three major conversation starters. When providers asked, "What's going on?" surrogates would share implications of the patient's status. When asked, "What has happened?" surrogates explained the patient's timeline without discussing implications for patient health. When asked for their understanding that was timestamped ("currently"), surrogates responded with implications and timelines. Different phrasings of similar questions can invoke different surrogate responses.

ROLE OF COFILIN ON MICROTUBULE INVASION OF DENDRITIC SPINES

Abhishek Kumar
Mentor: Erik Dent

Dendrites of excitatory neurons are covered with small, mushroom-shaped structures called dendritic spines. The Dent lab has discovered that during neuronal activity, microtubules (MTs) polymerize into spines allowing for the transport material around the cell. Our lab has also shown that vesicles can be transported along MTs entering spines; however, the mechanism by which MTs enter spines is still unclear. This process is thought to rely on actin filaments, which may act to guide MTs into spines. By working on a knockdown study of the actin-associated protein, Cofilin, preliminary findings hint at the role that this supporting protein plays in the process of MT invasion of spines.

INVESTIGATION OF THE CONTRIBUTION OF THE STIMULATOR OF INTERFERON GENES (STING) PATHWAY TO THE TYPE I INTERFERON RESPONSE IN MURINE GBM CELL LINES

Ria Kumari
Mentors: Paul Clark, Zachary Morris

Glioblastoma (GBM) is a potent cancer due to its high mortality and aggressive nature with a median survival of 15 months post-diagnosis. Immunotherapies are a promising approach to treating GBMs by remodeling the tumor microenvironment to recruit T cells and natural killer (NK) cells. Radiation therapy is known to increase tumor immunogenicity through increased T-cell infiltration stimulated by type I interferon (IFN) production, which is triggered by various cell-signaling pathways such as cGAS-STING and RIG-1. However, the relative contribution of each of these pathways toward the IFN response is not well understood, which limits the ability to harness a robust immune anti-tumor response. This research identifies the specific contribution of the cGAS-STING pathway toward the IFN response in murine GBM cells.

LEARNING USER PREFERENCES FROM PAIRED COMPARISONS

Shin Tsz Lucy
Mentors: Greg Canal, Robert Nowak

Recommendation systems heavily incorporate consumer preference inference from product rating or comparison feedback. Given that these often require large quantities of data, we aim to develop novel methods for preference learning using just a few ratings from each user. We include population-level components (common to many or all users) and personalized components customized to each user. This emphasizes the concept of revealing low-dimensional features from population-level components, which can enable estimating the preferences of each individual from a minimal number of ratings/comparisons.

IDENTIFICATION AND FUNCTIONAL ANALYSIS OF HYPOXIA RESPONSE ELEMENTS WITHIN THE PROTEIN KINASE-ENCODING GENE OF EPSTEIN-BARR VIRUS

Madeline Labott
Mentor: Janet Mertz

Epstein-Barr Virus (EBV), a human herpesvirus, has a latent and lytic viral life cycle. When EBV enters the lytic cycle, BGLF4, encoding a protein kinase can phosphorylate and activate ganciclovir, leading to the preferential killing of EBV-infected cells. Therefore, lytic reactivation provides a potential therapy for EBV-associated malignancies. Hypoxia, mediated by Hypoxia Inducible Factors (HIFs) induce EBV's lytic cycle. We hypothesized that putative Hypoxia Response Elements (HREs) found within the promoter region of the BGLF4 gene may regulate its expression. When we treated AGS cells transfected with a BGLF4 reporter plasmid with HIF-stabilizing drugs, we did not observe a change in luciferase expression. Additionally, HIF-stabilizing drugs did not increase BGLF4 expression by RT-qPCR. Therefore, the HREs identified likely do not independently induce BGLF4 gene expression.

DESIGNING NITROGEN FIXATION BIOSENSORS FOR USE IN HIGH-THROUGHPUT EVALUATION OF PLANT-ASSOCIATED COMMUNITIES

Claire LaFleur
Mentor: Claire Palmer

Testing for Nitrogen fixation within microbial communities in a high-throughput setting requires tedious and delicate work. Klebsiella variicola and Pseudomonas stutzeri are plant associated diazotrophs that have exhibited good N-fixation in soil communities in recent research. Using molecular cloning to create a plasmid containing the GFP gene downstream of the native nifH promoter — a conserved promoter of the nitrogen fixation regulation pathway — may allow for visual indication of nitrogen fixation in communities with KV and PS, thus optimizing high-throughput experiments.

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

Melissa Langkilde
Mentors: Amy Trowbridge, Shealyn Malone

Recent large-scale drought and bark beetle-induced mortality of piñon pine (Pinus edulis) has prompted research into identifying mechanisms underlying tree susceptibility to herbivores. Research suggests that drought alters the specialized metabolites produced in aboveground 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 metabolites in root cores collected from trees undergoing several intensities of short-term drought 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 aboveground disturbances.

DO IRX3 AND IRX5 DIRECT CYTOPLASM TRAFFIC BETWEEN OOCYTES DURING GERMLINE CYST BREAKDOWN?

Lauren Lansing
Mentor: Joan Jorgensen

The ovarian reserve is determined by the supply of primordial follicles a woman has at birth. Iroquois homeobox transcription factors, Irx3 and Irx5, support follicle survival via intercellular communication between oocytes and surrounding cells; however, how Irx3/5 promote follicle integrity is unknown. We hypothesized that Irx3/5 direct cytoplasmic content transfer between oocytes during germline cyst breakdown to ensure healthy follicles. We cultured embryonic ovaries from wild type and Irx3/5 double knockout mice in vitro throughout germline cyst breakdown. Ovary sections were analyzed to determine the size and quantity of oocytes in germline cysts, primordial and primary follicles. Results showed no significant difference in structural measurements or quantities between wild type and Irx3/5 double knockout oocytes, suggesting structural differences arise during later stages of follicular development.

EVOLUTIONARY HISTORY OF THE AE GENE FAMILY ACROSS ARTHROPODA

Lydia Larsen
Mentor: Carol Lee

Genes in the SLC4 gene family, specifically the Cl-/HCO3- anion exchanger (AE), play an important role in ion transport and the regulation of cellular pH. Previous research in the Carol Lee Lab indicates that the AE gene family plays an important role in saline to freshwater invasions of the Eurytemora affinis species complex. Despite AE's importance in this transition, little is known about the evolutionary history of the AE gene family across the phylum Arthropoda. To better understand this evolutionary history, I mined peptide and nucleotide sequences using publicly available genome databases as well as the Lee Lab's most recent draft of the E. affinis genome, aligned these sequences using gene alignment software T-Coffee, and constructed an AE phylogeny using maximum likelihood and bayesian phylogenetic approaches.

HANDHELD SHEAR WAVE TENSIOMETER MEASUREMENTS ARE SENSITIVE TO REGIONAL LOADING IN PHANTOM COLLATERAL LIGAMENTS

Mary Laudon
Mentors: Joshua Roth, Lesley Arant

Quantifying non-uniform loading in collateral ligaments is essential to understanding ligament injury and knee biomechanics. Our lab has developed a handheld shear wave tensiometer to measure ligament tension, but it remains unknown how tensiometer measurements are affected by non-uniform loading. This study aimed to determine 1) how accurately the tensiometer can measure total tension under non-uniform loads, and 2) the effect of load gradient and tensiometer tip position on measured shear wave speeds. We used a mechanical knee model to load a phantom ligament and introduce non-uniform loading. Shear wave speeds were measured at three positions under three load gradients. We found that tensiometers overpredict total tension under non-uniform loads, but they can capture the degree of non-uniform loading across the ligament width.

SIRT6 IN G361 CELLS INVOLVEMENT ON THE EMT PATHWAY IN THE DEVELOPMENT OF MELANOMA

Giuliana Lawrence
Mentors: Nihal Ahmad, Karla Anaya

Melanoma is one of the most dangerous forms of skin cancer, with a potential to metastasize, and become fatal, if not diagnosed early. The five-year survival of melanoma is dismal, even with new targeted and immune therapies. Therefore, therapeutic strategies are needed to combat this deadly neoplasm. Sirtuin 6 (SIRT6) is a histone deacetylase involved in a variety of cellular functions. From previous work from our lab, SIRT6 knockdown was found to have an anti-proliferative response in melanoma cells. The epithelial-to-mesenchymal (EMT) pathway contributes to the acquisition and invasiveness of cancer tumors. I am investigating SIRT6's role in melanoma and its correlation with the EMT pathway. The mechanisms behind melanoma invasiveness will be studied via determining modulations in mRNA and protein expression of key molecules involved in the EMT process.

PEER SHARE MENTAL HEALTH

Siena Laws, Elizabeth Liu
Mentor: Travis Wright

The Peer Share Mental Health program aims to promote mental health knowledge and create a sense of community at East High School through the power of peer mentorship. Workshops led by University of Wisconsin–Madison undergraduates give students the opportunity to grow their understanding of psychology and mental illness. Through these workshops, members are prepared to act as wellness ambassadors for their school, culminating in community projects led by the East student members. Peer Share members will share the mental health knowledge they've learned from these workshops with their classmates, bringing new depth to their school's health curriculum due to the understanding they've gathered from navigating their own mental wellness at the same school and within a shared community.

HOST GENETIC IMPACTS ON SHORT CHAIN FATTY ACID PRODUCTION

Caleb Lee
Mentor: Matthew F. Warren

Host genetics has been shown to influence short-chain fatty acid (SCFA) production pathways, and SCFAs can affect host metabolism and physiology. Gut microbes break down dietary fiber and ferment carbohydrates to make SCFAs. It is not known how host genetics influences SCFA absorption. I evaluated how SCFA levels were affected by host genetics in Diversity Outbred (DO) mice. DO mice carry ~40 million single nucleotide polymorphisms denoting genetic diversity similar to the human population. Using headspace gas-chromatography, I measured SCFAs in cecal and fecal contents and found a strong positive correlation between cecal and fecal acetate ($r = 0.84$; $p < 0.0001$). My findings suggest there is minimal host-driven absorption of acetate because fecal acetate levels were greater than cecal acetate levels.

SOCIAL NETWORKS AND PROFESSIONAL DEVIANCE IN HEALTHCARE

Jelena Lee, Allie Young
Mentor: Victoria Zhang

Healthcare professionals, contrary to popular belief, do not always follow the standard or correct rules of their practice. Due to the high-stakes nature of their profession, the concept of "professional deviance" within healthcare has come under increasing scrutiny within research circles. This thesis utilizes a social networks perspective to analyze the possible motivations and resulting consequences of professional deviance in healthcare through multidisciplinary literature reviews from various academic fields. The reasoning behind the decisions of healthcare professionals directly impacts our health and healthcare outcomes. By having a greater understanding of what influences these decisions, we can begin to explore possible solutions to reduce deviance to encourage the best outcomes for patient welfare.

REDUCING INFLAMMATION IN SPINAL CORD INJURY VIA TAILORED DELIVERY OF ANTI-INFLAMMATORY CYTOKINES

Owen Lefebvre, Roy Ram Klein
Mentors: Amgad Hanna, Dan Hellenbrand

The complex processes of inflammation post spinal cord injury (SCI) are a primary source of neural degeneration aided by the excessive infiltration of immune cells. Anti-inflammatory cytokines such as interleukin-4 (IL-4), interleukin-10 (IL-10), and interleukin-13 (IL-13) have shown to down-regulate this pro-inflammatory response in the injury site. Here, Sprague Dawley rats were contused with a 25mm weight drop, resulting in SCI. Mineral coated microparticles (MCMs) were created as a treatment method to deliver biologically active anti-inflammatory cytokines in a sustained manner. After treatment, cytokine levels were measured, and a decision matrix was designed to assess the ability of the treatment group to reduce inflammation. Synergy was detected between IL-4, IL-10, and IL-13, showing promise in reducing pro-inflammatory response.

CONTENT AND LINGUISTIC ANALYSIS OF YOUTUBE COMMENTS ON ADOLESCENTS' DIABETES DIAGNOSIS STORY VIDEOS

Meisi Li
Mentor: Maggie Bushman

Diabetes affects approximately 283,000 Americans under the age of 20. Adolescents commonly seek health information online. Few studies have explored engagement with YouTube videos about diabetes diagnoses of adolescents. This content and linguistic analysis study aimed to understand diagnosis disclosures and sentiment in comments on adolescents' diabetes diagnosis story videos on YouTube. Five YouTube videos were selected based on the most recent relevant videos. The top 40 comments from each video were evaluated for disclosure of diagnosis, diagnosis age, and associated symptoms. Linguistic Inquiry and Word Count software was used to evaluate comments for linguistic elements: positive and negative emotion, health, and body. Findings will inform how commenters are responding to or sharing content about adolescent diabetes diagnosis on YouTube.

A METAL-FREE APPROACH TO GENERATE FUNCTIONALIZED ROMP POLYMER

Ruojia Li
Mentor: AJ Boydston

Ring-Opening Metathesis Polymerization (ROMP) polymers have various applications in drug delivery and biomedical engineering. Among them, some unfunctionalized ones can be made using Metal-Free ROMP (MF-ROMP) which utilizes organic photocatalysts and initiators. In this project, we strive to improve the functional group compatibility of MF-ROMP. By screening the counteranions of the photocatalyst, we found that certain loadings of trifluoroacetate can significantly improve the initiator efficiency of MF-ROMP. Inspired by that, we installed the pentafluorophenyl (PFP) ester group onto the norbornene (NB) monomers and obtained 2. We successfully copolymerized NB and 2 via MF-ROMP. It has profound potential in insulating material and biopolymer. This project demonstrates the potential of increasing functional compatibility of MF-ROMP and its application in broader fields.

ROLE OF NEUROESTRADIOL IN THE BRAIN: SEX DIFFERENCE

Stephanie Li
Mentor: Ei Terasawa

Gonadotropin releasing hormone (GnRH) 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 were treated with high dose of estradiol benzoate along with the aromatase inhibitor, letrozole, which blocked the synthesis of estradiol from testosterone, while periodical blood samples for hormone analysis were obtained. Controls received estradiol benzoate and vehicle for letrozole. Findings from this study further clarify the sex difference and role of neuroestrodiol in the brain.

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BIOLOGICALLY INSPIRED CONVOLUTIONAL NEURAL NETWORKS FOR 3D VISUAL PROCESSING

Yanru (Lillian) Li
Mentor: Ari Rosenberg

Our eyes sense two-dimensional (2D) projections of the environment, like a movie on a screen, yet we perceive the world as three-dimensional (3D). To successfully interact with objects in our dynamic environment, the visual system needs to reconstruct 3D representations from these 2D retinal projections. However, the neuronal computations underlying this process remain relatively unknown. To investigate these 2D-to-3D transformations, I trained a biologically inspired convolutional neural network (CNN) to perform various 3D visual discrimination tasks. By examining the properties of artificial networks that most resemble the brain areas thought to contribute to 3D processing, this work will provide insight into the underlying mechanisms and computations that allow the brain to achieve a robust representation of the 3D environment.

TESTING A THEORY OF POPULATION NEURAL CODING IN THE VISUAL CORTEX USING MOTION ADAPTATION

Andrew Liang
Mentors: Xin Huang, Steven Wiesner

In motion perception, "direction repulsion" refers to the illusion of seeing motion directions of two overlapping random-dot stimuli appearing wider than the actual angular separation (AS). Motion adaptation can have significant effects on visual perception. However, the impact of motion adaptation on direction repulsion remains unknown. To address this question, we performed a psychophysics experiment with and without motion adaptation. With motion adaptation in the vector average direction of two overlapping motion directions, we found a significant increase in direction repulsion when the veridical stimulus AS was less than 90°. These findings are consistent with our hypothesis derived from a theory of representing multiple visual stimuli in the brain and provide insights into how neuronal populations in the brain represent multiple visual stimuli.

EXAMINING PREDICTORS OF SUBSTANCE USE AND TREATMENT ADEQUACY AMONG FORMERLY INCARCERATED OPIOID AND COCAINE USERS

Grace Licausi
Mentor: Tawandra Rowell-Cunsolo

Access to effective substance use treatment for those struggling with addiction, specifically formerly incarcerated people who use cocaine and/or opioids, may be inadequate. The study aims to assess factors that contribute to substance usage and determine whether individuals are accessing appropriate treatments. Three hundred and fifty formerly incarcerated individuals who have transitioned from custody to New York City communities during the previous three years will be interviewed and undergo urinalysis at 5 time-points (every three months) over a 12-month period. The study will examine individual and environmental-level risk factors that contribute to substance use patterns, as well as investigate discrepancies in treatment access in populations who experience incarceration. The findings could inform the development of targeted interventions to improve substance use treatment adequacy.

CHOLINERGIC NEURONS IN DOWN SYNDROME

Rachel Lichte
Mentors: Anita Bhattacharyya, Nicole West

Down syndrome (DS), caused by a triplication of chromosome 21, is characterized by intellectual disability and early Alzheimer's disease. Limited studies with human tissue have shown that there are fewer cholinergic neurons in the DS basal forebrain, an area of the brain involved in learning, memory, and attention. However, it remains unknown if individuals with DS are born with fewer cholinergic neurons or if the cholinergic neurons undergo accelerated degeneration. We are using immunocytochemistry and unbiased stereology to count the cholinergic neurons in control and DS post-mortem basal forebrain tissue across the lifespan to determine if individuals with DS are born with fewer cholinergic neurons or if the cholinergic neurons undergo accelerated degeneration.

ENVIRONMENTAL AND ECONOMIC ANALYSIS OF PLASTIC WASTE MANAGEMENT METHODS

Virginia Lilly
Mentor: Aurora Munguia- Lopez

The objective of this project is to compare standard plastic disposal methods (e.g., landfilling, incineration, and mechanical recycling) via environmental and economic metrics. Mechanical recycling methods can only treat simply designed single-layer plastics. Therefore, we also compare innovative recycling approaches, such as pyrolysis and the Solvent Targeted Recovery and Precipitation (STRAP) process. These processes can recycle specific types of plastics that are not currently recycled (e.g., multi-layer films). This project uses systems analysis tools, data collection methods, and literature reviews to compare these methods. Our analysis shows the advantages, disadvantages, and challenges of each alternative to help provide insight into the future of plastic recycling.

"MOMS ARE THE HUB. AND IF THE HUB DOESN'T FEEL GOOD, THEN THE WHOLE FAMILY DOESN'T FEEL GOOD": AN EXPLORATORY STUDY OF RURAL DWELLING MOTHERS ENGAGING IN PHYSICAL ACTIVITY

Anna Lindberg
Mentor: Susan Andreae

Gender gaps in physical activity (PA) exist with women being less active than men due to cultural and psychosocial factors. This exploratory descriptive study aimed to better understand the experiences of mothers in making health-promoting decisions for themselves and their families. Interviews were conducted with mothers living in rural communities which were audio recorded, transcribed, and coded. Codes were categorized to identify frequencies, patterns, and reoccurring themes. Themes included 1) pressures to prioritize family's needs over one's health, 2) family and social networks exerted contrasting influences on health choices, and 3) rural communities often limited health opportunities and resources. To close the PA gender gap, interventions should support mothers in navigating their multiple roles and demands while engaging in health promoting behaviors like PA.

THE EFFECTS OF FREEZE-THAW CYCLES ON SEED GERMINATION IN NATIVE AND INVASIVE FOREST SPECIES

Eliza Lindley
Mentor: Chad Zirbel

Forests provide valuable ecosystem services and habitat for biodiversity, but faced with increasingly erratic winter warming and competition with invasive species, successful recruitment of tree seedlings is threatened. Here, we test the effects of freeze-thaw events on germination success and seed survival, comparing two native and two invasive species. We subjected half the seeds to daily freeze-thaw, while the other half remained below freezing. We found that seed mortality was lower for invasive species, but more invasive seeds died when exposed to the freeze-thaw treatment than those that were not. Germination rates of native species significantly decreased in the freeze-thaw treatment, while germination of invasive species showed no significant difference. This suggests a competitive advantage for invasive woody species as freeze-thaw cycles become more common.

SINGLE RESIDUE MODULATION OF AN RNA-BINDING LANDSCAPE AND ITS CONTROL OF CELL FATE

MaryGrace Linsley
Mentor: Brian Carrick

Post-transcriptional control of gene expression by RNA-binding proteins (RBPs) is essential. RBPs often have multiple roles and can interact with other proteins to regulate RNA. C. elegans FBF-2 is an RBP responsible for two distinct functions in the germline: stem cell maintenance and the sperm/oocyte switch. In vitro, a single tyrosine (Y479) mediates FBF-2 binding to other proteins. We asked how Y479 functions in vivo by creating Y479A in fbf-2 using CRISPR-Cas9 mediated genome editing. FBF-2(Y479A) still maintains stem cells but loses its ability to specify the oocyte fate. FBF-2(Y479A) modulates binding to some mRNA targets and alters protein expression of these targets. We discovered a single residue on a conserved protein interaction interface altered the regulation of specific mRNAs and allowed separation of FBF-2 biological functions.

EXOSOME EXTRACTION FROM TUMOR CELLS AND MACROPHAGE

Jerry Liu
Mentor: Zhaoting Li

The goal of my project is the extraction of exosomes, which are considered a type of extracellular vesicle. The underlying mechanism of extraction is through filtration and ultracentrifugation of cells. There are also other extraction methods, each with pros and cons, which we aim to compare. The challenge is to determine the proper technique to extract exosomes at a high purity. Once extracted, exosomes can be used to diagnose diseases as each exosome carries a profile of the cell from which it originates. Exosomes also have potential therapeutic effects and use in drug and gene delivery. There are previous studies that modified exosomes to carry SiRNA to facilitate cancer cell therapy. Given its wide applications, exosomes are expected to be a fast-growing field of biological research for the years to come, making the extraction of which more crucial.

INVESTIGATION OF PATHWAY FOR CO2-INDUCED ANESTHESIA IN C. ELEGANS

Siyun Liu
Mentor: Han Wang

We studied how organisms behave differently when exposed to high concentrations of CO2 with the model organism C. elegans. We observed that wild-type C. elegans immediately enters an anesthetic state within a few seconds after applying CO2 above 75%, and it recovers within a few seconds after removing CO2. In strain JT722, which can detect the calcium level by showing different brightness of fluorescence of the neuron, we observed that the fluorescence of the detecting neuron is dimmer when applying high CO2, and it recovered the brightness a few seconds after removing CO2. This different behavior draws our attention, and we want to determine the neurons mediating the pathway behind this behavior and investigate if this different response is caused by the same signaling pathway that directs CO2-induced avoidance behavior, other pathway malfunction caused by some unknown gene, or the pH value changes of the environment.

TEACHING INDIGENOUS LAND DISPOSSESSION IN WISCONSIN: THE 1862 MOMENT

Claudia Liverseed
Mentor: Kasey Keeler

This project involves creating linked educational modules about the expropriation of Indigenous lands in Wisconsin through looking at the Morrill Act, which created land-grant Universities from the seizure and sale of Indigenous lands. The module I've worked on, The 1862 Moment, will provide key information on the broader context of the Morrill Act, while linking the Morrill Act to the Homestead Act, the Pacific Railway Act, the U.S.-Dakota War, the Civil War, and the creation of the USDA through the Organic Act, all of 1862. Together, these policies, events, and wars worked in tandem with the Morrill Act to alter Indigenous landscapes and communities. The educational modules allow the broader UW community to learn and reckon with this history and the present-day implications.

VIDEOS AND COMMENTS ABOUT ADHD ON TIKTOK

Faith Lopez
Mentor: Bradley Kerr

Attention-deficit hyperactivity disorder (ADHD) diagnoses have increased to a reported 10% of adolescents. Few studies have examined discussions of ADHD diagnosis on TikTok. The purpose of this study was to understand ADHD diagnosis content in TikTok videos and comments. This cross-sectional content analysis evaluated the first seventy-five TikTok videos under the hashtag ADHD and their top ten comments. Videos were evaluated for presence of personal experience, comedy/humor, and education (informational videos by physicians). Comments were evaluated for presence of disagreement (view that video content does not align with ADHD), agreement (view that video content aligns with ADHD), information (giving further information), and diagnosis disclosures. Findings may inform pediatricians about how adolescents may learn about ADHD diagnosis.

FRAGILE X SYNDROME VS AUTISM SPECTRUM DISORDER: BIOLOGY AND COMMUNICATION

Anna Lowe
Mentor: Andrew Alexander

Communication skills are impaired among individuals with Fragile X Syndrome (FXS) and Autism Spectrum Disorder (ASD). Furthermore, there are group differences in language perception and expression. The Peabody Picture Vocabulary Test (PPVT) and Expressive Vocabulary Test (EVT) along with other experimental measures were used to determine communication levels in boys (9-18 years old) with FXS and ASD. MRI was used to measure cortical thickness and R1 (myelination). This study investigated the group differences in cortical measures and the relationships between cortical measures in language regions to PPVT and EVT measurements. Significant group differences in cortical thickness were observed in brain regions. Associations were found between PPVT and R1 in receptive language regions of cortex and EVT in expressive language regions in both groups.

DIRECTED EVOLUTION OF NONRIBOSOMAL PEPTIDE SYNTHASE ENZYME EntF

Ivy Lucier
Mentors: Michael Thomas, Erin Conley

Nonribosomal peptide synthetases (NRPSs) are enzymes responsible for production of several important specialized metabolites, also known as natural products. Many natural products have properties that are of industrial and medicinal interest, making them an attractive target for engineering designer molecules. However, we first must learn how to change substrate specificity of NRPSs. This study uses NRPS EntF, which biosynthesizes the siderophore enterobactin, as a model to find the amino acid changes necessary to alter substrate specificity. We have created a directed evolution pipeline and found several mutants that have switched specificity. With this data, we aim to learn how to change substrate specificity from any amino acid to any other amino acid and create a knowledge base to aid creation of designer natural products.

USING GENE KNOCK-OUTS TO STUDY WXG/LXG OPERON EXPRESSION

Cora Luzinski
Mentor: Briana Burton

Found in both pathogens and nonpathogens, the Type VII secretion system (T7SS) is an understudied bacterial protein secretion system involved in interspecies competition. T7SS secretion substrates include both non-toxin proteins (WXG) and toxic proteins (LXG) encoded on WXG/LXG operons. As a nonpathogenic organism, it is unknown when Bacillus subtilis produces its LXG toxins to compete. We will test the expression of the eight WXG/LXG operons in Bacillus subtilis under various environmental and cellular conditions using transcriptional fusions of each WXG/LXG operon promoter with a GFP reporter. This is read by measuring the GFP emissions and OD readings for each reporter strain via a plate reader. Further combining the reporter strains with knock-outs of key regulators will reveal conditions important for T7SS activity in Bacillus subtilis.

INVESTIGATE THE ROLE OF GATA2 IN OVIDUCT AND UTERUS DEVELOPMENT IN MICE

Akil Maddineni
Mentors: Fei Zhao, Shuai Jia

Congenital defects in female reproductive tract organs are one underlying cause of infertility; however, the etiology for most of them remains incompletely understood. In this project, we identified a transcription factor Gata2 (GATA-binding factor 2) as a new critical player in the oviductal and uterine development. Removal of Gata2 in mice led to a shortened oviduct and hypoplastic uterus. These abnormal phenotypes indicate that cell proliferation and apoptosis could be affected during the formation of the oviduct and uterus. The aim of my research is to perform and quantify immunofluorescence staining of proliferation and apoptotic cell markers in control and Gata2 conditional knockout tissues. These will reveal whether cellular proliferation and or apoptosis contribute to the structural abnormalities observed in the absence of Gata2.

BIOENGINEERING SLICE-CULTURE MICROARRAYS OF THE DEVELOPING HUMAN CEREBRAL CORTEX

Jack Maher
Mentor: Randolph Ashton

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. Micropatterned culture models on 2D substrates allow cell aggregates to form a consistent and biomimetic structure. While advantageous, current techniques only model the initial stage of neural tube development. Here, I propose to conjugate an adhesive peptide on robot-micropatterned culture substrates, enabling radial outgrowth in bioengineered slice-cultures of the developing cortex. My goal is to optimize substrate and culture conditions which derive pseudostratified cortical neuron layers while maintaining a singularly polarized center, analogous to in-vivo corticogenesis.

HOW ARE RESEARCH ETHICS TAUGHT IN COLLEGE LEVEL COURSES? A QUANTITATIVE DIVE INTO RESEARCH METHODS IN PSYCHOLOGY TEXTBOOKS

Sneha Maheshwari
Mentor: Allyson Bennett

Knowledge about research ethics can help consumers of scientific research evaluate studies with an informed lens. We performed a quantitative analysis of the curriculum covered in research ethics in college-level Psychology courses. We examined Research Methods in Psychology textbooks (N=30) and quantified the depth of ethics coverage using page count, figures, tables, and review questions about ethics. We coded for ethics topics to compare the prevalence of human versus nonhuman animal research ethics content. On average, research ethics content comprised 4.7% of the books' content, and human participant ethics were significantly more prominent than animal subject ethics across all four categories (pages, figures, questions, $p<.001$; tables, $p=.003$). These findings provide preliminary descriptive knowledge to inform continuing improvements in teaching research ethics.

DEVELOPING A LABEL-FREE, NON-INVASIVE POTENCY-ON-A-CHIP ASSAY FOR CHIMERIC ANTIGEN RECEPTOR (CAR) T-CELLS

Lizzie Maly
Mentors: Dan Pham, Melissa Skala

CAR T cells are genetically engineered T cells that target specific antigens on tumor cells, a promising new immunotherapy, but is facing challenges in solid tumor response. Current 2D dish co-culture studies lack single cell tracking capabilities over time and the ability to easily modify/control Effector:Target ratio. Using a unique microfluidic device designed to isolate cells in separate chambers, we can facilitate cellular interactions between CAR T cells and target cancer cells while controlling the effector to target (E:T) ratio, overcoming the limitations of 2D co-culture systems. Additionally, by performing OMI (Optical Metabolic Imaging), a label-free, non-invasive multiphoton microscopy imaging technique, on these co-cultured systems, individual cellular metabolic activity can be measured and correlated with killing efficiency. We will determine the relationship between CAR T metabolism, effector to target ratio and CAR T killing efficiency using OMI and microfluidic devices. Understanding metabolic changes between different t-cell killing efficiencies will help improve CAR T cell products to ultimately improve the efficacy of treatment.

ASSOCIATION BETWEEN RESPIRATION RATE AND ANXIETY AND PTSD DURING ONE SESSION OF "DEEP" VIRTUAL-REALITY BIOFEEDBACK TREATMENT IN DETAINED ADOLESCENTS

Abdullah Marei
Mentor: Ryan Herringa

Detained adolescents are heavily understudied in clinical research despite experiencing disproportionately higher rates of trauma than the general population (Rivenbark et al., 2018). Weerdmeester et al. (2021) argue that virtual-reality biofeedback (VR-B) reduces anxiety through regulating physiological functions. In this pilot study, I examined the feasibility of VRB in treating anxiety and PTSD by looking at correlations between symptoms and RR at baseline. Ten detained adolescents (aged 10- to 16-year-old) were recruited from the Dane County Juvenile Detention Center to complete one "DEEP" VRB session. Anxiety scores were significantly correlated with respiration rate at baseline ($p = 0.047$) However, PTSD symptoms were not significantly correlated with RR at baseline ($p = 0.79$). Additional research could explore the potential of VRB for treating PTSD symptoms.

WHO OWNS DISCIPLINE? A POETIC INQUIRY OF ARTS PROGRAMMING

Cassidy Lynn Martin
Mentor: Erica Halverson

Using poetic inquiry (Saldaña, 2011) the original language of researcher's observations, has been extracted into three poetry collections to depict the stories of when students versus teaching artists own discipline. These collections are titled The Power of Drums, The Performance of Ourselves, and Something Extraordinary. We analyzed the observational data across three arts programs to understand who is owning discipline through behavior, particularly when students display behaviors that are traditionally described as defiant or disruptive. To help guide this research we have asked: (1) How can poetic inquiry give us a deeper understanding and better visualization of the connections in arts programming? (2) In what ways does arts programming create an environment that fosters leadership and exploration?

WIRELESS IN VIVO RECORDING OF CORTICAL ACTIVITY BY AN ION SENSITIVE FIELD EFFECT TRANSISTOR DETUNING A SINGLE RADIO FREQUENCY RESONATOR

Emily Masterson
Mentor: Aviad Hai

Wireless brain technologies empower neuroscience by offering platforms that minimize invasiveness and refine possibilities during electrophysiological recording and stimulation. Despite their advantages, most systems require on-board power supply and sizable transmission circuitry, enforcing a lower bound for miniaturization. Designing minimalistic architectures that sense neurophysiological events opens the door to microscale sensors and minimally invasive delivery of sensors. We present a circuit for sensing ionic fluctuations in the brain by an ion-sensitive field effect transistor that detunes a radiofrequency resonator in parallel. We establish sensor sensitivity by electromagnetic and in vitro analysis and validate this architecture in vivo during rodent hindpaw stimulation and verify correlation with local field potential recordings. This can be implemented as an integrated circuit for wireless in situ recording of brain electrophysiology.

SEARCHING FOR NEW PLANETS OUTSIDE THE SOLAR SYSTEM

Devansh Mathur
Mentor: Thomas Beatty

The Milky Way pales in comparison to the scale of the universe, yet there are approximately 200 billion stars, and on average each star has at least one planet orbiting it. These extra-solar planets reveal details about our own place in the universe, and most importantly, how life came about. As of today, we have confirmed the existence of 5200+ exoplanets, and this project aims to contribute to this growing body of knowledge. Using the Radial-Velocity (RV) method and Bayesian statistics, we are able to pinpoint which stars may have planets orbiting them. The RV method has been successful in detecting and characterizing habitable planets and this project aims to build on the search for planets outside our solar system.

FEW TREES, LITTLE CARBON? ABOVEGROUND CARBON STOCKS IN AREAS OF POOR FOREST RECOVERY 35 YEARS AFTER FIRE

Eileen Mavencamp
Mentors: Monica Turner, Nathan Kiel

Anthropogenic climate change is increasing wildfire activity throughout the western U.S., but it is unclear if forest ecosystems will continue to recover after fire and rebuild their carbon (C) stocks. At high elevations, forests dominated by fire-sensitive tree species already show signs of reduced postfire tree establishment. Measuring the pools of aboveground C where tree regeneration remained sparse 35 years after the historic 1988 Yellowstone Fires may determine how decreased tree recovery affects rates of postfire C accumulation. Allometric equations were used to estimate aboveground C stocks in these areas, and these results were contrasted with C stocks where tree recovery was robust. Recognizing how variation in postfire forest recovery affects C stocks is critical for determining how C balance may change as fire activity rises.

INSERTION AND INGESTION AS FORMS OF SELF-HARM IN FORENSIC ENVIRONMENTS: A SCOPING REVIEW

Emma McCoy
Mentors: Michael Koenigs, Katie Pereira

Incarcerated individuals are at particular risk for non-suicidal self-injurious (NSSI) behaviors. However, there is limited research examining the characteristics of specific subtypes of NSSI, such as insertion or ingestion, in correctional facilities. Thus, this scoping review intends to understand the extent and type of literature conducted on insertion and ingestion as forms of NSSI in forensic settings. This review follows the guidelines of conducting scoping reviews established by the Joanna Briggs Institute to consider empirical studies that investigated insertion and ingestion behaviors among incarcerated individuals residing in correctional settings. A comprehensive literature research was conducted by a medical librarian. Keywords for NSSI behaviors and correctional settings were included. Results were screened within Covidence by title and abstract and then full text by two independent reviewers.

NEWS REPORTING ON SOCIAL MEDIA AND DEPRESSION: EXPLORING GENDER

Grainne McDonagh
Mentors: Megan A. Moreno, Maggie Bushman

Depression and social media are often explored in news reports. The purpose of this study was to examine a decade of public news articles to understand gender associations with reporting of this topic to recognize who is included and the most common narrative of public consumption. Fifty-nine articles were evaluated. A content analysis was used to investigate journalists' and quoted sources' self–identified gender. The Linguistic Inquiry Word Count (LIWC) Analysis software was used to further understand differences in word choice including anxious language. Both journalists and quoted sources were mostly female. Articles written by female journalists used significantly more anxiety-related words. These findings could lead to refined training for all journalists and better understanding of public news consumption.

IMPACT OF NEPHRONECTIN ON MOUSE LUNG FIBROBLAST BIOLOGY

Marshal McGauley
Mentors: Lynn Schnapp, Carole Wilson

Nephronectin (NPNT) is a basement membrane protein and ligand of integrin α8 that is expressed by epithelial cells and fibroblasts in the lung. To study the role of NPNT in lung fibroblasts, we used mice deficient in NPNT or α8 to isolate and characterize these cells. We showed that the absence of NPNT in fibroblasts did not affect expression of matrix proteins (laminin, collagens I and IV) or α8. Chemokine expression was not different between WT and NPNT knockout (KO) cells after inflammatory stimulation. NPNT deficiency also did not alter fibroblast migration. We showed that α8 KO fibroblasts have minimal adherence to NPNT, confirming that these proteins interact. Our studies suggest that extracellular NPNT promotes fibroblast adhesion and possibly signaling through α8.

STUDYING SEVERE WEATHER AND CLIMATE WITH THE APPLICATION OF NASA AND NOAAS

Molly McKellar
Mentor: Mayra Oyola-Merced

The main objective is to look at satellite data over tropical storms to examine their thermodynamic environment. A variety of different storms, like Hurricane Fiona and Ian, are compared using satellite datasets from NASA and NOAA, as well as python modules, such as cartopy, to analyze different storms and see what information the satellites have captured. Using this information, we can compare the capabilities of different satellites and how they are used to forecast hurricanes. More specifically, we are looking at changes in the tropopause height and how it varies with developing storms and how it may be related to tropical cyclone intensification. Radio occultation and supportive datasets like IMERG and GOES allow us to identify changes in tropopause height throughout the duration of a tropical cyclone. While there is no correlation between the number of storms and climate change, studies indicate that changes in climate influence storm intensification, meaning we may see stronger storms in the future. This means people who live in areas where hurricanes are prominent may face increasing danger. Forecasting these storms is vital in protecting lives and planning for severe weather. Our final goal, which is to develop an accessible database of tropopause heights during hurricanes using radio occultation, has the ability to provide information that could help with understanding tropical cyclones that could aid in forecasting.

UNPREDICTABILITY AND MOTIVATION IN INSTRUMENTAL LEARNING IN ADOLESCENTS

Kinjal Mehta
Mentors: Lillian Xu, Seth Pollak

Adaptive learning requires flexibly executing or inhibiting actions based on feedback. Yet little is known about how the type of feedback (monetary versus affective) influences action learning, and how childhood experiences shape feedback sensitivity. In this study, we explored whether unpredictability, an important but currently understudied dimension of childhood adversity, influences action learning in the context of affective feedback using a modified Go/No-Go task. We found that children with less nurturing or predictable parents were more flexible in learning the correct actions, whereas children who experienced volatile income or change of parental custody were less flexible. These findings suggest that individual differences in action learning could result from different use of feedback information, which is shaped by childhood experiences.

THE RELEVANCE OF ADAPTATION PATHWAYS TO ADDRESS GREAT LAKES COASTAL HAZARDS IN A CHANGING CLIMATE

Lily Meisel
Mentor: David A. Hart

Adaptation pathways are an emerging method to address the uncertainties associated with a changing climate by keeping a range of options open as new stressors are experienced. Thoughtful pathways can aid in the reduction of natural hazards, but it can be difficult for communities to identify tipping points to initiate action and visualize alternative approaches to build community resilience across different timeframes. Using an interactive story map, I will start by identifying the key elements of an adaptation pathways approach. This will be followed by short case studies from around the world highlighting how adaptation pathways have been applied to increase community resilience to coastal hazards. Finally, recommendations will be drawn from the case studies to guide application of adaptation pathways to address Great Lakes coastal hazards as new knowledge emerges about climate change.

MESENCHYMAL STROMAL CELL (MSC) INTERVENTION IN ACUTE MURINE SUBMANDIBULAR GLAND (SMG) RADIATION DAMAGE

Lauryn Melzer
Mentor: Randy Kimple

Xerostomia is a common condition defined as dry mouth which can be caused by radiation. Mesenchymal stromal cells (MSC) have been proven to reduce xerostomia symptoms, but we are unsure of their mechanism. Radiation (15 Gy) was delivered to the SMG of C57B/l6 male mice (n=36); MSCs (250K cells) were injected into each SMG 1 day after radiation; salivary flow was measured monthly; SMGs were harvested and evaluated histologically to examine potential mechanisms (e.g., A-amylase, mucin, MIST1, Ki67, Massons-trichrome, and macrophages). We will present data quantifying alterations induced by RT and MSCs.

hERG1b SPECIFIC ANTIBODIES REVEAL CRITICAL REGION FOR hERG HETEROMERIZATION

Ethan Joseph Mendenhall
Mentor: Erick Rios Perez

Cardiac human Ether-a-go-go Related Gene (hERG) encodes the main ion channel responsible for ventricular repolarization. It has been shown that in the heart, this channel is composed of two subunits, hERG1a and hERG1b. Functional hERG channels are heterotetramers of hERG1a/1b. Both subunits are composed of six transmembrane domains, an N-terminal domain, which in hERG1a contains a Per-Arnt-Sim (PAS) domain, not present in hERG1b, and the C-terminal domain including a Cyclic Nucleotide Binding homology Domain (CNBhD), present in both subunits. PAS-CNBhD interaction determines the biophysical properties of hERG channels crucial for repolarization. Here, we propose to study the PAS-CNBhD interaction using single chain variable fragment antibodies specific to hERG1b and patch-clamp. We hypothesize that the antibodies will allow us to identify key regions for hERG1a/1b heteromerization.

UNDERSTANDING THE BIOPHYSICAL PROPERTIES OF hERG 1b IN LIVING CELLS

Leslie Mendoza-Villanueva
Mentor: Gail Robertson

The human ether-a-go-go gene (hERG) is essential for cardiac repolarization which stimulates and maintains the heart's regular contractions to pump blood to the body. Defects in hERG can lead to sudden cardiac death and arrhythmias, the improper beating of the heart. Isoforms of hERG (1a and 1b) assemble to form hERG1a/1b. From previous findings, hERG 1b retained the ER (endoplasmic reticulum) without 1a; traffic to the plasma membrane resulted only when 1a is present. When we express hERG 1b in Hela cells, which usually do not express any hERG isoforms, we see a punctate-like structure. We are using molecular cloning, transfection, and live imaging to explore what are the structural determinants of phase separation of 1b and the behaviors of 1b when certain regions are deleted.

INVESTIGATING THE RELATIONSHIP BETWEEN INHIBITORY CONTROL IN CHILDREN AND THE WHITE MICROSTRUCTURE BY UTILIZING FNIRS IMAGING AND MULTICOMPONENT RELAXOMETRY

Rishi Mereddy
Mentors: Doug Dean, Marissa Di Piero

Recently, research into the developing brains of children has made great progress. Magnetic resonance imaging and functional magnetic resonance imaging have allowed for understanding of the activated regions in a child, but only during sleep. Functional near-infrared spectroscopy (fNIRS) is an imaging process that is child-friendly and can be used while the child is awake. fNIRS in combination with the multi-component driven equilibrium single pulse observation of T1 and T2 technique can be used to quantify both the functional change, specifically inhibitory control, associated with age and sex and underlying white matter microstructure in brain that may mediate this change. Research into this relationship is lacking. More research will provide insight into the developing brain and its function during a critical time for development.

THE CONSISTENCY OF INDIVIDUAL ADAPTATION IN RESPONSE TO ALTERED AUDITORY FEEDBACK

Bailey Meyers
Mentor: Benjamin Parrell

Auditory feedback plays a vital role in an individual's maintenance of accurate speech production. When this feedback is altered through manipulation of formants (resonant frequencies of the vocal tract), individuals perceive an auditory error and consequently adapt their own speech to counteract this perturbation. Though there are clear group effects of adaptation in response to altered auditory feedback (AAF), there is great variability across individuals' adaptive response magnitudes. Here, we present individuals with AAF by altering the first formant during two separate testing sessions, each including two testing blocks. We seek to understand individual consistency within and across sessions and across stimuli. Rates of re-adaptation and de-adaptation to AAF are also analyzed to provide insight into the relationship between upper limb and speech motor control.

HOW CORALS FORM THEIR SKELETON, ANALYZED WITH SYNCHROTRON SPECTROMICROSCOPY AT THE NANOMETER SCALE

Jaiden Mezera, Samantha Anglemyer
Mentors: Pupa Gilbert, Connor Schmidt

This research aims to identify the factors that allow some species of coral to better withstand ocean acidification. Through the use of the Advanced Light Source synchrotron and PEEM spectromicroscopy, x-ray images of forming coral skeletons are obtained, with 60 nm resolution, and spectroscopic analysis, allowing us to see where different mineral phases are present in the coral skeleton. This will help to determine how the composition of different species of coral relates to its ability to withstand ocean acidification. Previous research has found that some species of coral are less vulnerable to ocean acidity due to the process by which they're formed. The information gained from these experiments is vital in saving beautiful and economically important coral reefs and the entire ecosystems they support.

EVOLUTIONARY DIVERGENCE AND CONSERVATION OF GRYLLOBLATTA (ICE CRAWLERS)

Madeline Michaelis
Mentor: Sean Schoville

Grylloblatta, or ice crawlers, are cold extremophile insects found in western North America. Due to their low vagility, populations are susceptible to isolation and rapidly diverge into new species. Grylloblatta are at risk of extinction, due to small population sizes and restricted geographic ranges. In this project, we work to analyze evolutionary divergences among Grylloblatta around the Washington-Oregon border and identify new species that may better inform the focus of conservation efforts. To accomplish this, we examine mitochondrial DNA sequence data to quantify sequence divergence and reconstruct the relationships of 47 individuals. We find new species and extend the geographic range of previously described species to low elevation habitats. These results inform efforts towards conservation of these species to reduce the risk of their extinction.

BALDUNG AND THE WOMAN: INVESTIGATING SEXUAL VIOLENCE IN EARLY MODERN NORTHERN EUROPE

Anna K. Michalski
Mentor: Jennifer Nelson

The art of early modern artist Hans Baldung Grien (1484/1485-1545) demonstrates how images can be religious, pornographic, and persuasive. Baldung often utilized the motif of "death and the maiden," in which a decaying, skeletal figure of death attacks a young woman. Though these works are disguised as images of the Fall of Man, they were also used for sexual purposes. I argue that these images also reflect the dangerous attitudes and intense violence to which women were subjected. Images like those of "death and the maiden" are rooted in fear and hatred of women's sexuality that dominated early modern culture. By recentering the narrative around experiences of early modern women, I find that they were still able to exercise agency, despite the violations they faced.

EFFECTS OF NATURALISTIC LARGE GROUP SYNCHRONY ON PROSOCIALITY

Karina Miller
Mentors: Michelle Marji, Paula Niedenthal

Synchronous movement within a group has been shown to increase prosocial attitudes (Wiltermuth and Heath, 2009). The majority of this research has focused on small-to-medium sized groups interacting within lab settings. In this study, we utilized a large, naturalistic group that synchronizes, the UW–Madison marching band (N=267), to further analyze the connection between synchrony and prosociality. We also looked at role, defined as leader vs. follower, as a potential moderator for the synchrony-prosociality relationship. Our method included drone footage and self-report surveys. We found that synchronous behavior is linked to increased feelings of group fusion, a form of attitudinal prosociality. This research has important implications for understanding the prosocial and intragroup effects of synchronized movement.

A SEARCH FOR KINEMATIC INFLOW SIGNATURES IN SIMULATED MOLECULAR CLOUDS

Jakob Mills
Mentors: Snezana Stanimirovic, Min-Young Lee

The relatively poor understanding of the very beginnings of star formation is extremely detrimental to our understanding of the Universe we inhabit. Using TIGRESS simulations of solar neighborhood-type regions of the interstellar medium, we focus on a close investigation of the kinematic structure and evolution of molecular clouds and their surrounding neutral hydrogen halos. By tracking these clouds across millions of years of evolution, we will identify important kinematic signatures that can be searched for in observational data. We will also apply our analysis to understand molecular clouds in many different interstellar environments, from areas with extensive high-density interacting structures to isolated molecular clouds that may only interact with their neutral hydrogen halos.

AORTIC CATHETERIZATION, PROBING THE GRAY AREA

Diego Izaak Miranda-Gandarilla
Mentor: John S. Hokanson

Aortic coarctation is a potentially fatal congenital heart defect that can significantly reduce lifespan. For decades, surgery has been the main course of treatment. Recently, however, catheter-based treatment strategies have evolved. As available treatments expand, choosing the best treatment option and when to use it becomes more complicated. Through our research, we will be able to show what is considered the current best practice for the care of people with aortic coarctation where there is no clear course of treatment. To collect data, I created an electronic survey that will be sent to pediatric cardiologists and congenital heart surgeons, anticipating preliminary results in April. Our goal is to enhance personalized patient care for aortic coarctation cases where the best treatment option may not be obvious.

THE ROLE OF TIMP-1 AFTER SPINAL CORD INJURY

Raveena Mishra
Mentors: Amgad Hanna, Dan Hellenbrand

Spinal cord injury (SCI) is a traumatic injury that typically results in permanent loss of motor function and sensory function. Several inflammatory cytokines are upregulated following SCI in rodents and cause secondary damage. However, tissue inhibitor of metalloproteinases (TIMP-1) is also normally upregulated post-injury, and it promotes astrocyte proliferation among many functions. If further upregulated after SCI, TIMP-1 could attract astrocytes to the compromised blood vessels and attenuate the immune response, lessening the secondary damage. The objective of this study was to quantify the inflammatory cytokines that are present 24 hours after SCI when TIMP-1 is injected via tail vein injection one hour post-SCI. It was found that inflammatory chemokines and cytokines levels are not significantly different between injured control and TIMP treatment rats.

FLEXIBLE, MODEL-AGNOSTIC METHOD FOR DATA EXTRACTION FROM TEXT USING GENERAL PURPOSE NATURAL LANGUAGE PROCESSING

Shrey Modi
Mentor: Maciej Polak

Materials science and engineering require accurate and comprehensive material databases extracted from research papers. However, the process demands significant human effort. We propose a simple method of extracting materials data from full-text research papers, resulting in a quickly developed database. The technique requires minimal or no coding, previous knowledge about the property, or model training. It delivers high recall and nearly perfect precision in the resultant database, thanks to natural language processing and large general language models such as GPT-3/3.5, bart, and DeBERTaV3. An analysis of the method's performance in extracting bulk modulus data is provided, with precision up to 90% at 96% recall. A database of critical cooling rates for metallic glasses is developed, demonstrating the effectiveness of the approach.

CHEMICAL MODULATION OF INTERSPECIES QUORUM SENSING BETWEEN PSEUDOMONAS AERUGINOSA AND BURKHOLDERIA MULTIVORANS

Diana A Morales Mijares
Mentors: Helen Blackwell, Lupe Aguirre-Figueroa

Quorum sensing (QS) modulates gene expression and induces group beneficial behaviors. QS enables bacteria to sense when critical population density has been achieved and stimulates gene expression that ensures bacterial success through production of virulence factors and the growth of biofilm communities. Previous studies have suggested that Pseudomonas aeruginosa and Burkholderia multivorans can perceive the others QS signals. The purpose of this research was to examine whether non-native inhibitors can modulate interspecies QS interactions between Pseudomonas aeruginosa and Burkholderia multivorans, whilst aiming to achieve high efficacy and good potency in several generations of inhibitors. Our lead compounds have increased potency and efficacy compared to the initial generations of inhibitors synthesized. Future directions include examining our lead compounds in a model disease organism.

PAIN AND POST-OPERATIVE DELIRIUM IN OLDER ADULTS

Henry Morrison
Mentor: Richard Lennertz

Postoperative delirium is the most common surgical complication for older adults. The association between pain and post-operative delirium is unclear. Using data from the Interventions for Postoperative Delirium: Biomarker-3 (IPOD-B3) cohort study (NCT03124303), we examined the relationship between baseline pain and postoperative delirium, change in pain and delirium, and pain at 90 days for patients with delirium. 104 patients were included. There was an upward trend in the relationship between average pain and delirium, no relationship between baseline pain and postoperative delirium ($p=0.7926$), and no correlation between change in pain and change in delirium. 90-day pain did not vary for patients with delirium. Our results do not show an association between pain and post-operative delirium.

SYMPTOM RECOGNITION AND ALLEVIATION STRATEGIES OF ADULTS LIVING WITH CANCER IN RURAL AREAS: A LITERATURE REVIEW

Mattigan Mott
Mentor: Kristine Kwekkeboom

Prior research on the symptom experiences of patients with cancer has emphasized those cancer patients of urban and suburban residence. The purpose of this literature review is to explore what adults living with cancer in rural areas are doing to recognize and alleviate their symptoms. More specifically, investigated the potentially unique means by which rural cancer patients recognize and alleviate their cancer-related symptoms. PubMed and CINAHL databases were searched for studies within the last 20 years (2002 - present) that addressed the question. Findings revealed that adults living with cancer in rural areas face unique cultural, social, and structural barriers that impact their ability to both recognize and alleviate their cancer-related symptoms.

IS VARIABILITY ACTIVELY CONTROLLED IN RESPONSE TO VISUAL PERTURBATIONS IN REACHING?

Erin Murdoch
Mentor: Ben Parrell

Whenever we produce a movement, it deviates from our plan. It is unknown if motor variability is inherent to the sensorimotor system or if it can be actively controlled. Previous research in our lab suggested there is an actively controlled component to motor variability in speech. It was not possible to causally test whether error calculation truly increased due to inaccuracies inherent to acoustic measures of speech behavior. Here, we replicate and expand our previous study through two experiments using reaching behavior, as it can be measured more precisely. This allows us to test 1) the universality of the behavior seen in speech, and 2) if the hypotheses about the sources of the observed variability increases generated from our computational model have empirical support.

EVALUATING CAREGIVER ADMINISTRATION OF EXECUTIVE FUNCTION TABLET ASSESSMENT IN DOWN SYNDROME

Jamie Musoff
Mentor: Emily Schworer

Research studies that include children with Down syndrome (DS) often rely on in-person testing, and there is a growing need for updated methods to remotely monitor outcomes with home assessments supervised by caregivers. This study examined caregiver and child behaviors during an executive functioning tablet task, the NIH Toolbox Dimensional Change Card Sort (DCCS), and compared caregiver behaviors to the children's performance to determine if caregivers administered the task appropriately. DCCS Computed Scores were not correlated with any caregiver behaviors when controlling for child age. Caregiver redirection of child off-task behavior was positively associated with the frequency of repeating instructions and negatively associated with child attention. Understanding caregiver behavior is essential for remote monitoring of cognitive assessments to ensure validity and accuracy of task administration.

EXPLORING GENDER AND ETHNICITY BIAS IN LETTERS OF RECOMMENDATIONS FOR PLASTIC SURGERY RESIDENCY APPLICANTS USING NATURAL LANGUAGE PROCESSING TECHNIQUES

Tanay Nagar
Mentor: Sarah Jung

Changes in the evaluation of prospective applicants to Plastic Surgery Residency programs has made it difficult to find objective ways of comparing applicants, making the Standardized Letter of Recommendation (SLOR) integral to the selection process. This study will utilize a dictionary categorized by textual cues along with a text analysis engine to explore gender and ethnicity-based differences/bias in the SLOR submitted by applicants to Plastic Surgery Residency Programs. Most previous studies performed on the SLOR have detected some bias in writing, although none have targeted the Plastic Surgery Field specifically. The results of this study, along with previous results, can be used to gain insight on the occurrence of biases and may be further utilized to create guidelines to mitigate implicit bias and reduce differences.

INVESTIGATING SDHB IN CARDIAC REGENERATION

Raya Nahlawi
Mentors: Ahmed Mahmoud, Wyatt Paltzer

Heart failure is the leading cause of death in the US. The long wait for heart transplants and the risk of graft rejection has motivated heart regeneration research. The loss of cardiac regeneration is associated with a metabolic switch from glycolysis to oxidative phosphorylation. Succinate Dehydrogenase (SDH) is a central enzyme in mitochondrial metabolism. Pharmacologic SDH inhibition can promote cardiac regeneration by inducing a metabolic switch from oxidative phosphorylation to glycolysis. It remains unknown whether cardiomyocyte-specific inhibition of SDH by genetic deletion of SDH Complex subunit B (SDHB) can promote heart regeneration following myocardial infarction (MI). My project investigates the role of SDHB in cardiomyocyte proliferation and heart regeneration, with the overall goal of identifying new targets for heart failure treatment.

CAN COMMERCIALLY AVAILABLE FIELD TESTS RELIABLY DETECT TRACE METHAMPHETAMINE?

Wiliam Naviaux
Mentor: Heather Barkholtz

The goal of this research was to investigate commercially available methamphetamine detection devices and determine their accuracy and reliability. Before this research none of the available devices had been tested in a peer-reviewed fashion. The goal of this research is to ensure that testing methods for methamphetamine surface contamination have peer-reviewed research to allow public health officials and other users of these tests to understand the limitations and actual capabilities of these tests when used to make remediation and safety decisions. Additionally a LC-MS/MS quantification method was developed to provide an additional option for end users of the tests.

BICAUDAL-C INTERACTION WITH mRNAs AND ITS ROLE IN TRANSLATION

Megan Nchekwaram
Mentors: Michael D Sheets, Maya Walker

Bicaudal-C (Bicc1) is a highly conserved RNA-binding protein. Bicc1 targets specific mRNAs and limits their translation to impact the synthesis of proteins they encode. Proteins whose synthesis is controlled by Bicc1 have important functions, especially in cells of developing embryos. When Bicc1 is defective, it inadequately affects the translation of Bicc1 target mRNA's and alters the fate of embryonic cells. Our question is how Bicc1 recognizes and binds to specific mRNAs to control their translation. Currently, my project is to generate Caenorhabditis elegans Bicc1 proteins by expressing it in E. coli. I will then analyze the protein's ability to bind to mRNAs through biochemical assays.

IMPLICATIONS OF CORN PERICARP EXTRACT (CPE) AS A NATURAL ANTIMICROBIAL PRESERVATIVE IN THE MEAT INDUSTRY

Ashley Nelson
Mentors: Vanessa Leone, Evan Chrisler

In the United States, ~48 million people experience food-borne illness annually, mostly attributed to consumption of raw or undercooked animal products. Some foodborne pathogens can alter meat's natural microbial composition, leading to increased spoilage rates and waste. There is pressure on the meat industry to identify safe and cost-effective alternative natural preservatives to combat product spoilage by inhibiting microbial growth and preventing oxidation. However, high inclusion rates, unpleasant aromas, and cost limit utility of current options. My objective is to investigate antimicrobial properties of corn pericarp extract (CPE), an abundant byproduct of corn ethanol production, as a natural preservative for raw meat products. I hypothesize CPE will 1) inhibit food-borne pathogen growth, and 2) maintain normal microbial communities in raw meat products during long-term storage.

WHAT IS REQUIRED TO BE A MODELER

Jaelyn Nelson, Chrystyna Prokulevich
Mentor: Paul Kelly

Models are important in the scientific process. Using models, scientists can discover features of reality. In the current philosophical literature, one of the most influential attempts to explicate what models fundamentally are is the inferentialist account (Khalifa, et al. 2022). The inferentialist account emphasizes the ability of models to facilitate surrogative reasoning, through which scientists can obtain answers to questions. Through such questioning, scientists are able to learn about the world and how the model relates to it. Our proposal aims to strengthen the inferentialist account by adding another layer to it, by considering who a modeler is, and what abilities are necessary to be considered one.

MiNAA: MICROBIOME NETWORK ALIGNMENT ALGORITHM

Reed Nelson
Mentor: Claudia Solis-Lemus

Network alignment algorithms match nodes between two networks according to their similarity. Traditionally, similarity has been defined topologically, such that the neighborhoods around the two nodes have similar structure. Recent network alignment implementations also include measures of biological similarity, yet these methods are restricted to one specific type of biological similarity. Our work extends existing implementations by allowing any type of biological similarity to be inputted by the user. This flexibility allows the user to choose whatever measure of biological similarity is suitable for the study at hand. Additionally, while most existing network alignment methods are tailored for protein or gene interaction networks, this work is the first one suited for microbiome networks.

GIRK2 EXPRESSION IN THE SUBSTANTIA NIGRA OF HEMIPARKINSONIAN CYNOMOLGUS MACAQUES

Lindsey Neumann
Mentor: Marina Emborg

Girk2 is a neuronal protein expressed in dopaminergic neurons. In Parkinson's disease, there is a dopaminergic neuronal loss in the substantia nigra pars compacta (SNpc), and girk2 expressing dopaminergic neurons seemed to be more vulnerable. Non-human primates are widely used as models of Parkinson's, yet little is known about girk2 expression in their brains. Here we analyzed girk2 expression in the SN of cynomolgus macaques (n=5) that received a unilateral intracarotid arterial injection of the parkinsonian toxin MPTP and were euthanized 3 months later. Quantification of girk2 showed a significant unilateral loss of expression in the MPTP treated SN. These results demonstrate that girk2 is expressed in the SN of non-human primates and is affected by the parkinsonian drug MPTP.

PREPUBERTAL LEUPROLIDE TREATMENT ASSOCIATED WITH LOWER ANXIETY LEVELS AND MAINTAINED SOCIAL BEHAVIOR IN FEMALE SPRAGUE-DAWLEY RATS

Amber Nguyen, Eden Lev
Mentor: Anthony Auger

Increased mental health for transgender individuals is contingent upon access to gender-affirming healthcare. We examined the effects of the hormone blocker, Leuprolide, on anxiety and play behavior. We used a rat model and conducted behavioral assays on female rats. Using an ethogram, we scored the play behavior for statistical analysis. We found that Leuprolide had no association with play behavior time differences in female rats. However, there were statistically significant differences that lead us to conclude that Leuprolide was associated with decreased anxiety behaviors in the female rats. We also examined neurogenesis markers using PCR analysis involved in anxiety and depressive behaviors. Further investigation is required to determine how these markers are impacted by Leuprolide.

CONJUGATION OF cMET INHIBITOR PEPTIDE AND RADIONUCLIDES TO DENDRIMER FOR TARGETING LUNG CANCER

Hung Long Nguyen
Mentors: Seungpyo Hong, JinWoong Lee

In the United States, lung cancer is the leading cause of cancer death and about 1 in every 15 men will develop lung cancer in his lifetime. Conventional drugs used for treatment based on monoclonal antibodies have some limitations due to their high price and side effects on the immune system. Therefore, a new cancer drug carrier using dendrimer, a nano-sized synthetic macromolecule, is being investigated to solve the issues. cMET peptides are highly expressed in various types of cancer and by blocking the cMET protein, the proliferation of tumors will be inhibited. Our research conjugates cMET inhibitor peptide and radionuclide chelator to generation 7 poly(amidoamine) dendrimer (G7) to create a drug that can inhibit cMET protein and shows therapeutic effects.

CONTENT AND ADOLESCENT-SPECIFIC DISCUSSIONS IN FACEBOOK SUPPORT GROUPS FOR PARENTS OF CHILDREN WITH ASD

Gracey Niedzielak
Mentor: Bradley Kerr

Autism Spectrum Disorder (ASD) affects 10% of adolescents. Adolescents with ASD tend to experience more challenging behaviors than adolescents with other developmental disabilities. There are few studies around ASD-focused parental support groups on Facebook. The purpose of this study was to evaluate the content of Facebook support groups for parents of children with ASD, including adolescent-specific discussions. In this cross-sectional content analysis study, the first ten posts and their first five comments within ASD support groups were evaluated. Measures included whether posts referenced behavior and venting and whether groups were adolescent-focused. Findings show common discussions of behavior and venting across all groups and few support groups for parents of adolescents with ASD.

IMPACT OF HOUSING STRATEGY ON HEALTH, WELFARE, AND PRODUCTION OF LAYING HENS

Annabel Noel
Mentor: Vanessa Leone

Concerns for laying hen welfare have resulted in shifts toward alternative housing strategies in the poultry industry. We examined how conventional (CONV) vs. aviary-style (AS) housing impacts bone quality and egg production. Age-matched and identically-housed laying hens (n=120, 60/treatment) were maintained in CONV cages or shifted to AS and fed identical diets for 3 months. Bone quality assessment on right tibias revealed no differences between AS and CONV housing in midshaft breaking strength, bone mineral content, and hen egg day production. However, average whole ($p < 0.05$), proximal ($p < 0.05$) and distal ($p < 0.005$) region bone density measured via CT was significantly higher in AS vs. CONV hens. These findings indicate that AS may delay osteoporosis onset relative to CONV housing.

THE IMPACT OF SEX ON CEREBRAL PULSATILITY ACROSS THE LIFESPAN

Alexander M. Norby
Mentors: Jill Barnes, Brandon Fico

Cerebral pulsatility refers to the amount of pulsatile energy transmitted through blood flow to the cerebral vessels in each cardiac cycle, which is measured as pulsatility index (PI). The ability to dampen pulsatility decreases as one ages, largely due to arterial stiffness. Importantly, it has been hypothesized that increased pulsatility elevates the risk of cognitive decline and cerebrovascular disease. Interestingly, females are disproportionately affected by cognitive decline and cerebrovascular disease. Therefore, we analyzed 4D Flow MRI hemodynamic data on males and females in young (n=43), middle-aged (n=40), and older adults (n=40). Young and middle-aged males had higher internal carotid artery (ICA) PI than females, but older females had higher ICA PI than males suggesting that there are sex differences in cerebrovascular aging.

INVESTIGATING THE RELATIONSHIP BETWEEN OBESITY AND BRAIN HEALTH BY MEASURING NEURITE MICROSTRUCTURE IN BRAIN REGIONS RELATED TO MEMORY

Hanna Noughani
Mentor: Barb Bendlin

Obesity may be associated with microstructural changes in brain regions underpinning memory. The neurite orientation dispersion and density imaging (NODDI) model measures neurite microstructure, providing indices of neurite density (NDI) and orientation dispersion (ODI). Participants (N=63) were cognitively unimpaired older adults imaged with multi-shell diffusion MRI to derive NDI and ODI in gray matter regions supporting memory (anterior parahippocampal gyrus, hippocampus) and connecting white matter (cingulum, uncinate fasciculus). Adiposity measures included visceral adiposity and percent body fat, both assessed with bioelectrical impedance, and BMI and waist circumference. Linear regression tested the relationship between adiposity measures and NODDI indices. Adiposity measures were not significantly related to NDI and ODI in regions of interest. Obesity was not associated with neurite microstructure in brain regions related to memory.

CORPORATE GOVERNANCE AND DIRECTORS

Alyssa Noworul
Mentor: Yaron Nili

This project focuses on S&P 500 companies and their board of directors. The purpose of this project is to find trends in the companies' proxy statements about their directors' skills. These trends are observed by analyzing proxy statements from 2016, 2019, 2021/22 and coding the directors' skills either a "0" or "1" depending on if the skill is present. We took a dive into general skills tables, skills matrices, and ideal skills for future board nominees. The current trends that have been found cover the relationship between skills matrices and ideal skills, lack of antitrust skills, and the correlation between technology and cyber security skills.

INVESTIGATING A SPECIALIZED ROLE FOR TFG IN THE TRANSPORT OF HIGH MOLECULAR WEIGHT PROTEINS

Vanessa Obrycki
Mentor: Molly Lettman

Trafficking of newly synthesized proteins out of the endoplasmic reticulum in a timely manner is crucial for the viability and proper functioning of cells. The first step in this process is the loading of proteins into COPII carriers which traffic to the ER-Golgi intermediate compartment. TFG is an important protein that assists in the COPII-mediated protein trafficking process by accumulating in between the ER and the ERGIC and facilitating transport. Research suggests that dysfunctional TFG has a significant effect on the trafficking of high molecular weight proteins, but no further research has been done on what protein sizes may be affected. By studying the trafficking patterns of four L1CAM truncations, a direct conclusion can be made involving TFG's role in trafficking proteins of various sizes.

ANTIPARASITIC ACTIVITY FOUND IN MULTIPLE NATURAL PRODUCT EXTRACTS

Sydney Oerter
Mentor: Kaetlyn Ryan

Over a billion people worldwide are infected with diseases caused by parasitic nematodes, disproportionately affecting developing countries. There are growing concerns of drug resistance for current treatments, and discovering new drugs has been hindered by inadequate screening pipelines and a lack of new chemistry. Our solution to this issue is screening natural compounds produced by microbes that share an environment with nematodes. We hypothesize that molecules produced by these microbes have an increased likelihood of possessing antiparasitic properties. Performing methanol extraction on bacterial isolates that were active against the model nematode C. elegans, we obtained crude extracts that could be used in screens against both C. elegans and their parasitic relatives. Activity against different stages of parasites and C. elegans were noted in multiple extracts.

EVALUATING THE EFFECTS OF COVER CROPS ON INSECT BIODIVERSITY AND FARMLAND ECOSYSTEMS USING META-ANALYSIS

Eugene Ohba
Mentor: Ben Luliano

Cover crops are gaining attention from scientists for their potential benefits in agriculture such as weed suppression and soil health. Cover crops may also enhance insect biodiversity and ecosystem services, but less is known about their effects, as there have been limited studies. In this study we conduct a meta-analysis to find under what conditions cover crops can increase the biodiversity of farmland insects, conserve predators, and provide an effective eco-friendly tool for pest management. We collected over a thousand articles from the Web of Science and Scopus, 40 of which met the criteria for our study. We will test the effect of cover crops on pest and predator activity and compare between monocultures and cover crop mixtures.

β-HYDROXYBUTYRATE AS A POTENTIAL THERAPEUTIC TREATMENT TO MITIGATE TAU PATHOLOGY

Sophia Farrin Oliai
Mentors: Tyler Ulland, Kendra Hanslik

Alzheimer's disease (AD) is the most prevalent form of dementia. Currently, treatments for AD are limited, and no cure exists. AD pathology is traditionally characterized by the presence of amyloid-β (Aβ) plaques, neurofibrillary tangles (NFTs), neuroinflammation, and metabolic changes. β-hydroxybutyrate (BHB), an endogenously produced metabolite, is known to inhibit nod-like receptor pyrin domain containing 3 (NLRP3) inflammasome activation and mitigate amyloid pathology in mouse models of AD. However, the impact of BHB on tau pathology is unknown. Here, we investigate if NLRP3 inflammasome inhibition through exogenous administration of BHB can mitigate the accumulation of hyperphosphorylated tau and rescue behavioral deficits in the PS19 mouse model of AD.

EVALUATING TIME RESTRICTED FEEDING AS A FEASIBLE TREATMENT FOR IMPROVING NIGHTTIME BLOOD PRESSURE PATTERNS

Caden V. Olson
Mentors: Jill Barnes, Brandon Fico

Time-restricted feeding (TRF) may be a feasible treatment to restore nighttime blood pressure (BP) dipping patterns, which has been linked to cardiovascular disease prevention. To evaluate the efficacy of a five-week TRF intervention, 24-hour BP patterns were evaluated before and after the TRF intervention in 28 participants. Dipping % and BP variability were analyzed for systolic BP, diastolic BP, and mean arterial pressure. No statistically significant changes were demonstrated in dipping % or BP variability ($p>0.05$). However, statistically significant decreases were observed in nighttime systolic BP averages following the TRF intervention ($p<0.05$). The study demonstrated that a 5-week TRF intervention improves nighttime systolic BP in a healthy population. We recommend similar studies be performed in clinical populations with larger sample sizes.

FISHABLE, SWIMMABLE, DRINKABLE WATERS: PERCEPTIONS OF WATER QUALITY POLICY AND INSTITUTIONAL FIT IN NORTHEASTERN WISCONSIN

Madelyn Olson
Mentors: Adena Rissman, Eric Booth

Water quality in Northeastern Wisconsin has suffered from nonpoint source pollution, resulting in increased phosphorus, nitrate levels and community concern over contaminated wells, algae blooms, and soil health. What are community perceptions toward tailoring water quality policies and institutions spatially, temporally, and functionally to their social, hydrological, agricultural, and ecological landscapes? We conducted 29 semi-structured interviews with farmers, industry members, citizens, county, state, and federal agency professionals, and non-governmental organization professionals. We found progress toward spatial targeting but time lags between policy development and implementation, along with an overall lack of resources for agencies and farmers. Our findings contribute to discussions about how to understand and enhance water quality by improving institutional fit, including the social processes shaping those perceptions.

HOW TO TEACH PARENTS ABOUT RACISM AND CULTURAL APPROPRIATION

Andi Orellana
Mentor: Ines Botto

The Anti-Racist Parenting Program is a program designed to support white parents in having conversations with their young children about race and racism in order to learn how to be respectful and not to be mean to people of color as well. However, while teaching kids about racism, many parents don't know how to teach their children about cultural appropriation. It is very important to teach their kids what cultural appropriation means and the core difference between appreciation and appropriation. Talking about Halloween can be especially hard when children wear different cultural costumes that are not theirs. They would often wear it without knowing why wearing it is wrong. Oftentimes white parents don't know much about what cultural appropriation means, why it is disrespectful, or how to explain that to their children. To help educate, I will be giving parents a step-by-step tutorial on how to explain to their children more about cultural appropriation. I will be doing a website that has all the sources, giving flyers of the step-by-step process, and showing examples of appreciation and appropriation.

CONSIDERING ENVIRONMENTAL JUSTICE IMPLICATIONS OF SULFUR DIOXIDE

Cecilia Orth
Mentor: Tracey Holloway

The Clean Air Act regulates sulfur dioxide (SO2) through the National Ambient Air Quality Standards (NAAQS). SO2 emissions primarily affect nearby communities, as SO2 increases asthma symptoms and irritates the upper respiratory tract. To assess these impacts, I conducted a policy analysis of the SO2 Data Requirements Rule (DRR). The DRR required air agencies to identify large sources of SO2 and characterize the area's air quality using models or ground-based monitors. In my review of state submissions to the EPA, I: (1) characterized the choice of modeling versus measurements to meet requirements; (2) evaluated where more than one SO2 source was considered (cumulative modeling); (3) mapped SO2 sources in ArcGIS to evaluate environmental justice disparities.

THE ROLE OF GABA IN HSPC DIFFERENTIATION

Casey Ostheimer
Mentor: Owen Tamplin

Hematopoietic stem and progenitor cells (HSPCs) maintain blood production throughout life via self-renewal and multilineage differentiation. In bone marrow, many factors including the nervous system regulate HSPC function. Previously, we found that neurotransmitter gamma aminobutyric acid (GABA) receptor B1 is expressed on and regulates HSPC proliferation and differentiation into B cells, which in turn produce GABA. We hypothesized that GABA-producing B cells in bone marrow regulate their own production through a feedback loop with HSPCs. To test this, we tracked differentiation of mouse HSPCs into B cells using the OP9 co-culture system. Using mass spectrometry, we quantified the GABA levels produced in the cultures. We will now test direct addition of GABA to these cultures to find the optimal stimulatory dose.

BRAINSTEM CONTRIBUTIONS TO SENSORIMOTOR FEATURES IN CHILDREN IN THE AUTISM SPECTRUM

Roselyn Pacheco, Lauren Salmi, Susan Lei, Madelyn Scheid
Mentors: Britanny G Travers, Olivia Surgent

One in 59 children in the United States are autistic. Previous research has suggested that early differences in brainstem development lead to cascading effects on the rest of the brain's structure, Yet, there is relatively little literature suggesting brainstem contributions to sensory and motor differences in autistic individuals. In this study, autistic and non-autistic children undergo behavioral and motor assessments, as well as a magnetic resonance imaging (MRI) scan, to investigate how the brainstem contributes to sensory and motor differences. An improved understanding of these associations will provide information that could ultimately impact the design and implementation of interventions to promote quality of life for autistic individuals.

ROLE OF FBXW7 IN CONTROL OF GATA2 LEVELS IN ENDOMETRIAL SEROUS CARCINOMA

Aanika Parikh
Mentor: Daniel Matson

Endometrial serous carcinoma (ESC) is an aggressive gynecologic cancer that mainly affects postmenopausal women and metastasizes early. Unfortunately, few prognostic markers are available to help predict ESC progression. The Matson Laboratory identified the transcription factor GATA binding protein 2 (GATA2) as prognostic of survival in ESC. However, the factors regulating GATA2 expression in ESC are unknown. In the bone marrow, the protein F-Box and WD Repeat Domain Containing 7 (FBXW7) regulates GATA2 levels via ubiquitin-dependent degradation. We hypothesized that FBXW7 may behave similarly in ESC. We are using siRNA to deplete FBXW7 levels in two patient-derived cell lines and western blot to measure GATA2 and FBXW7 levels. An increase in GATA2 levels after FBXW7 depletion would support that FBXW7 drives GATA2 degradation in ESC.

CASE STUDY OF A HMONG AMERICAN SHAMAN DIAGNOSED WITH SCHIZOPHRENIA: THE IMPACT OF NARRATIVE STORYTELLING VS. STRUCTURED INTERVIEWS

Hannah Park
Mentor: Maichou Lor

Schizophrenia is a chronic psychotic disorder affecting 2.8 million adults in the U.S. Adequate treatment for Schizophrenia requires a comprehensive assessment. However, current assessments limit patients from sharing their stories using pre-determined questions (structured), resulting in disparities of diagnosis and treatment. In this case study, we examine the quality of health information obtained from structured versus storytelling interviews of a 53-year-old Hmong woman. We analyzed her responses to assessments using medical records (structured interview) and narrative interview (storytelling interview). We found that storytelling elicited more health information including spiritual-related symptoms and social and environmental factors that impacted symptoms compared to structured interviews. Findings highlight the importance of using storytelling in clinical assessments to provide culturally-appropriate care for patients with Schizophrenia.

CORRELATION ANALYSIS OF THE INFLUENCE OF SOCIAL MEDIA ON ADOLESCENTS' SUBSTANCE USE

HyunJu Park
Mentor: Marina C Jenkins

Social media has been shown to influence risk of adolescent substance use, including alcohol, cannabis, and cigarettes. The purpose of this exploratory analysis is to identify aspects of social media and usage habits most strongly related to substance use in adolescents. Using data from a mixed-methods study involving an online survey and assessment of substance-related posts on adolescents' social media accounts, we will use a machine learning model to find which variables increased the risk of reported substance use. Variables include number of social media posts with substance references and self-reported substance and social media use measures. We will select the model with the highest F-1 score and accuracy. Further studies could inform adolescent substance use prevention utilizing influences identified in this analysis.

UNDERSTANDING TELOMERE-LOOP REGULATION BY SHELTERIN PROTEIN COMPLEX

Joana Pashaj
Mentor: Bianca Chavez

Telomeres are protective protein-DNA structures at the ends of eukaryotic chromosomes. A telomeric sequence is composed of dsDNA repeats followed by a 3' single-stranded tail. The tail can invade the dsDNA to form a lariat-like telomere-loop (T-loop) structure. The formation of T-loop is controlled by shelterin, a six-subunit protein complex. We hypothesize that shelterin protein complexes will have the strongest binding affinity to the base of the T-loop over linear DNA. To test this hypothesis, we have conducted a series of electrophoretic mobility shift assays. We show that shelterin not only binds tightly to telomeric D-loops, but also prefers D-loop binding over linear telomeric DNA. Outcomes from the above studies provide a biochemical basis to how shelterin stabilizes T-loop by using its unique DNA-binding properties.

INVESTIGATING THE ROLE OF METABOLISM ON iNKT CELL CYTOKINE PRODUCTION

Niharika Patankar
Mentors: Jenny Gumperz, Nikhila Bharadwaj

Cancer tumors utilize multiple metabolic pathways, creating a toxic nutrient deprived microenvironment, killing many immune cells. Recent immunotherapy interest has focused on invariant Natural Killer Cells (iNKT) and their ability to produce large amounts of inflammatory cytokines. Due to the relative lack of knowledge about the mediative effects of iNKT cells, in this project we attempt to understand the metabolic needs of iNKT cells. We hypothesize that cytokine production will decrease in low nutrient environments. ELISA analysis indicates that iNKT cytokine production does not depend on glucose or glutamine.

ROLE OF PROSTAGLANDIN EP3 RECEPTORS AND Gz PROTEINS ON PANCREATIC BETA-CELL SIGNALING AND FUNCTION

Krupa Patel
Mentor: Gisela Wilson

In the United States, approximately 90-95% of all diabetes cases are type-2 diabetes. There is a known correlation between obesity and the occurrence of type-2 diabetes. To better understand this relationship, mice homozygous for the Leptin Ob mutation are used to study the effects of obesity on pancreatic beta-cell glucose metabolism and insulin secretion. This research project explores the role of prostaglandin EP3 receptors and Gαz subunit, which are known to have inhibitory effects on glucose and hormone stimulated insulin secretion. As type-2 diabetes becomes increasingly prevalent around the world, it is important to recognize the potential ways to prevent obesity from leading to type-2 diabetes through cell and gene targeted medications.

CONTROLLING CRISPR/Cas9 IN INDUCED PLURIPOTENT STEM CELLS (iPSCs) USING A DEGRADATION METHOD

Vrusha Patel
Mentor: Namita Khajanchi

CRISPR-Cas systems enable precise, programmable modifications to any gene, making them a revolutionary tool in biomedical research. Prolonged Cas9 activity has negative-consequences such as off-target editing, genotoxicity, immunogenicity, and undesired on-target modifications. Current methods to control CRISPR/Cas9 systems lack high-resolution temporal control. Here, we show that we can use Cas9 with this degron and control it by FDA-approved pomalidomide (POM). We evaluate the degron's effectiveness in degrading Cas9 and the on- and off-target editing efficiency with and without POM in induced pluripotent stem cells (iPSCs). Our results show that withdrawing POM reverses degradation of Cas9-degron and addition of POM reduces off-target editing. This project will characterize a new technology for targeted degradation of Cas9 with potential for broad application in gene and cell therapy.

GENETIC VARIANT DISCOVERY FOR FIBROTIC MYOPATHY IN THE GERMAN SHEPHERD DOG

Margaret Patterson
Mentor: Peter Muir

Fibrotic myopathy is a rare disease affecting the German Shepherd Dog (GSD) that causes muscle contracture and fibrosis in the caudal medial thigh muscles resulting in pain and lameness. Cases rarely occur in other breeds, suggesting a genetic etiology. The pattern of familial risk suggests a recessive Mendelian disease. Discovery work has identified a KCNN4 insertion as a candidate genetic variant. To further investigate, DNA from 45 dogs will be screened using a polymerase chain reaction (PCR) assay to genotype each dog for the presence or absence of the KCNN4 insertion. This work is significant as it seeks to determine the genetic basis of fibrotic myopathy by investigating if the variant association is significant in a large group of dogs, suggesting the proposed variant is causal.

NARROW BOTTLENECKS CONSTRAIN INFLUENZA A VIRUS GENETIC DIVERSITY DURING DIRECT CONTACT TRANSMISSION

Siyang Peng
Mentor: Thomas Friedrich

Influenza A virus (IAVs) variants evolve seasonally under positive selection at the population level, but how variants arise in individual hosts is poorly understood. Here we show that within and between hosts, IAV evolution is predominantly shaped by genetic bottlenecks imposed by physical and biological barriers. We performed site-specific inoculation of IAVs bearing molecular barcodes in the upper respiratory tract of ferrets. We then tracked and quantified unique viral lineages as the infection spread throughout the respiratory tract and by direct contact transmission to naïve hosts. Bottleneck size estimations reveal that most viral diversity is lost following anatomical compartmentalization and transmission. We propose that IAV evolution within hosts is predominantly shaped by genetic drift and founder effects resulting in slow stochastic viral evolution.

WISCONSIN SUBLIMINALITY

Alexander Peseckis, Austin Gent, Morgan Schmit
Mentor: Joe Salmons

Previous research into Wisconsin English has documented features marking an accent. These features operate at different levels of listener awareness, and listeners show awareness of a Wisconsin accent even in the absence of the most salient markers. We test this notion with three Wisconsin features — prevelar raising (like bag), back /u/ (boot), and final /z/ devoicing (cars) — then combine them at different levels of "intensity" to see how different levels and combinations of the three affects listeners' perceptions of a speaker having a Wisconsin accent. Our findings indicate a synergistic relationship between prevelar raising and /u/-backing in supporting listener perceptions of a Wisconsin accent.

TOWARDS DEGRADATION OF PE USING A CO-CULTURE OF YARROWIA LIPOLYTICA AND STREPTOMYCES

Jess Peter
Mentor: Erica Majumder

Plastic accumulation in landfills is a waste management challenge. There is current research on ways microbes can potentially reduce this pollution. This study focuses on the use of a yeast - Yarrowia lipolytica - in conjunction with a bacterium – Streptomyces sp. – for plastic degradation. Here we co-culture the two landfill-isolated species to encourage growth and simulate how microbial communities might interact in nature. The cultures were grown at ratios of 1:0, 0:1, 1:1, 1:2, 2:1, 1:4, and 4:1 in YPD before being added to minimal media with polyethylene (PE) as the primary carbon source. A growth curve is being generated using OD measurements. We will also measure concentration of and identify degradation products with High Pressure Liquid Chromatography.

FRAGILE X SYNDROME CORTICAL ORGANOIDS EXHIBIT ALTERED CELL PROLIFERATION DURING DEVELOPMENT

Lily A Peters
Mentors: Xinyu Zhao, Soraya O Sandoval

Fragile X syndrome (FXS) is a genetic disorder with intellectual and cognitive disability. Cortical organoids (3DOs) derived from human induced pluripotent stem cells (iPSCs) are useful for studying FXS since they closely resemble prenatal human brain development. Defects in neural progenitor cell (NPC) proliferation can impair neurogenesis leading to brain dysfunctions. How NPC proliferation is affected in FXS remains unclear. To address this, we used immunohistochemistry to identify proliferating NPCs in 3DOs differentiated from FXS patient-derived iPSCs. We used stereology for quantitative analysis across several developmental stages and demonstrated that NPCs in FXS 3DOs had increased proliferation compared to those in control 3DOs. Overall, determining the molecular and cellular changes in FXS can lead to a better understanding of its pathogenesis for future treatment development.

A MODERN CONFLICT: ASSESSING THE EFFECTIVENESS OF RUSSIA'S MILITARY IN THE UKRAINIAN WAR

Elliot Petroff
Mentor: Yoshiko Herrera

At the outset of the war in Ukraine, it was assumed by most experts that Russia would swiftly and decisively conquer Ukraine. In actuality, the war has lasted longer than most estimates despite Russia having significant advantages in the number of troops and the strength of its military. The essay evaluates Russia's performance by looking at previous Russian conflicts, Russian intelligence and chain of command, Russian logistics, and factors on the ground in Ukraine such as equipment and morale. This essay finds that the Russian military failed in every aspect to carry out a successful attack in the early months of the conflict. It concludes that Russia's failure to take Ukraine was based on Russia's own mistakes in the conflict.

ASSOCIATION OF ESTROGEN RECEPTOR GENE KNOCKDOWN WITH WEIGHT GAIN IN FEMALE NONHUMAN PRIMATES

Andi Pieczynski, Terrianna Lyles, Lillian Marrah
Mentor: David Abbott

This study looked to evaluate the presence of estrogen receptor alpha (ERα) gene knockdown in the hypothalamic arcuate nucleus (ARC) and ventromedial nucleus (VMN) of adult female rhesus macaques. The administration of a viral vector was monitored via MRI for ERα neuron targeting. Experimental monkeys (n=4) received shRNA encapsulated in adeno-associated virus 8 (AAV8) while the control monkeys (n=4) were injected with scrambled RNA (shRNA) with no gene targets. The retrospective expression quantification occurred approximately 11 months after gene silencing. This is one of the first studies that examines ERα in female nonhuman primates, and our findings suggest that it is important for metabolic regulation.

A FORWARD GENETIC SCREEN FOR IDENTIFYING SUPPRESSORS OF LEAF MORPHOLOGICAL DEFECTS IN THE ARABIDOPSIS MUTANT ORBICULATA

Jeffrey Pietroske
Mentor: Jake Brunakrd

Forward genetic screens in Arabidopsis thaliana have repeatedly highlighted the necessity of amino acid metabolism and ribosome biogenesis for proper leaf morphogenesis. One such mutant, orbiculata, makes round, chlorotic leaves and results from a mutation in the gene encoding ferredoxin-dependent glutamate synthase. Transcriptomic analysis of orbiculata indicated widespread induction of ribosomal protein genes, suggesting disruption of amino acid metabolism and protein biosynthesis. To explore the connections among glutamate synthesis, ribosomal protein gene expression, and leaf shape, I conducted a forward genetic screen and identified a dominant suppressor mutant, Lettuce, in the M1 generation. Lettuce produces dark green leaves, exhibits developmental abnormalities, and appears to suppress the orbiculata phenotype. Currently, I am mapping for recessive suppressors in the M2 generation.

AUDITORY SOURCE SEGREGATION AND EXECUTIVE FUNCTIONS IN CHILDREN WITH COCHLEAR IMPLANTS

Emma Pittman
Mentor: Ruth Litovsky

Children spend time in environments where it is difficult to focus on one talker while ignoring background speech. This type of auditory source segregation is difficult for typically developing (TD) children, and especially for children with sensorineural hearing loss fitted with cochlear implants (CIs). With more hearing-impaired children receiving CIs, more research is needed to understand how well children with CIs can segregate speech, in particular comparing high- and low-predictability in multi-talker (noisy) environments. To investigate, we simulate aspects of hearing loss and CI processing in TD children. Participants listen to target sentences of varying predictability in quiet or in background noise. Executive function is assessed to test the hypothesis that cognitive abilities are related to auditory source segregation in complex listening environments.

HOW CONTEXTUAL CLUES MIGHT HELP PRESCHOOLERS LEARN WORD MEANINGS

Rayane Prado
Mentors: Jenny Saffran, Ellie Breitfeld

Adults know "cake" is a dessert, is associated with celebrations, and can have different flavors. But how do children learn these complex meanings of words? Previous literature has investigated perceptual (i.e., objects' shape), social (i.e., speakers' emotions), and linguistic (i.e., speech content) cues to meaning, but little research has addressed how the context in which these cues occur may impact children's learning. To tackle this gap in the literature, the current study analyzes if children use the context in which novel objects occur as a cue to word meanings. Specifically, if a novel object appears in a kitchen, do preschoolers assume that the object is edible? Preliminary data suggests that preschoolers do associate novel objects with context-related verbs (i.e., "eat").

AN EXAMINATION OF HANDEDNESS AS A PREDICTOR OF TEMPERAMENT AND LEARNING ABILITY IN THE COMMON MARMOSET (CALLITHRIX JACCHUS)

Elizabeth Preuss
Mentor: Peter J. Pierre

Our investigation aims to determine the relationship that various metrics of handedness have to temperament and learning in the common marmoset. Twenty pair-housed marmosets (10 male, 10 female) performed the TUBE test and Box task under observation. We recorded which hand individuals used to interact(handedness), the initial time to contact novel objects(cautiousness), and the time needed to complete a task over multiple trials(learning). We hypothesize that there will be positive relationships between left-handedness and cautiousness as well as strength of handedness and accelerated learning. Describing relationships between sex, handedness, and temperament in this species will help clarify gaps in the current literature. Furthermore, addressing the connection between the strength of handedness and learning may illuminate the role lateralization plays in expanding cognitive capacity across species.

REGULATION OF LYSOSOMAL LIPIDS BY THE α1,6-MANNOSYLTRANSFERASE ALG12

Siwei Qian
Mentors: Jess Davidson, Judith Simcox

Lysosomes are essential organelles in the cell that perform tissue-specific roles in macromolecular degradation, transport, and cellular signaling. An important component of lysosomes are bis(monoacylglycero)phosphates (BMP) lipids. BMPs are anionic glycerophospholipids that are found in intraluminal vesicles of late endosomes and lysosomes and are involved in sphingolipid degradation, cholesterol transport, and lysosomal membrane dynamics. BMP lipid levels are increased in lysosomal storage disorders, nonalcoholic fatty liver disease, and cardiovascular disease. Physiological stresses such as cold exposure, high-fat diet, and fasting can also increase BMP levels. Despite evidence of their crucial role in lysosomal function, key enzymes and proteins involved in the synthesis and regulation of BMP lipids are unknown. We performed quantitative trait loci analysis of high fat diet fed mice using genomics and lipidomic datasets to map several genetic regulators of hepatic BMPs. We identified the α1,6-mannosyltransferase Alg12, an N-linked glycosylation enzyme, as a candidate. Using targeted liquid chromatography-mass spectrometry (LC-MS) to quantify BMP lipids, we found that overexpressing Alg12 led to increased BMP levels while the lysosomal abundance remains unchanged. Alg12 is involved in trafficking proteins to the lysosome through the mannose 6-phosphate receptor pathway. We hypothesize that Alg12 is modulating BMP lipid levels through targeting a regulator to the lysosome. To identify the Alg12 target responsible for altered BMP lipid levels, we will assess glycoproteomics of Alg12 overexpression and null cells. Understanding BMP regulation by Alg12 will bring new insights into the contribution of BMP lipids to lysosomal function.

IDENTIFYING NOVEL COMPOUNDS FOR THE PROMOTION OF INSULIN SECRETION

Ryan Quinn
Mentor: Tara Price

Type 2 diabetes (T2D) is caused by the inability of insulin-secreting pancreatic islets to sufficiently increase insulin secretion in response to somatic insulin resistance. Due to the wide variety of T2D genetic causal factors, existing drugs are not effective in all patients. Therefore, additional therapies are needed. A genome wide association study in diversity outbred mice identified the correlation to insulin secretion for all genes. The most positively correlated genes were put into a web display to identify compounds that increase the expression of these genes. Of these compounds, 33 were screened for their ability to induce insulin secretion in isolated islets in response to glucose stimulation. Compounds that successfully increased insulin secretion are analyzed for common pharmacophores to create T2D drugs in the future.

WOUND HEALING IN MOUSE VOCAL FOLD EPITHELIUM

Josef Rademacher
Mentors: Susan Thibeault, Renee King

Studies using animal models to explore vocal fold wound healing have consistently excluded mice. Those including mice did not closely examine vocal fold epithelial healing. With mouse models becoming increasingly more frequent in voice research, documenting this healing process can inform future experiments. During re-epithelialization, several components are signaled to or synthesized at the wound site, including Ki67, laminin, cytokeratins 8 and 13, p63, epidermal growth factor, and transforming growth factor-1. This study creates a 12-week timeline of the distribution and accumulation of these components in mouse vocal fold epithelium after vocal fold abrasion. Immunohistochemistry and immunofluorescence staining were conducted on mouse larynx samples to visualize these constituents. Foundational knowledge gained in this study provides critically needed benchmarks for future vocal research using mouse models.

USING VirX1 TO IODINATE PHOSPHOTYROSINE FOR ENRICHMENT WITH SUZUKI-MIYAURA CROSS-COUPLING

Chase Radziej
Mentor: Haley Bridge

Phosphotyrosine (pTyr) is a post-translationally modified amino acid that is involved in many cellular functions. However, little is known about where it facilitates these processes in the cell and no method exists for covalently modifying pTyr in live cells. Flavin-dependent halogenases (FDHs) are enzymes that react with substrates with a designated halogen. VirX1 is one such FDH that has been used for its preference in iodination and ability to work on a variety of diverse substrates. These preferences in iodination and substrate flexibility will be used to iodinate pTyr to be used in a Suzuki-Miyaura Cross-Coupling reaction. While this reaction could occur with any halogen, iodine is advantageous because it allows it to react with a boronic acid that has biotin attached for enrichment.

COMPARISON OF ENERGY-DEPENDENT BIOLOGICAL EFFECT BETWEEN X-RAYS AND GAMMA RAYS

Shrey Ramesh
Mentor: Randall Kimple

The Cesium Irradiator Replacement Program (CIRP) was established in 2014 with the goal of replacing isotope-based biological irradiators with non-isotope alternatives. Most dosimetry is based on 137Cs irradiators, so implementation of X-ray technology into radiobiological research has posed challenges to the research community. The major difficulty is a result of the incorrect assumption that dose is a constant entity directly transferable across irradiation types. We initiated this study to establish consistency in dose measurement and biological response both in vivo and in vitro, especially looking at the relative biological effect of X-rays versus cesium. Clonogenic survival and comet assays were used to determine dose response in vitro. Lethal Dose 50/30 was the metric used to determine dose response in vivo.

USING MACHINE LEARNING TO FIT ELLIPSES FROM DIFFERENTIAL ATOMIC CLOCK EXPERIMENTS

Nico Ranabhat
Mentor: Shimon Kolkowitz

The precision and accuracy of atomic clocks has increased rapidly over the past decade, leading to improvements in technologies such as relativistic geodesy and GPS. However, in some cases, methods of extracting information from atomic clocks via data fitting is still not optimal. This work introduces two machine learning methods for fitting elliptical data obtained from atomic clock experiments: a neural network and a maximum likelihood estimate. When given enough data, the maximum likelihood estimate is shown to produce more accurate fits than the current least-squares method. Ideas for further improving these machine learning methods are discussed.

PHASeR

Lina Raouf
Mentor: Corrine Voils

Pharmacogenomic testing uses patients' genetic and genomic information to improve medication prescribing by identifying whether a patient might have a response, which could be positive or negative, to a target medication. In recent years the Veterans Health Administration has introduced the Pharmacogenomic Testing for Veterans (PHASER) program with the goal of offering testing at 100 sites by 2023. An evaluation team led by Dr. Corrine Voils is assessing factors related to the successful implementation of the PHASER. This research seeks to improve the uptake of pharmacogenomics testing in VA healthcare facilities by identifying different facilitators and barriers. Quantitative data along with qualitative interviews will be used to assess factors that influence adoption at the patient, provider, and facility level.

MATERNAL AGE AT TIME OF BIRTH AND FUNCTIONING OF ADULTS WITH DOWN SYNDROME

Anna Grace Ravis
Mentor: Sigan Hartley

Down syndrome (DS) is a genetic condition which predisposes individuals to a variety of medical, psychiatric and aging-related conditions. The risk at age 25 of having a child with DS is 1 in 1250, which increases to 1 in 100 at age 40. We examined the association between maternal age at time of birth and medical, psychiatric, and cognitive functioning of adults with DS (N =365), aged 25-76 years. We hypothesized that higher maternal age at time of birth would be associated with more severe medical, psychiatric, and cognitive impairments in the adult with DS. Findings could inform intervention for the DS community and increase awareness of the risks associated with advanced maternal age.

LIFETIME STRESSORS, DEPRESSION, AND COGNITIVE HEALTH IN MIDDLE-AGED & OLDER ADULTS

Emilie Reese
Mentor: Megan Zuelsdorff

Exposure to stress across the lifespan empirically associates with higher risk for age-related cognitive impairment. Mechanisms are understudied and may be population-specific. In a sample of middle-aged and older enrollees in the Wisconsin Registry for Alzheimer's Prevention (N=1,380), we aim to explore whether (1) stress predicts depressive symptoms, (2) depression mediates relationships between stress and cognitive function, and (3) relationships differ by gender. Stress exposures and depressive symptoms are self-reported. Cognitive outcomes include performance on tests of executive function and memory. Multivariable regression models and secondary stratified analyses are used to address all study aims. Results will be ready for presentation at the 2023 symposium and will illustrate the role of depression as a modifiable link between social adversity and later-life dementia risk.

TESTING A METABOLIC PATHWAY IN RHODOPSEUDOMONAS PALUSTRIS RESPONSIBLE FOR THE METABOLISM OF γ-VALEROLACTONE, A TOXIC CHEMICAL IN THE BIOFUEL PRODUCTION PROCESS

Josie Reeve
Mentor: Ben Hall

γ-Valerolactone (GVL) is a chemical used to break down biomass into biofuels. However, this chemical is toxic to fermentative microbes. It has been found that the bacteria Rhodopseudomonas palustris is able to metabolize GVL. In order to understand how R. palustris metabolizes GVL, a metabolic pathway has been proposed. To test this pathway, a plasmid containing five genes thought to be responsible for these bacteria's ability to consume GVL will be created. Should the metabolic pathway of R. palustris be isolated, it would be possible to add this sequence, in the form of a plasmid, into Escherichia coli, a well-studied bacterium. Ideally, this would allow E. coli to convert biomass into biofuels while also metabolizing GVL, removing this toxic chemical in the process.

MAPPING THE PLANE OF THE MILKY WAY WITH THE SMALL RADIO TELESCOPE

Declan Regan, Andy Zhang, Jack Worley, Karlee Kimberling, Lucy Steffes, Robert Wheatley, Tyler Schmaltz
Mentor: Snezana Stanimirovic

The Small Radio Telescope (SRT) was used to map continuum radiation at 1410.0 MHz along the plane of the Milky Way galaxy. We collected 40 observations, spanning -9 to 9 degrees in galactic latitude and 5 to 32 degrees galactic longitude. Continuum radiation spans a range of frequencies of photons emitted by thermal free-free radiation and synchrotron radiation. The observed spectrum was then converted from frequency to velocity. We averaged and integrated each observation to create a brightness intensity at each position. We then averaged each of the data points using bilinear smoothing. Our map and values agree with previously published work, indicating higher intensities closer to the plane of the galaxy, where gas and dust are more abundant.

THE ROLE OF SEMANTIC SIMILARITY IN L2 VOCABULARY LEARNING

Geanessa Reglos
Mentor: Jose Luis Garrido Rivera

This project investigated the role of semantic similarity on L2 learning. This project includes semantic similarity measures (Vinson & Vigliocco, 2008) and accounts for twelve confounding variables. Three cluster types were created based on semantic similarity measures (i.e., blocked), and the other three (i.e., mixed) were created to match the blocked clusters on the confounding variables. Four training sessions were created based on the learning direction (L2-L1 vs. L1-L2) and cluster types. Participants were exposed to word-image pairs and indicated afterwards whether image-word pairs were correct, chose the correct image based on an oral cue, and translated words. Immediately and a week later, participants were tested again. Our findings indicate differences in semantic similarity influence retention. This research informs L2 learning in classrooms and beyond.

EVALUATING THE EFFICACY OF COMBINING RADIATION AND GNE-140 ON B78 MELANOMA

Delaney Reindl
Mentor: Randy Kimple

B78 melanoma, derived from B16 melanoma, is a murine tumor cell line commonly used in preclinical studies. In most cancers, high lactate levels and increased lactate dehydrogenase A (LDHA) activity increase immunotherapeutic resistance. LDHA is largely responsible for the glycolytic conversion of pyruvate-to-lactate and is associated with increased cancer development. While high LDHA expression is present within all tumor cells and lactate dehydrogenase B (LDHB) levels vary, inhibition of both increases tumor sensitivity to treatment. We will conduct experiments in vivo and in vitro to determine whether there is a synergistic effect between radiation therapy (RT), LDHA/B inhibitor GNE-140, and immune checkpoint inhibitors (ICI). We hope to increase the efficacy of the melanoma treatment and translate findings into a clinical study.

INVESTIGATION OF THE ROLE OF LRRC10 IN HUMAN iPSC-CM PROLIFERATION

Navid Reshadi Nezhad
Mentor: Olofunke Olorundare

The adult human heart lacks regenerative capacity, demonstrated by the replacement of cardiac tissue with fibrotic scar in infarcted hearts. Studies done in cavefish and zebrafish have shown that Leucine Rich Repeat Containing 10 protein (LRRC10) plays a role in the proliferation of regenerating fish cardiomyocytes. In this study, an assay for the measurement of human cardiomyocyte proliferation was developed using human iPS cells to investigate the effect of LRRC10 knockout on the expression of mitotic markers, Ki67 and pHH3. There were reduced Ki67-labeled cells in both control and LRRC10 knockout iPS-cardiomyocytes from Day 18/19 to Day 22/23 at 200K and 300K seeding densities ($p<.05$, $n=3$). However, there was no significant difference in proliferation between control and LRRC10 KO iPS-cardiomyocytes.

DEFICITS IN BEHAVIORAL AND NEURONAL PATTERN SEPARATION IN TEMPORAL LOBE EPILEPSY

Sophie J. Rewey
Mentors: Rama Maganti, Matt Jones

The dentate gyrus (DG) acts as a "gate" to regulate cortical input to the hippocampus and as a "filter," preventing abnormal signal flow. These two functions allow for the correct storage and recall of similar memories, an ability called pattern separation. It is known that in temporal lobe epilepsy (TLE), the function of the DG as a "gate" breaks down. However, whether TLE relates to pattern separation deficits remains unknown. We hypothesize that pattern separation deficits predict vulnerability to TLE. To test this relationship, we will perform pattern separation tests on control and epileptic mice with different strains of susceptibility to TLE. Overall, we aim to understand the relationship between TLE and the DG, in its role as both a gate and a filter.

ASSOCIATION BETWEEN POLICY AND PRACTICE IMPLEMENTATION AND WATER QUALITY IN THE NORTHEAST LAKESHORE REGION OF WISCONSIN

Brice Richardson
Mentor: Adena Rissman

Water quality is a significant concern in Northeast Wisconsin, indicated by the many water bodies on the state's impaired waters list and the prevalence of contaminated wells. I seek to inform the development and implementation of policies and practices that help achieve Total Maximum Daily Load water quality targets within the region's social context. I do so by conducting correlation analyses to investigate the research question: to what extent is subwatershed intervention coverage associated with water quality? I use the Soil Water Assessment Tool (SWAT) model to represent water quality, measured as phosphorus runoff, with spatial data sourced from federal, state, county, and municipal agencies. These analyses determined that intervention intensity varies throughout the region and does not always correlate with better water quality.

ENHANCING GASDERMIN-INDUCED TUMOR PYROPTOSIS THROUGH PREVENTING ESCRT-DEPENDENT CELL MEMBRANE REPAIR AUGMENTS ANTITUMOR IMMUNE RESPONSE

Nathaniel Richmond
Mentors: Quanyin Hu, Zhaoting Li

Pore-forming Gasdermin protein-induced pyroptosis in tumor cells promotes anti-tumor immune response through release of pro-inflammatory cytokines and immunogenic substances. However, endosomal sorting complexes required for transport (ESCRT) III-mediated cell membrane repair significantly diminish the tumor cell pyroptosis by repairing and removing gasdermin pores. Here, we show that blocking calcium influx-triggered ESCRT III-dependent membrane repair through a biodegradable nanoparticle-mediated release of calcium chelator (EI-NP) strongly enhances GSDMD-induced tumor pyroptosis via a bacteria-based delivery system (VNP-GD). We developed an injectable hydrogel and a hydrogel-based cell patch for peritumoral administration. The hydrogels, functioning as the local therapeutic reservoirs, can sustainedly release VNP-GD to trigger tumor pyroptosis and EI-NP to prevent the ESCRT III-induced membrane repair to boost pyroptosis effects, working synergistically to augment the anti-tumor immune response.

MEASURING BARRIERS TO LONG-TERM CARE RESIDENT PREFERENCES: DEVELOPMENT AND CONTENT VALIDITY TESTING

Rebecca Ringlien
Mentor: Tonya Roberts

Person-centered care (PCC), or care consistent with preferences, improves outcomes for residents in long-term care. However, few studies focus on measuring specific barriers to meeting resident preferences, hindering identification of actionable targets to improve PCC delivery. The purpose of this study is to develop and test the content validity of a survey that measures staff barriers to fulfilling resident preferences. Phase I involved two rounds of testing with content experts (n=11) who rated the relevance of survey items and provided feedback for item improvement. The survey was revised and content validity indices improved. Phase II is underway and involves cognitive interviewing with survey end-users (n=~10 certified nursing assistants). Once completed, this survey will be the first instrument to measure staff barriers to meeting resident preferences.

QUANTIFICATION OF INDOOR AIR VOC MEASUREMENTS IN A UNIVERSITY BUILDING DURING FINALS WEEK

Matt Rivard
Mentor: Delaney Kilgour

A dataset of indoor air samples was compiled between December 8 and December 21, 2021 using a coupled GC and PTR-MS instrument in the Mechanical Engineering building at UW-Madison. The data was used to quantify concentrations of common volatile organic compounds (VOCs). These concentrations from the GC were analyzed against real-time measurements of air sample concentrations from the PTR-MS, room occupancy numbers, CO2 concentration, and other studies involving indoor air sampling of a similar nature in order to identify trends among specific VOCs. Findings from the dataset will be useful in setting regulatory standards for indoor air quality.

UNDERSTANDING CULTURAL CONNECTIONS IN ANTHROPOLOGY

Robin Robinson
Mentor: Neil Kodesh

As a member of the diaspora, in search of heritage and identity, it is my responsibility to use my knowledge and abilities to do work in this field because my perspective contributes to a wider shift in Anthropology that considers all realities of different communities. The types of questions that interest me lie in understanding how ancient Northeastern African communities connected with people in the Indian Ocean diaspora, what role slavery played in the fall of Middle Age Africa, and what was the role of ancient religion in the connections of these regions? I am drawn to the study of anthropology to examine connections between people of the Indian Ocean World and Northeastern Africa during the Middle Ages. My interests lie in pursuing a literature review to understand ancient history through an interdisciplinary approach. I intend to carry out a study of how those who came before us along the rim and involved in the trade networks of the Indian Ocean interacted with one another during the Middle Ages. What drives me in my study of interactions humans have made over time is tied to my search for ethnic heritage and identity. In my pursuit of obtaining a doctoral degree in Anthropology it is important to me that this work motivates me intellectually and contributes to my understanding of self and others.

BRAIN STRUCTURE OF 1-MONTH-OLD INFANTS MAY PREDICT FEAR EXPRESSION AT 2 YEARS

Sophia Roche
Mentor: Doug Dean III

The neural networking that occurs between birth and 2 years of age is critical for brain maturation. Diffusion magnetic resonance imaging (dMRI) allows us to examine infant brain microstructure that lays the foundation for future behaviors. The relationship between neural structure and development of critical behaviors is essential for identifying infants who may be at risk for sub-optimal behavioral outcomes later in childhood. This study investigated the relationship between the cytoarchitecture of fear-related brain areas at 1 month of age and fear expression at 2 years. We hypothesized that disorganization of fear centers at 1 month correlate with intense fear expression. Determining an early structural-behavioral relationship will pave the way for development of targeted interventions designed to improve childhood outcomes.

INFECTION AFFECTS WATER LOSS IN TOMATO LEAVES

Ashley Rodriguez
Mentors: Kimberly Cowles, Jeri Barak-Cunningham

The goal of the project is to determine if bacterial infection affects water loss from leaves. When a leaf is removed from the plant, water evaporates through the leaf pores, and the leaf weight goes down over time. For this project, tomato leaves were infiltrated with the plant pathogens (Xanthomonas gardneri or Pseudomonas syringae pv tomato) or water to see if infected leaves lose water at a different rate from healthy leaves. Two days after infiltration, the leaves were weighed every 30 minutes for 3 hours to measure weight loss due to water evaporation. The hypothesis for the experiment is that infection traps more water inside the leaf because the stomata are closed. There's more evaporation with the water control because the stomata are open.

IMPACTS OF PROLONGED DROUGHT ON GENOMIC VARIATION IN AN ALPINE BUTTERFLY

Emelia Rogers
Mentor: Sean Schoville

Understanding how species will respond to global warming and its accompanying consequences is paramount in today's world. The Sierra Green Sulfur Butterfly (Colias behrii) of the Sierra Nevada has undergone a recent population decline due to a severe drought. A significant decrease in population size can have negative consequences on a species' fitness and genetic diversity. I conducted an experiment in which genomes from samples of C. behrii were taken from before and after the drought event to measure any change in genetic diversity. Statistical analysis results show that C. behrii populations lacked genetic differences among populations before and after the event and indicate that the species underwent a genetic bottleneck. I propose further population modeling and analysis to quantify the erosion in genetic diversity.

ASSESSING VIRAL POPULATION DYNAMICS IN PREGNANT NON-HUMAN PRIMATES WITH PROLONGED ZIKA VIRUS INFECTION

Liv Romanov
Mentor: Tom Friedrich

The potential for Zika virus (ZIKV) to cause fetal harm was first recognized during the Americas outbreak from 2015 to 2016. Prolonged infections (>21 days) have only been documented in pregnant people or pregnant non-human primates. The mechanism of prolonged ZIKV infection is poorly understood, but infection of the fetus or fetal compartment may be the source of replicating virus. I hypothesize that prolonged detection of ZIKV RNA in blood indicates ongoing viral replication in immunologically privileged sites such as the maternal-fetal interface (MFI). This study leverages next-generation sequencing to analyze ZIKV populations in a pregnant non-human primate model. This work will establish a novel model of virus persistence and enhance public health efforts to monitor for ZIKV genotypes with a propensity for fetal harm.

GENOMES OF THE AUTONOMOUS PARVOVIRUS MINUTE VIRUS OF MICE INDUCE REPLICATION STRESS THROUGH RPA EXHAUSTION

Sarah Rubin
Mentor: Kinjal Majumder

The oncolytic parvovirus Minute Virus of Mice (MVM) establishes infection in the vicinity of cellular DNA breaks. However, the mechanism of how MVM generates cellular DNA breaks remains unknown. Using single molecule DNA Fiber Analysis, we have discovered that MVM infection leads to a shortening of host replication forks as infection progresses and induces replication stress prior to the initiation of virus replication. Ectopically expressed viral non-structural proteins cause host-cell replication stress, as do UV-inactivated non-replicative MVM genomes. The host single-stranded DNA binding protein Replication Protein A (RPA) associates with the UV-inactivated MVM genomes, suggesting MVM genomes might serve as a sink for cellular stores of RPA. Overexpressing RPA in host cells prior to UV-MVM infection rescues DNA fibers, confirming that MVM causes RPA exhaustion.

OPTIMIZING GEOSPATIAL SEARCHING FOR PROXIMITY TO HEAVY METAL CONTAMINATED SITES: UTILIZING DOGS AS HOUSEHOLD SENTINELS OF METAL EXPOSURE

Leah Russell
Mentor: Freya Mowat

Age-related neurologic decline contributes to deterioration of physical and mental wellbeing, impacting daily life. Chronic exposure to environmental sources of heavy metals is an important cause of such decline but is poorly understood due to protracted study durations in humans. Pet dogs often share the same environment as their owners, and thus, may represent a household sentinel for toxicant exposure with accelerated physiological outcomes. Previous studies have investigated proximity of the dog home to contaminant sources such as Superfund and Brownfield sites using Google Maps. Our work has developed methods using geospatial software (ArcGIS Pro) to create a more nuanced and time-efficient method for searching. We plan to compare proximity to contaminated sites with heavy metal concentrations in dog blood, hair, and drinking water.

INVESTIGATING POWER DYNAMIC INFLUENCE ON CONVERSATIONAL ENTRAINMENT

Tia Sadlon
Mentors: Arella Gussow, Maryellen MacDonald

The relationship between social power and language has received much attention in recent research, though primarily from corpus-based experiments. This study instead examines the effects of power dynamics on sociolinguistic entrainment – the phenomenon wherein conversational partners' speech becomes more similar – throughout a live dialogue. Lexical choice entrainment was measured by analyzing how frequently a participant used "target" words. Hypothesized results include greater entrainment from participants whose partner possesses two types of social power compared to one. Participants who entrain more will perform better in the task and rate the task, conversation, and confederate more positively. Per these results, the amount individuals entrain relates to both the degree and kind of power their interlocutor holds. Further research should follow on how power differences impact interpersonal communication.

CONTROLLING MICROBIAL GROWTH IN FOODS WITH SODIUM CHLORIDE

Geoffrey Saemann
Mentor: Wendy Bedale

Health risks associated with heavy salt consumption have led to efforts to reduce salt concentrations in food products, and the task of salt reduction often falls to food manufacturers. However, salt is useful in foods to limit the growth of pathogenic or spoilage microorganisms. The aim of this review article is to review published studies that examined how sodium reduction in foods affects the survival and growth of pathogenic and spoilage organisms and their production of toxins and other hazardous substances.

HARVESTING 2-D MATERIALS FOR ITS UNIQUE PROPERTIES

Muaz Salem
Mentor: Jun Xiao

Exploring novel quantum phases and accessing the properties of certain quantum phases for energy applications has become an important field of research. However, the current methods of practice, such as strain engineering, obstruct characteristics responsible for the quantum phases of interest. Recently, two-dimensional (2D) materials have been discovered to have unique optical sensing properties that resonate at extreme frequencies. Our group, through this research, is planning to harvest 2D materials of which we will pulse high energy frequencies that can perturb the excitation of substances instantaneously. Our goal is to be then able to provide an alternative method of exploring novel quantum phases that provides faster quantum phases.

MECHANICAL STIMULATION OF PLANTS: USING AUTOMATED INTERMITTENT CONTACT TO PROTECT PLANTS IN SPACE

Ainsley Salisbury
Mentor: Simon Gilroy

In space, plants are exposed to a different environment than they are on Earth. By characterizing the plant molecular sensing system through the response to mechanical touch, we can understand stress response in plants and increase plant durability. To evaluate this response, plants need to be mechanically stimulated in a controlled and reproducible way. This will be done using the Automated Botanical Contact Device (ABCD) to simulate reproducible, intermittent contact with the plant shoots. Preliminary data shows that the touched plant root system grows more lateral roots compared to the untouched plants, suggesting a change in root architecture. By understanding the impact of touch stress on root system morphology, we can develop strategies for improving plant growth both on Earth and in spaceflight conditions.

NEGATIVE POLARITY ITEMS IN UPPER MIDWESTERN ENGLISH

Eleanor Sand, Miranda Vescio
Mentor: Joe Salmons

Regional American English dialects are becoming increasingly distinct, not only phonologically, but also semantically and syntactically. The present study targets a gap in the research on Upper Midwestern dialects: the loss of negative polarity with the Negative Polarity Items (NPIs) "yet," "anymore," and "budge." Participants (n = 396) were asked to complete an online sentence judgment task (20 experimental stimuli, 20 fillers) about perceptions of a target sentence (e.g., "We have time yet.") and its speaker. The results show that loss of negative polarity with NPIs is perceived to be a rural, uneducated, and Midwestern feature. However, the reported speaker production of this construction (excluding "yet") challenges this perception. This has implications for dialect perception and change within Upper Midwestern English.

IDENTIFYING THE CCR2-DEPENDENT COLLAGEN PRODUCING MYELOID CELL TYPE IN THE INFLAMED MOUSE PROSTATE

Jaskiran Sandhu
Mentor: Chad Vezina

Lower urinary tract symptoms (LUTS) are prevalent in aging men, and one cause of LUTS is prostatic fibrosis. I found that bone marrow-derived myeloid cells are recruited to the E. coli inflamed mouse prostate where they produce collagen. The inflamed prostate synthesizes CCL2, a chemokine binding CCR2 on circulating cells, including myeloid cells, and guides their migration into injured tissues. Additionally, the deletion of Ccr2 prevents prostatic fibrosis without impairing the prostate's inflammatory response to bacterial infection. This project aims to pinpoint the myeloid cell subtype responsible for prostatic fibrosis. Fluorescence activated cell-sorting and immunohistochemistry were used to test the hypothesis that monocytes are recruited to inflamed prostates of genetic control but not Ccr2 knockout mice. Preliminary results show a Lyc6hi/Cd11b+ cell absent in the inflamed Ccr2 KO prostate.

EFFECTS OF ESTRADIOL DEPRIVATION ON PANCREATIC ISLET MORPHOLOGY OF OVARIECTOMIZED FEMALE RHESUS MACAQUES

Mihika Sathe, Taylor Byington
Mentor: David Abbott

Estradiol (E2) is a female sex hormone that regulates the menstrual cycle. Studies in female rodents suggest that E2 deprivation leads to accumulation of extracellular plaque in pancreatic islets. Subsequent diminished islet numbers of insulin-producing beta and other cells increase the likelihood of conversion to type 2 diabetes (T2D). The results of our previous study in marmoset monkeys, however, showed no such pathology. The purpose of the current study was to determine the effects of E2 deprivation on pancreatic islet pathology of female rhesus macaques. These monkeys share 93% of their genome with humans and are a more comprehensive model for humans. We hypothesize that total E2 deprivation will increase extracellular plaque in macaque pancreatic islets compared to controls and signs of T2D.

PHYSICAL PROPERTIES OF SNOWFALL OVER THE GULF OF FINLAND

Megan Schaaf
Mentors: Tristan L'Ecuyer, Julia Shates

Snowfall events are a vital source of water resources and have important impacts on the Earth system as a whole. In the Western United States where water is often scarce, for example, people rely on snowmelt in the spring to provide water for both agriculture and consumption. Snowfall can, however, be difficult to forecast in both weather and climate predictions. There are uncertainties in snowfall forecasts because of the variability from different temperature layers in the atmosphere that impact the intensity and water content of snow. In addition, direct measurements of snowfall accumulation can be uncertain because of impacts from wind. These factors make it hard to anticipate when, where, and how intensely snow is going to fall. Field campaigns with ground-based radars help expand our understanding of the atmosphere and can help improve snowfall predictions in future models. This study will use data collected during the Light Precipitation Evaluation Experiment (LPVEx), which occurred over the Gulf of Finland during the months of September 2010 and January 2011, to examine the properties of snowfall events using observations from a vertically profiling radar and scanning weather radar. Meteorological conditions are considered in order to determine how snowfall characteristics are influenced by the precursor conditions leading to the events. This study hopes to better understand the interactions between snowfall characteristics and the local meteorological conditions that drive them.

IDENTIFYING BACTERIAL GENES ESSENTIAL FOR ANAEROBIC PURINE METABOLISM IN THE HUMAN GUT

Emma C Schiffmann
Mentor: Federico Rey

Uric acid is the product of purine metabolism in humans and influences the host's disposition for inflammatory disease. Most uric acid is excreted via urine, however a portion remains in the gut and is used by bacteria as a source of carbon and energy. Six genes in E. coli are upregulated when grown anaerobically on uric acid or purines, however, the characterization of these genes remains evasive. With the use of genetic engineering, the role of each gene in purine metabolism may be understood. Two genes were recombineered to see whether growth on uric acid, purines, or glucose was inhibited or not, compared to the parent strain. These mutant strains will be valuable to test the role of these genes in animal studies.

SURVEY OF SCREENING SUDDEN CARDIAC DEATH IN YOUNG ATHLETES

Jenna Schlondrop
Mentor: John Hokanson

Sudden cardiac death (SCD) in young athletes is rare but receives mass attention due to its tragic nature. Although SCD is an important clinical issue, there's little data for decision-making regarding pre-participation screening in young competitive athletes. We've created a survey to collect data from healthcare providers in different subspecialties of pediatric cardiology involved in decision-making for pre-participation screening. Respondents thought the emphasis on screening was appropriate, and 80% were at least slightly concerned about the liability associated with reading screening ECGs. Similarly, respondents didn't want to screen males differently than females but failed to recognize the significant difference in SCD incidence between them. Data collected will help determine recommendations and shape future discussions for current best practices regarding pre-participation screening.

THE FORMATION OF "DENSITY SNAKE" HELICAL STRUCTURES WITHIN MST TOKAMAK DISCHARGES

Brandon Schmall
Mentors: Noah Hurst, John Sarff

"Density snakes" are helical structures formed in plasma generated within the Madison Symmetric Torus (MST) and other fusion devices. A numerical method was developed to identify and analyze these structures using interferometry measurements of the electron density rather than the typical soft x-ray measurements, which measure temperature. It was found that snakes within MST are of similar form to those found in other devices even though MST was created for reversed field pinch plasmas. The spontaneous nature of snakes in MST is compared to the pellet-induced snakes in other devices. The association between the pitch of the helical magnetic field and the snake radius will also be discussed.

EFFECT OF CORTISOL ON POSTPARTUM DISEASE IN DAIRY COWS

Sophia G. Schoenfeld
Mentors: Pedro Monteiro, Milo Wiltbank, Laura Hernandez

This case-control study evaluated the association between cortisol and disease incidence. Additionally, the effect of pregnancy-associated glycoproteins (PSPB) on uterine disease was evaluated. Dairy cows (n=122) had blood and urine sampled daily from D-14 to D3 relative to parturition. Cortisol and PSPB were evaluated by ELISA, and data were analyzed by SAS. Incidence of diseases were 18.8%(23/122), 17.2%(21/122), 4.9%(6/122), and 12.3%(15/122) for RP, metritis, mastitis, and scours, respectively. Prepartum cortisol was not related to disease incidence. Postpartum, cows with RP (5.5±0.59 vs. 4.0±0.42ng/mL), metritis (5.7±0.58 vs. 3.7±0.36ng/mL) or scours (6.0±1.44 vs. 4.2±0.89ng/mL) had increased ($P<0.05$) cortisol compared to healthy cows. Urine cortisol was increased prepartum and postpartum in cows with uterine disease. PSPB reflected uterine disease. Thus, cortisol relates to disease incidence in dairy cows.

EFFECTS OF KISSPEPTIN 10 (KP10) ON FOOD INTAKE IN FEMALE MONKEYS

Suzanne Schott
Mentor: Ei Terasawa

Increases in the release of gonadotropin releasing hormone (GnRH) initiate puberty onset. However, the mechanism of the pubertal increase in GnRH is unclear. Because the neuropeptide kisspeptin is an important regulator for GnRH neurons in the hypothalamus, we examined the effects of the kisspeptin agonist, KP10 on puberty. Three of six juvenile female monkeys received hourly infusion KP10, while the other three juvenile females were assigned controls. Food intake was measured daily, and body weight was assessed weekly. Preliminary results indicated that while KP10 infused females exhibited signs of puberty, it did not alter the amount of food intake or the body weight. It appears that the KP10 action on GnRH neurons is independent from the mechanism controlling food intake and subsequent body weight regulation.

CHARACTERIZATION OF LAMININ α IN THE SEXUAL PLANARIAN SCHMIDTEA MEDITERRANEA

Claire Schwabe
Mentors: Phil Newmark, Melanie Issigonis

Planarians are an excellent model to study regenerative biology as they are able to regenerate a whole animal from a small fragment of tissue due to the presence of stem cells called neoblasts. The sexual planarian Schmidtea mediterranea is also a model for germ cell biology as it can regenerate its entire reproductive system. Recent advances in molecular biology allow us to probe how planarians make new germ cells. Laminin α, a major component of basement membranes, was cloned, and in situ hybridization was performed to observe the expression pattern in sexual planarians. dsRNA was generated to perform transcript knockdowns and observe the resulting phenotype in reproductive tissues. Ultimately, understanding the phenotype of this gene can further the understanding of germ cell biology.

INVESTIGATING THE IMPACT OF ALTERNATE ELECTRON ACCEPTORS ON EXPRESSION OF DMSO REDUCTASES IN SALMONELLA ENTERICA

Analea Scott
Mentors: Johanna Elfenbein, Eddy Cruz

Non-typhoidal Salmonella must use anaerobic respiration to overcome physiologic hypoxia to establish a successful infection within the gut. The anaerobic electron acceptors nitrate and tetrathionate promote Salmonella growth during enteritis while fumarate and dimethyl sulfoxide (DMSO) promote growth before enteritis. This study utilizes transcriptional reporters to understand how electron acceptor availability impacts expression of three homologous DMSO reductases in Salmonella. We hypothesize electron acceptors with reduction potentials higher than DMSO repress DMSO reductase expression. Our data demonstrate nitrate suppresses expression of one DMSO reductase while fumarate enhances its expression. These data suggest intestinal fumarate may act as a signal to activate DMSO reduction during infection. Future directions of this project will link these phenotypic changes in gene expression to known regulatory systems in Salmonella.

ACID TOLERANCE ADAPTATION TOWARDS INCREASED BIOSYNTHESIS OF BIODEGRADABLE PLASTICS FROM DAIRY WASTE STREAMS

Ethan Seng
Mentor: Erica Majumder

Polyhydroxybutyrate (PHB) is a biodegradable plastic polymer produced by bacteria which could replace certain non-biodegradable plastics. Industrially, PHB is produced using costly food-derived feedstocks. Acid whey, a dairy industry waste stream, may be a cost-effective alternative if bacteria can be engineered to grow using it as a carbon source. E. coli LSBJ has been modified to produce PHB in neutral pH, however, it cannot produce PHB in acidic environments. We aim to engineer E. coli LSBJ for optimal PHB production in acidic environments via laboratory evolution and determine how the acid tolerant strain differs from the un-evolved strain using genome sequencing. Additionally, we are optimizing E. coli LSBJ further using targeted genomic insertion plasmids to insert crucial PHB production genes into the genome.

MODELING ELECTRIC GRID RESILIENCY AND EQUITY IN RESPONSE TO WILDFIRE RISK

Gabriela Setyawan
Mentors: Sofia Taylor, Line Roald

Our changing climate increases the risk of extreme weather occurrences, including wildfires. One of the causes of large wildfires is power line faults. Currently, the preventive action taken by utility companies is to switch off the power for lines with a high risk of wildfire. However, this directly impacts the customers served as their lives depend on the critical electrical infrastructure. Therefore, it is essential to maintain grid resiliency due to climate change and understand the social context surrounding the grid to ensure equitable access. This work utilizes mathematical optimization and GIS to improve electric grid operations and planning by considering environmental and social factors.

VERTICAL OMR IN ZEBRAFISH

Adina Shaikh
Mentors: David Ehrlich, Nick Milicic

The optomotor response (OMR) is a behavior found in zebrafish where they will swim in the same direction as visual stimuli to stabilize their position in the environment. It has been widely used as a reliable behavioral response useful for understanding sensorimotor function in fish during experiments. However, OMR has only been studied in the horizontal plane; the current study examines if there is an OMR that exists in the vertical plane. This would allow for new experimental designs that utilize the vertical OMR in zebrafish to study how fish steer in the vertical plane. Utilizing a drifting, striped grating pattern, if the zebrafish swim in the same direction as the grating, then this would suggest that they exhibit vertical OMR.

BUMBLE BEE COLONY LIFE STAGE AND POLLEN QUALITY AS FACTORS AFFECTING FLOWER VISITATION FREQUENCY

Amanda Shalit
Mentor: Stephanie McFarlane

Bumble bees (Bombus spp.) are economically important pollinators that are threatened by habitat loss. Understanding bumble bee nutritional needs can help land managers provide optimal floral resources for maintaining bumble bee populations. Previous research has shown that bumble bees prefer pollen that has a high protein-to-lipid ratio (P:L) but has yet to document whether bumble bee foraging habits change over the colony's life cycle. We collected pollen (P:L) and bumble bee visitation data across southern Wisconsin during both the spring and summer foraging seasons. Our preliminary analyses show a positive correlation between P:L and bumble bee visitation during the summer, which we predict will reverse in the spring as queens require more lipids after overwintering.

ROLE OF BROWN FAT BETA ADRENERGIC RECEPTORS AND EXTRA OVARIAN ESTRADIOL IN REGULATING FEMALE BODY WEIGHT

Sindhu Shankar
Mentors: David Abbott, Molly Willging

Almost half of the United States adult population is obese. Obesity, defined clinically as a body mass index ≥30, is characterized by positive energy balance resulting in lipid accumulation in white adipocytes. Studies in female rodents have implicated a lack of estradiol (E2) action, via estrogen receptor alpha (ESR1) in the hypothalamus, as a primary culprit. E2/ESR1-enabled beta-adrenergic receptor signaling in brown adipocytes opposes weight gain by thermogenesis. Women depleted of E2 through menopause are likely to develop obesity. Studying the onset of obesity in women is ethically challenging, thus, a nonhuman primate (NHP), sharing many functional processes, can serve as a translational model. Investigating brown adipocyte function in these E2-depleted NHPs presents a potential for finding new therapeutic targets for obese women.

SMALL MONETARY INCENTIVES LEAD TO GREATER ADHERENCE IN A WEIGHT LOSS PROGRAM

Armaan Shetty
Mentor: Corrine Voils

Assessed how incentives for dietary and/or weight tracking impact weight loss behavioral adherence. Analysis of participants randomized to one of four conditions in a weight loss intervention: incentives for dietary tracking, incentives for self-weighing, both, or none. Participants were asked to self-weigh at least twice weekly and log food and drink five days weekly. Kaplan-Meier analyses examined differences across the conditions. Participants incentivized for dietary self-monitoring had an average 15.8 weeks until the first non-adherent week compared to 5.9 weeks for those not incentivized for dietary self-monitoring. Those incentivized for self-weighing had an average 18.0 weeks of self-weighing until the first non-adherent week compared to 13.5 weeks for those not incentivized for self-weighing ($p=0.02$). Incentivizing behaviors associated with weight loss improved adherence to those behaviors.

PROBING THE SURFACE INTERMEDIATES OF ELECTROCHEMICAL METHANE OXIDATION

Chien-Rung Shih
Mentor: Marcel Schreier

Electrochemical methane oxidation provides a promising pathway to convert the chemical energy stored in methane more efficiently into electricity. While Pt catalysts have been proposed to lower the overpotential of electrochemical methane oxidation, the mechanism of methane oxidation on Pt (100) remains unclear. Thus, in this study, we are motivated to probe the identity of methane adsorbates on the Pt (100) surface. To achieve so, methane was first adsorbed under various constant potentials. Subsequently, a positive potential sweep was applied to oxidize all the surface adsorbates to CO_2. The oxidation states of the surface intermediates are then obtained by the integration of current and CO_2 fluxes. The result suggests the potential dependence of the surface intermediates and provides the first step for further investigation.

INVESTIGATING STING-MEDIATED AXL SUPPRESSION IN MELANOMA IMMUNITY AND HETEROGENEITY

Carl Shirley
Mentor: Nihal Ahmad

Immunotherapy resistance remains a challenging barrier, preventing successful metastatic melanoma treatment. Recent preclinical studies concomitantly utilizing stimulators of interferon genes (STING), agonists, and current immunotherapies have demonstrated durable responses. However, the relationship of STING to melanoma heterogeneity, a significant contributor to immunotherapy resistance, remains unknown. Elevated tumoral AXL receptor tyrosine kinase (AXL) expression is associated with phenotypic plasticity, heterogeneity, and therapy resistance. Here, I utilize RT-qPCR and western blot techniques to demonstrate that STING overexpression decreases AXL expression in two human melanoma cell lines. From Gene Expression Omnibus datasets, I generate a patient cohort showing that AXL levels may dictate immunotherapy responses in patients with active STING signaling. I then propose to investigate the significance of AXL in STING-mediated melanoma immunogenicity and heterogeneity.

ALTERATIONS IN THE MICRO-STRUCTURE OF WOOL AFTER FREEZING; WHAT CLIMATE CHANGE COULD MEAN FOR PERMAFROST BURIALS

Rebecca Sikes
Mentor: Jonathan M. Kenoyer

The Altai Mountains of Southern Siberia host dozens of permafrost burial sites, containing rare examples of preserved textiles from the Scythian culture (ninth to second centuries B.C.E). This project seeks to add the dimension of thawing caused by climate change into the conversation on Pazyryk wool and how it affects the cuticle structure of wool threads. Frozen Kalasha wool was imaged with a scanning electron microscope, and a perceptible change was found in the cuticle structure of the threads. Pazyryk wool threads were also compared to these samples. Increasing global temperature puts permafrost sites in danger, so understanding temperature impacts on wool's microstructure is critical. This experiment shows that frozen wool fibers change their structure, which can inform analysis of permafrost textiles moving forward.

EXPLORING QUASAR WINDS: AN ANALYSIS OF DATA FROM THE SLOAN DIGITAL SKY SURVEY

Aahaan Singh
Mentor: Catherine Grier

Quasars are extremely bright regions at the centers of galaxies that are powered by supermassive black holes. Such objects can have significant effects on the development of their galaxies via high velocity outflows of gas. The purpose of this research is to analyze the quasar RMID-508, an object of interest that could provide more information on general quasar behavior. This was done by observing the variability of a broad absorption feature in the quasar spectrum which, based on preliminary analysis, has fluctuated dramatically in strength over very short timescales. Spectra from 90 separate observations of the quasar were cleaned, fitted, and analyzed to gain further insight into the magnitude and frequency of these fluctuations.

CHILESAURUS: PUTTING A SQUARE DINOSAUR IN A ROUND HOLE

Shailaja Singh
Mentor: Scott Hartman

Discovered as an articulated skeleton in 2004, Chilesaurus has vexed researchers since the moment study on it began. Having leaf shaped teeth, a retroverted pubis, and two fingers, this specimen shows a combination of traits not found elsewhere in Dinosauria. Due to this strange set of characteristics, it was originally placed in Theropoda, however subsequent studies have placed it in families ranging from Sauropodamorpha to Neornithischia. The disagreements about this specimen have even led to theories reorganizing the entire dinosaur family tree, doing little to elucidate the organism's position in the story of Dinosauria. Using phylogenetic analysis through maximum parsimony using R and comparison of characters in between Chilesaurus and other dinosaur groups, we aim to conduct our own analysis of Chilesaurus, hypothesizing it to have a place within Theropoda.

THE ROLE OF STEROID HORMONE IMBALANCE IN BLADDER PATHOLOGY

Kegan Skalitzky
Mentor: William Ricke

An underexplored contributor to lower urinary tract dysfunction is inflammation. Previous work has demonstrated that the age-related increase in the estradiol to testosterone ratio creates hormone imbalance that induces prostatic inflammation and fibrosis, and that osteopontin knock-out (OPN-KO) ameliorates this effect. It is unknown whether this triggers changes in the bladder. Male WT or OPN-KO mice were treated with testosterone and estradiol to induce hormone imbalance, and bladder tissues were collected after two, six, or twelve weeks. Immunohistochemical staining of CD45 and picrosirius red staining were performed to assess immune cell infiltration and collagen deposition, respectively. Analysis revealed that inflammation, but not fibrosis, occurs in the bladder following treatment in both WT and OPN-KO mice.

ELUCIDATING THE ROLE OF PHD FINGERS IN HISTONE METHYLTRANSFERASE PROTEIN NSD2

Sara Slager
Mentor: John Denu

Histone methyltransferase proteins play a vital role in epigenetic control of gene expression, with impacts on both normal growth and the development of multiple cancers. Overexpression of Nuclear Receptor Binding SET Domain Protein 2 (NSD2), a methyltransferase protein known to activate gene expression through methylation of histone H3 lysine 36, is implicated in oncogenesis in multiple tissues. While the catalytic SET domain of the protein is well characterized, the functions of other domains such as the 5 zinc-coordinating plant homeodomains (PHD), are less understood. Loss or mutation of PHD5 has been shown to decrease the methyltransferase capabilities of NSD2. Through in vitro experiments, we aim to determine the binding capability and specificity of NSD2 PHD5 to histone H3, possibly giving insights into targeted cancer treatments.

CHERENKOV RADIATION DETECTION DEVICE TO COLLECT ENERGY OUTPUT READINGS

Colin Smith, Bryan Brady, Eliot Ciuperca, Landon Kohler, Nicholas Zakowski, Tristan Lockert
Mentor: Adrien Couet

The objective is to determine the power output of the UW-Madison nuclear fission reactor by observing the light emitted through Cherenkov Radiation. There will be 2 known energy outputs used to create a calibration curve, which will be used to determine the energy output of unknown value. The values for the power output will be detected through the use of photoresistors with high sensitivity. These photoresistors will capture values of voltage resistance for ~300-500 nm, which will be correlated with energy output.

THE IMPACT OF THE LuxR REGULON ON VIBRIO FISCHERI HOST COLONIZATION

Emily Smith
Mentor: Mark Mandel

Bacteria can coordinate group behaviors by sensing the accumulation of signals in a process called quorum sensing. In Vibrio fischeri transcriptional regulator LuxR is a key quorum-sensing receptor that is necessary for persistence in the host. One reason for this phenotype is LuxR-regulated luminescence, but there are approximately a dozen other loci regulated by LuxR, and here we aimed to characterize their roles during colonization. We created strains of V. fischeri where each locus was deleted, and we are determining colonization phenotypes of the resulting strains. This research provides a foundation for understanding how quorum sensing influences host colonization.

FXR1 DEFICIENCY LEADS TO IMPAIRED MORPHOLOGICAL DEVELOPMENT OF HUMAN EXCITATORY NEURONS

Riley Smith
Mentors: Xinyu Zhao, Natasha Mendez

Fragile X autosomal homolog 1 (FXR1) is an RNA-binding protein in the fragile X-related protein family (FXRs), a group of proteins important for neurodevelopment. While FXR1 has been associated with schizophrenia and bipolar disorder, its function in human brain development remains unclear. In order to process information and transmit signals, neurons must develop proper morphology. We examined the impact of FXR1 deficiency on the morphology of excitatory neurons (exNs) derived from human induced pluripotent stem cells (iPSCs). Using Sholl analysis, we found that FXR1-deficient exNs have reduced neurite complexity compared to control exNs. Our findings have uncovered that FXR1 is important for human neurodevelopment. Gaining insight into the function of FXR1 in exNs helps our understanding of mechanisms underlying neurodevelopmental disorders.

MATH MEETS SCIENCE: AN INTERVENTION STUDY TO IMPROVE CHILDREN'S INTERPRETATIONS OF DATA TABLES

Megan Smitz, Margaret Mackinnon
Mentors: Martha Alibali, Rui Meng

Understanding data is an important aspect in everyday life. As analyzing data is being introduced into the curriculum at an earlier age, it is of growing importance that students understand how to interpret data and which intervention techniques are most effective at supporting children's learning. Previous research suggests that students often use frequency-based strategies rather than ratio-based strategies. Our study examines how 7th graders interpret data in 2x2 tables to investigate whether conceptual or conceptual+procedural instruction supports children's ability to correctly interpret data tables and use ratio-based strategies. Conceptual instruction highlights why using frequency-based strategy is wrong, and the conceptual+procedural instruction provides steps of using the conditional probability strategy. We analyze the shifts in children's strategies in response to the intervention.

ASSESSING THE RELATIONSHIP BETWEEN APPENDECTOMIES AND CROHN'S DISEASE DEVELOPMENT

Michael Sohn
Mentor: Andrew Lokuta

The appendix, once thought to be vestigial, has more recently been suggested to be a key regulator of gut bacterial homeostasis, and thus, its removal has been hypothesized to be a risk factor for development of GI auto-immune disorders like Crohn's Disease (CD). To better analyze the limited research on this topic, a meta-analysis was performed on studies which compared rates of appendectomies and CD. Using the standardized measurement of Odds Ratio (OR), the results of the meta-analysis supported the theory that the removal of the appendix is correlated with increased rates of CD. While this analysis helps elucidate the appendix's potential bodily role, post-appendectomy patients ought to note that avoiding smoking and high-fat diets have also been proven to reduce the risk for CD.

EFFECT OF PATIENT DERIVED XENOGRAFT ESTABLISHMENT ON TUMOR MICROVESSEL DENSITY

Hannah Sondreal
Mentor: Liliana Berube

Patient-derived xenografts are critical to understanding tumors, and these models give insight to therapeutic response and mechanisms of resistance. Currently, there is variation in establishment techniques of head and neck PDXs, including site of establishment and number of passages. We aim to directly compare these methods in order to understand possible differences between these model systems. Utilizing H&E staining, we will quantify the vascularization of the tumors and compare between engraftment site and over passages. Vascularity is essential to analyzing tumor growth, leading to insights into the evolution of cancer. By measuring the microvessel density (MVD) of heterotopic and orthotopic PDXs, we will determine how the site of engraftment impacts vessel density which will provide insight into potential limitations of approaches taken to establish PDXs.

CHARACTERIZATION OF PIG PLURIPOTENT STEM CELL-DERIVED PHOTORECEPTORS FOR CELL REPLACEMENT

Kai Sovell
Mentor: Kimberly Edwards

Photoreceptor (PR) loss due to retinal degenerative disease or injury is a devastating cause of blindness worldwide. Advancements have been made in the generation of human pluripotent stem cell (hPSC)-derived PRs for transplantation. However, differences in synaptic proteins between species is a barrier for human PR integration and function when testing transplants into a non-human retina. To overcome this, we developed a protocol for making pig pluripotent stem cell (pPSC)-derived PRs for pig-into-pig cell replacement studies. We verified the generation of mature pPSC-derived PRs by brightfield microscopy, immunocytochemistry, and reverse transcriptase-polymerase chain reaction. These cells will be used in future pPSC-derived PR cell transplantation efforts in collaboration with the National Eye Institute to complement ongoing human studies.

MARIAN DIAMOND AND THE FOUNDATIONS OF NEUROPLASTICITY: A HIGH SCHOOL ACTIVE LEARNING EDUCATION MODULE

Emma Speck-Wayne
Mentor: Allyson Bennett

As a neuroscience pioneer in 1962, Marian Diamond challenged stereotypical assumptions of who belongs in science and paved the way for future generations of women in STEM. Her discoveries demonstrated that structural brain changes can occur in response to enriched environments. The active-learning based education module I developed teaches high school students about synaptic neuroplasticity and the contributions of Dr. Diamond to inspire student interest in science. The module adheres to national educational standards and features three collaborative discovery-based activities on core concepts in neuroanatomy and functional brain organization, an interactive presentation on Dr. Diamond, and several other active learning materials highlighting modern applications of neuroplasticity research. All coursework is designed to encourage student engagement in research, promote inclusion, and facilitate further exploration of science.

QUANTITATIVE POLARIZED LIGHT IMAGING OF PULMONARY VALVE LEAFLETS

Shreya Sreedhar
Mentors: Colleen Witzenburg, Daniel Pearce

Aberrations in collagen alignment can cause changes in the mechanical properties of heart valve leaflets and increase the risk of valve dysfunction and disease. Quantitative polarized light imaging (QPLI) is a useful tool that uses division-of-focal-plane polarimetry to quantify the full field collagenous organization of thin heterogenous tissues. QPLI provides overall incident light intensity (S0), the angle of linear polarization (AoP), and the degree of linear polarization (DoLP). QPLI was applied to pulmonary valve leaflets, which are thin heterogeneous cardiovascular tissues. We evaluated the hypothesis that light intensity and tissue thickness are correlated and determined spatial patterns in AoP and DoLP. In the future, this technique can also be used in dynamic loading conditions to further study the collagen alignment in altered loading states.

PRION-PROTEIN DISCOVERY IN BACTERIA

Mridula Srivathsan
Mentor: Silvia Cavagnero

Prions are responsible for transmissible spongiform encephalopathies. Prions become infectious through the conversion of the cellular form into an aggregated scrapie conformation. Prions are known to exist in vertebrates, yeast, and fungi and often bear disordered (IDR) and folded regions of comparable size. Identification of bacterial prions has been mostly unsuccessful. This project identified prion candidates in E. coli using a computational script that identifies IDR and folded regions based on amino-acid sequence. 14 prion candidates that were identified by screening of the E. coli proteome via this program were narrowed down to 3 based on other criteria. These prion candidates will be validated in lab. Identification of prion-like proteins in E. coli will aid the development of antibiotic-independent strategies to treat bacterial infection.

MAPPING NEUTRAL CARBON ACROSS THE OUTER LAYERS OF THE HELIX NEBULA USING THE ATACAMA COMPACT ARRAY

Lucy Steffes
Mentors: Jesse Bublitz, Snezana Stanimirovic

The Atacama Compact Array (ACA) was used to map and examine the abundance of neutral atomic carbon [C I] at three regions in the outer layers of the Helix Nebula (NGC 7293). Strong detections of [C I] were found and mapped for the East and West positions. Due to low integration times, a detection of [C I] was not resolved at the West Position, so upper limits were calculated instead. Globule-like structures, previously obscured by dust, were also observed at the Rim Position at two different velocities, giving more information about the barrel structure of the Helix Nebula. Maps of [C I] were also compared to high energy transitions from the Hubble Space Telescope and to IRAM-30m single dish molecular observations in the same regions.

ALL THINGS CONSERVED: FROM SEQUENCE TO SPECIES

Hugh G Steiner
Mentor: Prashant Sharma

In the wake of species loss, areas of high diversity and endemism must be identified using phylogenetically informed metrics to preserve the maximum available biodiversity. Here we assessed conservation threats to Israeli cave systems, specifically spiders of the genus Tegenaria. A spectrum of eye morphologies has been observed in Israeli Tegenaria with strong associations with cave sites. These associations suggest specific patterns of speciation and the incidence of microendemic taxa within Tegenaria. We sequenced ultraconserved elements of Tegenaria to infer a phylogeny and delimit species. Our data pinpointed numerous cryptic species, with many microendemics restricted to individual cave sites. We employed the R package canaper and Categorical Analysis of Neo- and Paleo-Endemism (CANAPE) to generate conservation metrics that are informative for future policy.

VOLUME TRANSPORT CHANGES THROUGH WEST GREENLAND ARCTIC GATEWAYS IN CMIP6 MODELS

Connor Steinke
Mentor: Hannah Zanowski

The Arctic straits west of Greenland, Nares, Barrow, and Davis, are important gateways between the cold, fresh Arctic Ocean and the warmer, more saline waters of the North Atlantic. The processes that influence changes in the typically southward-flowing volume transport through these gateways are not yet well understood, though some theories point to the influence of large-scale atmospheric dynamics or changes in sea surface height. In this project, we turn to global climate models from the 6th phase of the Coupled Model Intercomparison Project (CMIP6) to explore the varied future of volume transport around Greenland and the possible mechanisms that drive these changes in future climate forcing scenarios.

MECHANISMS UNDERLYING METAPHASE ARREST INDUCED BY HIV-1 VIF PROTEIN

Kaelyn Stephenson
Mentor: Aussie Suzuki

Human immunodeficiency virus (HIV) is a retrovirus that leaves infected individuals with the potential to develop AIDS and a compromised immune system. Viral infectivity factor (Vif) is an accessory protein of HIV-1 that degrades host cellular antiviral APOBEC3G enzyme. The exact mechanism underlying Vif induced G2/M cell cycle arrest is poorly understood. Preliminary results from the collaboration between Dr. Suzuki and Sherer Laboratories identified that Vif uniquely arrests cells at metaphase in mitosis. I examined p53 dependency in Vif-induced mitotic arrest by comparing phenotypes in p53 expression and explored the mechanisms underlying metaphase arrest by Vif to determine the timing of Vif expression within the cell cycle. These experiments will help create a better understanding of the mechanisms that Vif-induced cell cycle arrest.

TESTING A SELF-MADE CHERENKOV RADIATION DETECTOR IN THE UW REACTOR TO COLLECT LIGHT DATA

Chase Alexander Stormoen, Eric Stoikes, Phillip Rother, Ryan Leung, Lincoln Ogren, Matthew Schaefer
Mentor: Adrien Couet

Cherenkov radiation is a special type of radiation emitted from nuclear reactors which is easily seen from the deep blue light that is emitted. Using an external-photodiode housed in a container, it is possible to interpret the light as the power output from the reactor. Our goal is to create such a device that is able to detect and interpret the light data and get an estimate on the reactor's true power output. The diode's housing must be carefully designed to prevent water from entering and the container must be positioned in such a way that does not interfere with normal reactor operations.

FIBROTIC PRECISION-CUT LUNG SLICES FOR ASSESSMENT OF RADIOLABELED PROBE TARGETING

Kristen Stott
Mentor: Ksenija Bernau

Detection of fibrotic disease activity, especially in pulmonary fibrosis, is challenged by the lack of molecular imaging probes that specifically assess this phenomenon. We are developing a novel radiolabeled probe to allow the detection of pulmonary fibrosis disease activity. To ensure that the probe specifically targets markers of fibrotic disease activity in the lung, we developed a new ex vivo technique that radiographically assesses probe targeting in living precision-cut lung slices (PCLS). We demonstrate that [Cu-64]-PEG-FUD localizes to the injured lung while the [Cu-64]-PEG-mFUD peptide control does not. We also show that there is an increase in [Cu-64]-PEG-FUD probe uptake in fibrotic compared to normal lungs. Finally, by decellularizing lung sections, we found that our probe specifically targets the extracellular matrix in the fibrotic lungs.

ROLE OF BinK IN SYMBIOTIC BIOFILM REGULATION IN VIBRIO FISCHERI

Dawson Stroik
Mentors: Mark Mandel, Denise Ludvik

Bacterial biofilm regulation is critical during Vibrio fischeri colonization of the Hawaiian bobtail squid, Euprymna scolopes. BinK, a hybrid histidine-kinase, has been shown to be a key inhibitor of biofilm, however the signaling mechanisms are unknown. Using a bacterial two-hybrid (BACTH) approach, evidence shows BinK interacts with SypF, one of the two-component signaling (TCS) proteins that activates biofilm formation. The BinK receiver (REC) domain interacts with the SypF histidine phospho-transferase (HPT) domain. Mutations in the hypothesized catalytic amino acid D794 disrupt interactions with SypF(HPT), confirming that D794 is necessary for the interaction. Further work will define the interaction interface between BinK and SypF and determine the effects of interrupting the interaction.

PREVALENCE AND SEVERITY OF IRIS SEVERE MOSAIC VIRUS IN IRIS PRODUCTION IN WISCONSIN

Sydney M. Stroschein
Mentor: Derrick Grunwald

Iris severe mosaic virus (ISMV) is a devastating disease in irises. To determine the prevalence of ISMV in Wisconsin, we conducted field surveys in 2021 and 2022. Using visual inspection and ELISA methodologies, we demonstrate ISMV occurrence differing between iris species, with the highest incidence in Iris germanica: 76% (2021) and 79% (2022). No other species, including Iris versicolor and Iris sibirica, tested positive for ISMV. Prevalence was tracked throughout the growing season. No statistical differences in symptom presentation were observed; however, higher viral titers were measured in the months after flowering. Our results show ISMV is highly prevalent in Wisconsin-grown Iris germanica, excluding other species as a reservoir, and the critical need of disease diagnosis and management that do not rely on visual inspection.

HOROSPHERES IN HYPERBOLIC GROUPS: A COMPUTATIONAL APPROACH

Katerina Stuopis, Noah Jillson, Pramana Saldin
Mentors: Tullia Dymarz, Daniel Levitin

This research project aims to find and optimize algorithms capable of generating localized horosphere pieces. Given an alphabet, we consider the infinite collection of words. We then define a discrete notion of distance between these words and construct a graph from this collection by connecting words that are distance one apart. Intuitively, a horosphere is a sphere with its center taken to infinity. Over this graph, we compute various horospheres using our discrete distance metric. Our central object of study is the right-angled Coxeter group defined by a graph that is a flag (no square) triangulation of a torus. Using concepts of geometric group theory we create visualizations of these geometric structures within their hyperbolic groups. Joint work with Qianruixi Wang and Kaicheng Xue.

DNA METHYLATION DYNAMICS FOLLOWING TRAUMATIC BRAIN INJURY IN MICE

Shruti Subramanian, Jeongwoo Choi
Mentor: Charles Kozhikkadan Davis

After a controlled cortical impact to induce Traumatic Brain Injury (TBI) in mice, we investigated the levels of DNA modifications, 5-methylcytosine (5mC) and 5-hydroxymethylcytosine (5hmC), and the mRNA and activity levels of ten-eleven transolcases (TET), the enzyme that converts 5mC to 5hmC. We found that both 5mC and 5hmC levels were increased at all the time points we collected our data at, but insignificant changes in TET isoform levels. Increased 5hmC levels offered neuroprotection in other disease models. Future studies may aim to stimulate the conversion process by applying exogenous molecules that mimic cofactor or cosubstrate. It may also be therapeutically relevant in the case of neurological disorders.

MUNCHAUSEN DETECTIVES VERSUS MEDICAL DOCTORS: A CONTENT ANALYSIS OF THE SUBREDDIT R/ILLNESSFAKERS

Katie Sullivan
Mentor: Brad Kerr

Over 25% of American adolescents and young adults report having chronic health conditions or disabilities. It remains unclear how stigma surrounding chronic illness and disability is disseminated through Reddit. The purpose of this content and linguistic analysis study was to examine content shared in r/IllnessFakers, a forum in which users speculate about the validity of influencers' reported conditions. Twenty posts were selected, including 10 most engaged and 10 most recent posts. The first 20 comments on each post were assessed for negative subject-targeted sentiments, informational trends (e.g., generalizations, misinformation), and basis of evidence (e.g., anecdotal, scientific), as well as affective and social processes using the validated Linguistic Inquiry and Word Count software. Results may inform future stigma mitigation and bullying prevention strategies in digital spaces.

STICKY-SPOT MIGRATION OBSERVED AT BENCH GLACIER FROM SEISMIC DATA SPANNING 14 YEARS

Lindsay L. Summers
Mentors: Lucas K. Zoet, Nathan T. Stevens

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 can produce "ice-quakes" in the presence of high debris concentration on basal ice. These "sticky-spots" provide information about sliding mechanics. 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 clusters of seismicity shifted down-glacier by about 250 meters in 14 years. We propose that this down-flow shift in seismicity arises from advection of a dirty band of basal ice, providing a key empirical constraint on sticky-spot migration behavior on decadal timescales.

INVESTIGATING THE THERMAL STRUCTURE OF VENUS ATMOSPHERE USING TEMPERATURE PROFILES OBTAINED BY THE AKATSUKI

Shufan Sun
Mentor: Sanjay Limaye

The radio occultation method is a remote sensing technique to measure temperature variation with altitude in Venus's atmosphere. During the short duration of the occultation event, the radio beam is refracted by the atmosphere, providing a measure of the index of refraction from which the atmospheric density profile can be retrieved. Data from 76 profiles collected by the Akatsuki orbiter are available, covering the 35-100 km altitude range. The profiles need to be interpolated into fixed vertical levels for quantitative analysis of the thermal structure. The primary vertical scale given in the profiles is distance from the planet center, with the mean radius of Venus being 6051.8 km. This method provides an effective way to study Venus's atmospheric thermal structure remotely.

HERITABILITY OF HYPERANDROGENISM IN FEMALE RHESUS MACAQUES EXHIBITING NATURALLY OCCURRING PCOS-RELATED TRAITS

Yuhan Sun
Mentor: David Abbott

Polycystic ovary syndrome (PCOS) affects many women; is characterized by high testosterone (T) levels, polycystic ovaries, and irregular menstrual cycles; and is associated with insulin resistance, increased BMI, and infertility. Studying nonhuman primates (NHP) could provide valuable insight into the causes of PCOS given NHP genetic and physiological similarity to ourselves. In previous studies, we found PCOS-like characteristics in female rhesus macaques with naturally high levels of T. In this study, we aim to investigate the heritability of high T levels and PCOS developmental origins in a laboratory macaque population. By analyzing body measurements and steroid hormone levels in naturally occurring high T females, we hope to gain a better understanding of the heritability of traits associated with PCOS in women.

OPTIMIZING CANINE MAJOR HISTOCOMPATIBILITY COMPLEX GENOTYPING VIA NEXT GENERATION SEQUENCING

Yuqian Sun
Mentor: Matt Reynolds

Major histocompatibility complex class I (MHC-I) and II (MHC-II) molecules are essential components of the immune system. MHC genes are extraordinarily diverse and inheritance of specific MHC variants affects an individual's susceptibility to disease. However, the impact of canine MHC genes on disease outcomes are poorly understood, partially due to a lack of methods for MHC genotyping dogs. Thus, this study aims to optimize canine MHC genotyping using high-throughput next generation sequencing (NGS). We optimized polymerase chain reaction (PCR) conditions for amplifying full-length MHC-I and near full-length MHC-II genes and sequencing on NGS platforms to determine canine MHC genotypes. We anticipate these methods will benefit canine MHC disease association studies and help determine the impacts of individual MHC genes on cancer therapies.

DEVELOPING A PEER COACH DELIVERED FALL PREVENTION PROGRAM

Yuxin Tang
Mentor: Susan Andreae

Falls are the leading cause of injuries in older adults in the US. Studies show that participation and retention in fall prevention programs fail to ensure that the activities are supported by the participants' social networks or enjoyed by the participants. Thus, it is important for programs to meet individual beliefs and cultures and provide a supportive exercise environment. Using an iterative process guided by the RE-AIM planning framework, semi-structured interviews and group discussions were conducted with community stakeholders that focused on identifying feasible and acceptable ways to incorporate strategies shown to be effective in reducing fall risks. Our approach may be helpful for other communities seeking to adapt evidence-based health programs to a local community to improve sustainability and dissemination.

SOUTH ASIAN IMMIGRANT EXPERIENCES WITH INTIMATE PARTNER VIOLENCE

Khushi Tanna, Megha Brahmbhatt, Celeste Anais Sanchez
Mentor: Roli Sharma

Thousands of South Asians (SA) immigrate to America annually, yet despite leaving their home country, societal rules, in-laws, and patriarchal beliefs remain, often manifesting in the form of abuse. With the rate of intimate partner violence relatively high amongst the diasporic SA population, our attention is drawn to the unique forces that prompt such violence. This study will specifically focus on 5 SA immigrant victims across the United States who are in shelters, still in the marriage, or separated from their abuser. 90-minute interviews will be qualitatively analyzed to unravel the effects that culture, gender norms, and traditions have on the normalization of abuse, along with deepening our understanding of the struggles immigrants face in America with the hope of preventing future acts of violence.

SPATIAL RESOLUTION OF Plk1 ACTIVITY DURING THE MITOTIC CHECKPOINT

Madison Taychert
Mentor: Robert Lera

Persistent chromosomal segregation errors during cellular division generate new genetic combinations in tumors, which can promote chemotherapy resistance. Polo-like kinase 1 (Plk1) ensures faithful chromosome segregation, but linking specific Plk1 target protein interactions to distinct cellular outcomes has proven difficult with hundreds of possible Plk1 effectors. Utilizing a previously developed chemical genetic system, we examine the synergistic relationship between Plk1 and Monopolar spindle 1 (Mps1) to spatially resolve Plk1 activity in the establishment of the mitotic checkpoint – a process critical for chromosome segregation fidelity. The data from this newly developed assay will serve as the first step towards determining which specific Plk1 substrate interaction assists in the establishment of the mitotic checkpoint.

IMMUNE CHECKPOINT INHIBITORS IN COMBINATION WITH RADIOPHARMACEUTICAL THERAPY

Mason Kobxeeb Thao, Dane Paul Swenson
Mentors: Jamey Weichert, Cynthia Choi

Unlike many other diseases, cancer is unique with various categories of cancerous conditions requiring different approaches in therapy. Emerging approaches such as radiopharmaceutical therapy (RPT) and immune checkpoint inhibitors (ICI) have gained great recognition in recent years for their ability to selectively target cells accurately and effectively for treatment. Previous studies have shown a greater regression of cancer cells when radiopharmaceutical therapy and immune checkpoint inhibitors are administered jointly. The study investigates the aptitude of combined immune checkpoint inhibitors with radiopharmaceutical therapy using the monoclonal antibody Dinutuximab. Mice models are used to quantify the tumor volume of RPT compared to external beam radiation, ICI compared to non-ICI, and the control group to determine the therapeutic suitability of RPT in combination with ICI.

TELOMERIC LOOP REGULATION BY THE SHELTERIN COMPLEX

Victoria Tholkes
Mentor: Bianca Chavez

Telomeres are DNA-protein structures that protect mammalian chromosomal ends from attrition during genome duplication. Telomeres contain a double-stranded DNA (dsDNA) region and the single-stranded DNA 3′ overhang. Both are composed of a highly conserved telomeric sequence, TTAGGG. The overhang can loop and invade the dsDNA region to form a displacement loop (D-loop), regulated by the telomeric protein complex, shelterin. To investigate this understudied interaction, we used biochemical gel-based assays to characterize the binding affinity of the human shelterin complex to reconstituted telomeric D-loops. We found that shelterin prefers binding telomeric D-loops over overhangs by 10-fold. To validate this preliminary data, fluorescence polarization and MST binding assays will be performed. Our studies provide insights into how shelterin assembles at various telomeric structures.

MEASUREMENT OF BACTERIAL TRANSPORT AND IMMOBILIZATION IN CARBONATE BEDROCK AQUIFERS OF WISCONSIN

Sophia Thompson
Mentor: Christopher Zahasky

Understanding the transport and retention of contaminants in fractured dolomite is important for prevention and prediction of microbial agents in Wisconsin aquifers. The overall objective of this research is to quantify preferential bacterial breakthrough and immobilization through Silurian dolomite of eastern Wisconsin. There is an incomplete understanding of dynamic processes of bacteria transport and immobilization in realistic geologic systems, such as drinking water wells. With the use of a highly automated flow-through experimental system and spectrophotometry, it is possible to determine experimental time-dependent bacterial transport and retention profiles in dolomite and to characterize bacteria attachment properties. The results provide new understanding of bacterial groundwater contamination and more accurate and geologically specific information about how bacteria and microbial agents are immobilized or migrate to groundwater sources.

UNDERSTANDING THE ROLE OF ENERGY JUSTICE IN ENGINEERING

Tony Tian
Mentor: Kate Fu

Incorporating energy justice into the engineering field can better ensure clean energy resources are accessible to all, especially those in disadvantaged communities. Yet, the role of energy justice in science and engineering fields is not well understood. We conducted an online survey, which garnered over 200 responses, to better understand the role concepts of energy justice currently play in energy research and engineering. Although most participants recognized the importance of incorporating energy justice into energy technology design, they found reflecting energy justice in technical projects to be difficult to implement and oftentimes outside of their formal responsibilities. Ultimately, by better understanding the challenges energy engineers and researchers face, we are able to better inform them on how to consider all communities in their energy projects.

LATINOS AND ELECTIONS IN THE AGE OF IMMIGRATION SURVEILLANCE: LA PARTICIPACIÓN POLÍTICA

Natalia Torres, Briana Medina
Mentor: Kennia Coronado

The Latino population in the United States is expected to grow at an exceptional rate, yet little is known about the role of Spanish-language radio and its influence on political participation. Spanish-language radio allows Latinos, a heterogeneous group of different nationalities, legal statuses, and political affiliations, to present a new narrative on how their political behavior can be displayed. This project examines ethnic media and its influences on Latino political behavior and participation. Our data focuses on radio elites and key actors such as the radio show hosts and the analysis of discourse derived from six radio shows from various U.S. states, which took place leading up to the 2020 United States Presidential election. Our research contributes to the scholarship on Latino political incorporation and participation during elections.

THE EFFECTS OF PUBERTY BLOCKERS ON ANXIETY AND AMYGDALA ADENOSINE RECEPTOR LEVELS

Sofia Torres Roman
Mentor: Anthony Auger

As we continue to research many health disparities, we've learned more about the effects of adversity and hormones on adolescent mental health. To further understand puberty blockers, we are looking to see how they impact the brain, physiology, and health of those taking them. Specifically, we will analyze how puberty blockers impact anxiety-like behavior and adenosine receptor levels in the adolescent amygdala. As many transgender and nonbinary youth halt pubertal development with puberty blockers, it is important to understand how puberty blockers impact overall well-being and physiological health, as well as adolescent anxiety.

LIVING CONSCIOUSNESS, INCOMPLETE COLLECTIONS: PRESENTING ABSENCE WITH AGENCY AT THE ACROPOLIS MUSEUM

Panagioti Tsiamis
Mentor: Sarah Carter

What gives materiality to that which has been lost? This case study, revolving around the museological techniques employed at the Acropolis Museum, explores how the careful utilization of presence and absence within a particular space—furthermore, across spaces—is vital to understanding our perception of loss and ownership. By way of this case study, I have attempted to dissect this message, analyzing how traces of loss shape the material world and approaching absence at the museum from a myriad of perspectives. Here, absence is encountered not solely through empty spaces, but equally by way of placeholders, places, and traces. It is through these methodologies that the presence of absence can be better understood and considered a vital component of material culture.

UNCOVERING THE CONDITIONALLY ESSENTIAL ROLE OF HUMAN CHKA

Anna Turdo
Mentor: Ross Soens

Our lab performed a CRISPR-based forward genetic screen in human blood cancer cells to determine how nutrient availability affects cell proliferation using traditional medium (RPMI) and Human Plasma-Like Medium (HPLM). Compared to RPMI, HPLM more accurately models nutrient conditions in adult human plasma. One of the strongest RPMI-essential hits from this screen was CHKA, which encodes for choline kinase alpha (CHKA). I hypothesize that CHKA serves a context-dependent role due to an unknown gene-nutrient interaction present in RPMI but hidden in HPLM. Thus, I have generated CHKA-knockout cells in a chronic myelogenous leukemia cell line to confirm the RPMI-essential phenotype. By performing relative growth assays while manipulating media nutrient levels, I can begin to identify the gene-nutrient interaction leading to the context-dependent role of CHKA.

WHY IS THE DEVELOPMENT OF EXACT NUMBER ORDERING HARD FOR CHILDREN?

Ashley Turell
Mentors: Stephan Ferrigno, Sydney Buffonge

Learning to order exact numbers is an important but challenging stage in early mathematical development in children. Here, we examine why children find putting numbers in order so difficult. One possibility is that children lack the needed number knowledge. Alternatively, children may lack the needed ordering knowledge. In our study, 3- and 4-year-old children ordered pictures of numbers (fingers and dots) and shapes (blobs and circles) from least to most or smallest to largest. We found that children not only struggle with ordering pictures of numbers but also pictures of shape sizes, suggesting that their ability to order numbers relies on their general ordering ability. This work helps inform the importance of general ordering abilities in how children learn early number knowledge.

DEFINING THE MECHANISMS OF T CELL MEDIATED CANCER AND HOST CELL KILLING FOLLOWING ALLOGENEIC HEMATOPOIETIC CELL TRANSPLANTATION

David Turicek
Mentor: Christian Capitini

Over the past 50 years, allogeneic hematopoietic cell transplantation (allo-HCT) has effectuated dramatic improvements for patients with B cell malignancies. Following clearance of all immune and cancer cells, donor cells are instituted as a new immune system. Despite donor cell protection against cancer relapse (GVL), donor T cells can also attack host tissue (GVHD). GVL and GVHD, both mediated by donor T cells, are thus intrinsically linked. Our project examines the mechanism of cytotoxicity of T cell subsets against human B cell cancers and mouse cells, representative of the antigenic environment in our xenogeneic transplant model. Defining the mechanisms of GVL and GVHD is instrumental for improving patient prognosis after an allo-HCT because it will enlighten us on how to maximize GVL and minimize GVHD.

IMPACT OF PATHOLOGIC ALTERATIONS IN CHOLANGIOCARCINOMA FROM THE VETERANS HEALTH ADMINISTRATION

Inem Uko
Mentor: Jeremy D Kratz

With the Cancer Moonshot, the Veteran Health Administration (VHA) founded the National Precision Oncology Program. This program was established to provide comprehensive molecular profiling for US military veterans with advanced cancers. Biliary tract cancer, also known as cholangiocarcinoma (CCA), is a morbid cancer with an estimated 5-year survival of 10%. We aim to summarize the genomic changes that exist in cholangiocarcinoma. We summarized a retrospective, multicenter cohort of 764 patients (pts) with cholangiocarcinoma identified from 128 unique VHA centers across the United States using UWIRB#2020-0696. Specimens of advanced CCA were tested between 04/2019-12/2022 and underwent comprehensive next-generation sequencing of the tumor using FoundationOne CDx (n=717) or FoundationOne Liquid (n=77). The frequencies of molecular alterations that include point variants, gene amplification/loss, and gene fusions were annotated using summary statistics.

UTILIZING MACHINE LEARNING FOR ULTRA-LOW POWER COMMUNICATIONS

Alexander Ulate
Mentor: Younghyun Kim

In Internet of Things (IoT) and smart devices, power consumption on the node devices is important for longevity and cost of a system. By utilizing Machine Learning on the receiving side of device communications, the power utilized by a LoRA or similar low power communication paradigm on a transmitting device can be reduced without a significant drop in transmitted information accuracy. With a focus on showcasing Machine Learning on time-series data being transmitted, this could be applied to IoT cases where there are multiple node devices and sensors that need to last a long time, such as on smart farms or homes.

EFFECTIVENESS OF TRANSCRANIAL MAGNETIC STIMULATION ON CONSTRAINT-INDUCED LANGUAGE THERAPY IN APHASIA

Sanshray Vallecha, Laurel Adams, Eva Sakellakis
Mentor: Haley Dresang

Approximately one in three people who have a stroke develop aphasia, a language disorder resulting from brain damage. A common treatment method for aphasia is constraint-induced language/aphasia therapy (CILT/CIAT), which requires patients to communicate verbally without compensatory modalities. Pairing CILT with repetitive transcranial magnetic stimulation (rTMS), which supports brain repair by modulating neural signals, may create new treatment options for aphasia patients. However, rTMS effectiveness on CILT outcomes may critically vary based on aphasia subtype, severity, and neurological profile. This study presents preliminary findings from a modest sample to identify individual differences that contribute to the variable effectiveness of rTMS on CILT. Our results will inform the development of an algorithm to better predict therapy response and recovery, moving toward personalized aphasia medicine.

RESPONDER ANALYSIS OF THE 5MINUTES4MYSELF PROGRAM

Kayla Van Asten, Emma Swatek
Mentor: Elizabeth Larson

5Minutes4Myself is a wellness promotion program for caregivers of children with autism aged 8-21; it is a manualized approach using motivational interviewing-based coaching and a habit-building app to support lifestyle change. A study assessing the intervention's feasibility found that participants who increased mindfulness also had reductions in stress post-intervention, while others did not benefit. To better understand why some benefited while others did not, we will conduct a responder analysis on 11 participants. We will examine whether the two groups differ in their personal characteristics or resources, which will allow us to examine and potentially address the needs of non-responders and further refine the program.

HYDRAULIC AND ALLOMETRIC CHANGES IN TSUGA CANADENSIS AS IT REACHES ITS SOUTHERN RANGE LIMIT IN WISCONSIN

Cecilia Vanden Heuvel
Mentor: Steven Augustine

Eastern hemlock (Tsuga canadensis) is found across Wisconsin but is most dominant in northern forests. Since the recession of glaciers, eastern hemlock populations in southern Wisconsin dwindled into small, isolated relicts. These relict sites continue to persist, even as local climates have become more arid. Little is known about how eastern hemlocks have acclimated to these atypical environments, and we explored how they altered their hydraulic systems to cope with this aridity. Five populations were sampled across Wisconsin to measure their hydraulic vulnerability and leaf allometry. From this, we are able to better understand how species are able to persist outside their typical ranges.

KNOWLEDGE, ATTITUDES, AND BEHAVIORS TOWARDS TICK-BORNE DISEASES IN THE HMONG POPULATION OF WISCONSIN

Magic Vang
Mentors: Susan Paskewitz, Xia Lee

Lyme disease is a concern for many Wisconsinites, as cases have increased with more than 3,000 being reported in 2020. The Hmong population is a high-risk group because their cultural practices may expose them to ticks that transmit Lyme disease. Additionally, limited education and outreach targeted at this population has made them vulnerable to tick-borne diseases. Results from this Hmong KAB survey showed that respondents demonstrated less concern (24.8% were very concerned about Lyme disease) in comparison to a recent KAB survey of Wisconsin residents that were majority White who were more than twice as concerned (57.5% were very concerned about Lyme disease).

BIOMINERAL FORMATION OF CCHH AND MHC IN CORAL SKELETONS AND NACRE

Shreya Vattem, Tarak Sristy
Mentors: Pupa Gilbert, Connor Schmidt

Biomineralization is a process by which living organisms form mineral structures, such as shells and skeletons. Calcium carbonate (CaCO3) is a mineral well-known to form nacre, coral, and sea urchin skeleton formation. Of the six polymorphs of CaCO3 known to exist, only three (calcite, aragonite, vaterite) have been observed in biominerals. Among the other three polymorphs, CCHH was only recently discovered through lab-made synthesis, while MHC was known synthetically and geologically but never biogenically. While investigating transient amorphous precursor phases to biomineral formation in over 200 million spectra, we discovered that CCHH and MHC occur transiently in forming coral skeletons and nacre, but not in sea urchin spines. This discovery helps to better understand biomineralization processes and has implications for biomineral's resilience to climate change.

THE EFFECTS OF BILINGUAL STORYBOOK FORMATS ON MONOLINGUAL AND BILINGUAL CHILDREN'S WORD LEARNING

Nisha Vazzalwar, Eveanna Mendoza
Mentor: Melina Knabe

Bilingual storybooks might be an effective way to support children's vocabulary learning in two languages. This study examines how the format of bilingual storybooks affects vocabulary learning in monolingual English-speaking and bilingual Spanish-English children (ages 3-5 years). Bilingual storybooks are most commonly presented in blocked-language (i.e., full-sentence translations in English and Spanish) and mixed-language (i.e., single Spanish words inserted in English sentences) formats. In this study, 50 monolingual children and 35 bilingual children were read a blocked- and mixed-language storybook. Then, their memory for the new words were assessed. Using these results, we will determine which format leads to better word learning in these two groups. This information will help parents and educators choose the right storybook format for their child's language learning.

AERODYNAMICS DEMONSTRATION

Cesar Velez
Mentor: Mallory Conlon

Physics as a field is often plagued by the stigma that it is too complicated for the common person. The goal for this project is to fight that stigma by introducing physics to younger audiences in a manner that is informative and captivating. In this project, we will create an interactive demonstration to explain the concept of lift vs. drag, as we feel this will be the best way to engage and teach our audience about the properties of aerodynamics. Throughout this project, we will examine how this demonstration affects the audience and their perception of physics as a whole. We hope to increase the possibility that students will see physics as a viable career path and ease the stigma surrounding physics as a profession.

EFFECT OF MOVIN ON PERCEIVED BARRIERS TO AMBULATION AND UNIT AMBULATION CULTURE IN ACUTE CARE NURSES

Margaret Violante, Anna Callies
Mentors: Barbara King, Linsey Steege

Up to 65% of older adults lose their ability to ambulate independently during a hospital stay. Nurses identify multiple barriers that prevent them from ambulating older patients. Mobilizing Older adults Via a systems-based INtervention (MOVIN), has been shown to reduce barriers and improve patient outcomes. The purpose of this poster is to present data from one of four units participating in a randomized controlled trial to test the effectiveness of MOVIN. Surveys included two reliable and valid instruments used to measure Barriers to Ambulation and Unit Ambulation Culture. Nursing staff from a single unit participated in the study. Results of the survey demonstrate significant improvements in nurse behaviors and unit ambulation culture demonstrating a reduction in barriers and increase in positive attitudes towards ambulation.

UNDERSTANDING THE STRUCTURE AND FUNCTION OF ESCHERICHIA COLI. CELL DIVISION PROTEIN FtsB

Alexander Vorobiov
Mentor: Samridhi Garg

The divisome is a conserved division machinery consisting of many essential filamentous temperature sensitive (Fts) proteins that aid in bacterial cell division. Our study aims to determine the functionality of the FtsB, an essential Fts protein, and confirm its dimeric structure, a complex consisting of two identical molecules linked together. We performed cysteine cross-linking experiments in the native membrane to form disulfide bridges between adjacent FtsB monomers to understand its dimeric state. Observation of a dimeric FtsB band on western blots may indicate that FtsB is a dimer due to the close contact necessary for the formation of a disulfide bond. The results of the experiment will provide insight into the functionality and structure of FtsB and further our understanding of bacterial cell division.

OPTIMIZATION OF THE BEER SUPPLY CHAIN IN A CIRCULAR ECONOMIC MODEL

Madeline Vukovich, Isaac Odintz, Ethan Saye
Mentor: Styliana Avraamidou

Beer is the fifth most consumed beverage worldwide, but the brewing process has harmful environmental implications. This research intends to convert the beer supply chain from a wasteful, linear production model into a circular model that can be implemented by brewing companies. The Circular Economy (CE) attempts to recapture and recycle by-products while increasing reliance on renewable energy sources. The identification of the best transformation pathways will be conducted through a mixed integer linear programming and optimization CE systems engineering framework using Gurobi. This will be based on data from identified, alternative pathways to production. It is expected that through this transformation to CE, the beer supply chain would become economically, environmentally, and socially sustainable and serve as a paradigm for future economic transitions.

CONSTRUCTION OF A PARALLEL PLATE FLOW CHAMBER FOR MODELING OF AORTIC VALVE BLOOD FLOW

Elizabeth Wacker
Mentor: Kristyn Masters

Calcific aortic valve disease (CAVD) is characterized by valve thickening, calcification, and inflammation, which inhibit proper heart function. Disease presentation is sex-dependent, with males more typically displaying calcification and females exhibiting increased fibrosis, and is especially common in those over 65. Since in vivo valvular endothelial cells (VECs) constantly experience blood flow, studying them under these conditions better approximates the physiological environment, and can thus be used to model both healthy and diseased conditions. Using porcine VECs, a flow system consisting of a peristaltic variable flow rate pump, parallel plate, and dialysis tubing was designed to maintain cell viability for an experimental duration of at least 24 hours. Future goals of this apparatus are to characterize how morphology and sex affect the CAVD disease response.

BENCHMARKING A NEUTRAL-ATOM QUANTUM COMPUTER

Nathan Wagner
Mentor: Mark Saffman

In this study, we simulate the algorithmic performance of a small neutral-atom quantum computer with all-to-all versus limited connectivity. The study is based on the suite of twelve benchmarks developed by the Quantum Economic Development Consortium. Circuits are simulated with a noise model consistent with experimental data. We find that all-to-all connectivity improves circuit fidelity by 10%-15% compared to nearest neighbor connectivity in circuits consisting of 3-6 qubits.

TARGETED DENDRIMER PEPTIDE CONJUGATES FOR ENHANCED CANCER IMMUNOTHERAPY

Emily Walker
Mentor: Piper Rawding

With the emergence of precision oncology, the use of biological therapies to manipulate the immune system to slow tumor growth and eliminate cancer cells is on the rise. However, many of the current clinically used cancer immunotherapies have significant limitations, including systemic toxicity and high cost. To this end, our group has engineered a modular nanoparticle scaffold for targeted drug delivery; this system is based on the integration of poly(amidoamine) (PAMAM) dendritic nanoparticles with immune checkpoint targeting peptides (dendrimer-peptide conjugates, DPCs). In our recent studies, engineered DPCs targeting programmed death-ligand 1 (PD-L1) were synthesized and analyzed in vitro to determine their binding efficiency and toxicity. We found that the DPCs exhibit selectivity and low toxicity, demonstrating their potential as novel and efficient cancer immunotherapeutics.

THE EVALUATION OF AMBIGUOUS SMILES AND THE MODERATING ROLE OF REJECTION AMONGST THE SOCIALLY ANXIOUS

Grant Walker
Mentors: Ethan Harrod, Paula Niedenthal

Rejection and negative evaluation are primary concerns among individuals suffering from social anxiety. Previous findings have demonstrated that individuals with social anxiety are faster to identify negative changes in facial expressions and are more likely to label neutral expressions as negative. The present study expands upon past research in an examination of potential differences in stress responses (indexed via salivary cortisol) between individuals with varying degrees of social anxiety when viewing neutral and negative expressions. Participants were exposed to neutrally or negatively valenced facial expressions and were rejected or included in a virtual game. We predict a significant rejection by anxiety by expression interaction such that the positive moderating effect of social anxiety on stress response to facial expressions is itself positively moderated by rejection.

IDENTIFYING BROADLY-SHARED BACTERIAL COLONIZATION FACTORS

Vincent Watring
Mentor: Mark Mandel

Over the past decade, a number of studies have identified bacterial genes required for animal colonization. Here, we seek to extend these data by revealing those genes required for colonization broadly across wider phylogenetic distances. After collecting Tn-Seq data that has determined required genes for colonization, we can discover orthologs, evolutionarily shared genes, between our bacterial species of interest. We then mapped these shared genes to Tn-Seq colonization data to discover broadly conserved putative colonization genes. The resulting candidates provide the basis for systems-level analyses and for targeted approaches to examine novel genes and the roles that they play during beneficial and pathogenic colonization.

TIMING IS EVERYTHING: COYOTE ACTIVITY VARIES WITH TIME OF DAY BUT NOT MOON ILLUMINATION

Amelia Weidemann
Mentors: Allison Brehm, John Orrock

Although coyotes are widespread across North America and important players in many ecological interactions (e.g., predation, competition), the timing of coyote activity remains poorly understood. Using five seasons of data from camera traps from 13 National Ecological Observatory Network deciduous forests across the U.S., we examined how the number of coyote detections varies with time of day. Our analysis of 32,181 photos reveals that coyote detections are significantly greater at night and crepuscular hours than during the day, and coyote activity is not affected by aspects of the environment that affect other mammals (i.e., moon illumination). These results provide a way to understand the times of day when coyotes are most active, and thus inform coyote-related management (e.g., how to minimize human-coyote conflicts).

STACKING ENGINEERING OF 2-D MATERIALS FOR NOVEL QUANTUM INTERPLAY

Chris Wells
Mentor: Jun Xiao

For those who live in a technologically-based society, our technology's efficiency is increasingly valuable in our daily lives. Using a team-based approach, made up of undergraduates, PhD students, and post docs, the Xiao Group hopes to explore the scientific and technological applications of two-dimensional materials. There are many known potential properties found with combinations of 2D materials such as thermal and electrical conductivity, photon manipulation, and ferroelectricity. By studying the interactive structures and forces of 2D-Heterostructures, our lab hopes to advance physics research and create new technological applications, including Optical and Computational Devices, with 2D materials.

AMYLOID MODERATION OF THE RELATIONSHIP BETWEEN DEPRESSION AND CONNECTED SPEECH

Madeline Wherley
Mentor: Kimberly Mueller

Dementia is characterized by declining cognition, including connected speech-language (CSL). Amyloid-beta plaques are early biomarkers for Alzheimer's disease (AD). We examined how amyloid moderates the relationship between depression and CSL in adults at risk for AD, using linear mixed-effects models. n=347 participants with amyloid PET scans from the Wisconsin Registry for Alzheimer's Prevention were included; they had a mean age of 63(sd=5.8). Models showed a significant main effect such that individuals with higher depression scores tended to have fewer words per minute (WPM) and correct information units (CIU) per minute. Amyloid positivity did not moderate this relationship. These findings provide further insight into the interaction between depression, AD risk, and communication.

TEMPORALLY INDUCIBLE mTOR KNOCKOUT STRAIN CAN BE USED TO STUDY NEURON AGING

Sophia Whitley
Mentor: Claire Richardson

Consequences of aging include an increased risk factor of various neurodegenerative diseases. Aging is modulated by metabolic processes, and determining the mechanisms that contribute to the aging process would uncover how cognitive diseases can be prevented. Using the model organism Caenorhabditis elegans, we developed a way to study the impact of the evolutionarily conserved target of rapamycin (TOR) pathway on neuron aging. Using Cre-Lox recombination technology to inactivate TOR and a neuron-specific fluorescent transgene to visualize neuron morphology, we have the tools to test the hypothesis that TOR functions cell-intrinsically within neurons to promote aging.

WOODY ENCROACHMENT AND MANAGEMENT IMPACTS ON INTRASPECIFIC TRAIT VARIATION IN TALLGRASS PRAIRIE

Abigail Widell
Mentor: Katherine Charton

Woody management is employed with the goal of maintaining herbaceous plant community diversity in encroached tallgrass prairie. However, outcomes of management remain unpredictable. Plant functional traits serve as predictive tools for understanding plant fitness and community assembly, but their predictive capacity is limited by lack of understanding of trait variation within individual species. We ask whether intraspecific variation of herbaceous tallgrass prairie plant functional traits is driven by a response to (1) rapid environmental changes via woody management, and (2) underlying environmental gradients. We measured functional traits in a tallgrass prairie management experiment. We found no indication of intraspecific variation in response to either. These results suggest conservatism among growth and resource acquisition traits and lacking sensitivity to rapid habitat changes and long-term environmental conditions.

ASSOCIATIONS OF SMOKING WITH POSTOPERATIVE DELIRIUM IN OLDER ADULTS

Anna Williams
Mentor: Richard Lennertz

The smoking epidemic is on the rise and the negative consequences associated with it are only increasing. The primary goal of this study was to investigate smoking's association with postoperative delirium. It was hypothesized that smoking would be a significant risk factor for in-hospital delirium. Data were collected from an ongoing observational study at the University of Wisconsin where 329 adult patients were recruited. These patients were scheduled for major elective non-intracranial surgery with an anticipated hospital stay of at least two days. Pack-year smoking history was recorded at baseline visits, and postoperative delirium was evaluated each hospital day following surgery. Patients were placed into either the smoking group or the non-smoking group, allowing the relationship between delirium severity and smoking history to be investigated.

SOCIAL WORK: EXPLORATION INTO SEX WORK

Jelani Williams
Mentors: Lara Gerassi, Kate Walsh

The purpose of this study is to 1) adapt, develop, and refine a preliminary, multi-item measure to identify sex trading among university students, and 2) understand the experiences of undergraduate and graduate students who are involved in virtual and in-sex trading. This phase of the project included qualitative interviews with students who were knowledgeable about sex trading. The URS researchers study dissemination to find participants who have experienced or know someone who has. The survey aims to comprehend the experiences of individuals involved in sex trading or sex work. These recommendations can assist researchers in developing a comprehensive and sensitive survey tool to understand better the experiences of individuals involved in sex trading or sex work and provide programs to assist people in these situations.

SPIRAL DENSITY WAVES FOR HYDRODYNAMICS

Kevin Williams
Mentor: Roark Habeggar

To model the interstellar medium in a spiral galaxy, we need to consider all the forces acting on the gas. The largest force on the interstellar medium is gravity from stars. If we want to include this force in simulations of the interstellar medium, we need to find a closed functional form of the gravitational force. We model the gravitational force by finding a base solution to the Poisson equation for an axisymmetric time-independent system. Then, applying perturbation theory to the Poisson and Navier-Stokes equations, we find the functional form of spiral density waves. With this functional form, we analyze the stability of our galactic model through time before adding it to our simulation. I will be sharing visualizations and analysis of our model.

THE EFFECT OF INVASIVE SHRUBS AND URBANIZATION ON WHITE-TAILED DEER, ODOCOILEUS VIRGINIANUS, ANTIPREDATOR BEHAVIOR

Joseph G. Willman
Mentors: John Orrock, Carson Keller

White-tailed deer, Odocoileus virginianus, use antipredator behavior to avoid predators and accurately respond to perceived risk within different environments. Given the increase in urbanization and plant invasions, rapidly changing environments may cause species to alter antipredator behavior affecting their survival and persistence. To evaluate the effects of invasive plants and urbanization on antipredator behavior, we manipulated the presence of invasive shrubs within forests across a rural-to-urban gradient; we established two 20m x 20m plots within invaded forests and removed all invasive shrubs from one randomly selected plot. Cameras were placed in the center of each site to measure deer antipredator behavior (vigilance, temporal activity). Preliminary results suggest that vigilance may be greatest under moderate urbanization and can vary by sex when invasive shrubs are present.

TRANSPORT PROTEIN ENGINEERING IN ESCHERICHIA COLI TO ALLEVIATE TOXICITY AND IMPROVE SUSTAINABLE CHEMICAL PRODUCTION

Deanna Wilson
Mentors: Will Bothfeld, Brian Pfleger

Finding sustainable methods of producing complex chemicals for industrial purposes is vital as the global climate crisis continues. Genetically engineered Escherichia coli present a viable solution for obtaining sustainable biochemicals. Previous research utilized genetically edited E. coli cells to overexpress genes, producing organic compounds at higher yields. A challenge limiting E. coli bacterium from producing complex chemicals most efficiently is toxicity from mass amounts of biologically produced chemical molecules within the cells. This project approaches this challenge by deleting a large series of transporter proteins to create a “clean” strain, then adding back in single transporters to find which is most effective. Furthermore, further protein engineering of the most viable transporter candidates can allow the cells to better secrete the toxic products and improve production capacity.

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

Alexis Woida, Samantha Williams
Mentors: David Abbott, Molly Willging

Declining serum estradiol (E2) levels during menopausal transition are associated with heightened risks for metabolic disease. 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. Twenty adult female rhesus monkeys were OVX and received: 1) E2-containing capsules and letrozole, or empty capsules and either 2) vehicle or 3) letrozole treatment. Data on food intake, physical activity, energy expenditure, and body fat distribution were collected. The results of this study could provide important insights into the relationship between nutrition, physical activity, and body composition that could have significant implications for the development of effective interventions to prevent and manage obesity and related health conditions.

DO INVASIVE SHRUB REMOVAL TECHNIQUES AFFECT SMALL MAMMAL GRANIVORY?

Eren Wolf, Alexa Hanson
Mentor: Brad Herrick

Non-native, invasive shrubs can rapidly colonize and disturb habitats with negative consequences for native flora and fauna. The Lost City invasive shrub management experiment at UW–Madison Arboretum models the dynamic effects of manual shrub removal and forestry mowing, with and without prescribed fire on native plants and small mammal behavior. This model is further influenced by the presence of invasive jumping worms (Amynthas spp.), which affect soil structure and leaf litter layers. Do these combined factors influence the foraging behavior of granivorous small mammal species? We studied these behaviors by establishing trail cameras near feeding depots in 25 buckthorn management plots in which animals could feed on the seeds of four common oak savanna plant species and jumping worm cocoons.

EXPLORING GENOMIC VARIATION IN DSCAM2: IMPLICATIONS FOR EVOLUTION AND ADAPTATION OF BLACKLEGGED TICKS

Luke Wolfe
Mentor: Sean Schoville

Dscam2 (Down Syndrome Cell Adhesion Molecule) is a gene that plays an essential role in the nervous system and basic immune regulation of many animals, including ticks. Dscam2 has been implicated in immune system regulation and transmission of pathogens by ticks. Interestingly, recent studies have shown high levels of variation and patterns of selection in Dscam for black-legged ticks from different locations. Due to its essential role in immune function, it may modulate pathogen loads. In exploring SNPs of Dscam2 in 92 ticks across the U.S., trends were found in phylogenetic clustering and geographical location in addition to microbial relative abundance. Here we examine genomic variation in Dscam2 as a potential marker for the evolution and adaptation of these important arthropod disease vectors.

FMR1-DEFICIENT PRIMATE NEURONS EXHIBIT INCREASED OXIDATIVE STRESS LEVELS

Natalie Wolkoff
Mentors: Minjie Shen, Carissa Sirois

Fragile X Syndrome (FXS) results from Fragile X Messenger Ribonucleoprotein (FMR1) deficiency and is a prevalent inherited intellectual disability. FXS results in cognitive impairment, behavioral deficits, and neuronal developmental and functional impairment. The mechanisms behind FMR1 deficiency leading to these phenotypes are not fully understood. Previous studies show that FMR1-deficient immature neurons in mice exhibit fragmented mitochondria, impaired mitochondrial function, and increased oxidative stress. This study aims to identify whether FMR1-deficient human and non-human primate neurons also display these phenotypes and if treatment could rescue them. Results reveal altered mitochondrial morphology and elevated nitrotyrosine levels in FMR1-deficient human and primate neurons. Treatment with leflunomide mitigated these cellular phenotypes and decreased oxidative stress levels in FXS neurons. These findings provide critical data for potential therapeutic development.

IMPACT OF ADIPONECTIN RECEPTOR ACTIVATION ON SKELETAL MUSCLE INFLAMMATION IN AGED MICE

Nina Wood
Mentor: Rozalyn Anderson

Sarcopenia, the loss of skeletal muscle mass and function with age, is associated with reduced metabolism, chronic inflammation, and decreased physical function. AdipoRon, an adiponectin receptor agonist, has been shown to stimulate metabolism in skeletal muscle in young mice, and preliminary data show beneficial effects of AdipoRon treatment on age-related changes in metabolism and physical function in aged mice. This study will test the hypothesis that skeletal muscle inflammation plays a role in sarcopenia and its prevention by AdipoRon. In aged and AdipoRon treated mice, systemic and muscle-specific inflammatory parameters will be studied through muscle tissue histology and quantitative analysis. These experiments will elucidate the connection between sarcopenia, adiponectin signaling, and inflammation and establish AdipoRon as a novel potential treatment for sarcopenia.

ULTRAFAST LEARNING OF 4-NODE HYBRIDIZATION CYCLES IN PHYLOGENETIC NETWORKING USING ALGEBRAIC INVARIANTS

Bella Wu
Mentor: Claudia Solis-Lemus

The abundance of gene flow in the Tree of Life challenges the notion that evolution can be represented with a fully bifurcating process, as this process cannot capture important biological realities like hybridization, introgression, or horizontal gene transfer. Coalescent-based network methods are increasingly popular, yet not scalable for big data, because they need to perform a heuristic search in the space of networks as well as numerical optimization that can be NP-hard. Here, we introduce a novel method to reconstruct phylogenetic networks based on algebraic invariants. Our novel inference methodology is optimization-free as it only requires evaluation of polynomial equations, and as such, it bypasses the traversal of network space, yielding a computational speed at least 10 times faster than the fastest-to-date network methods.

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

Sherrie Wu
Mentors: Uyen Thy Nguyen, Lindsay Kalan

While colonizing the skin, microbes secrete small molecules that inhibit the growth of other microorganisms to promote their own well-being. A skin bacteria, a strain within the phylum Bacillota, which is called LK464, was found to have antimicrobial properties. To survey its activity, the bacterium was grown, and its metabolites were collected. Testing the bacterium and its metabolites against various skin pathogens using susceptibility assays revealed antimicrobial activity against Gram-positive Staphylococcus aureus and the fungus Candida albicans. The project and future directions will focus on elucidating the identities of the antimicrobial molecules. Ultimately, discovering the molecules with profound antipathogenic properties will create a better understanding of microbial interactions on the skin and may lead to a new antimicrobial treatment.

BIOKLUSTERING: A WEB APP FOR SEMI-SUPERVISED LEARNING OF MAXIMALLY IMBALANCED GENOMIC DATA

Yuke Wu
Mentor: Claudia Solís-Lemus

Accurate phenotype prediction from genomic sequences is a highly coveted task in biological and medical research. While machine-learning holds the key to accurate prediction in a variety of fields, the complexity of biological data can render many methodologies inapplicable. We introduce BioKlustering, a user-friendly open-source and publicly available web app for unsupervised and semi-supervised learning specialized for cases when sequence alignment and/or experimental phenotyping of all classes are not possible. Among its main advantages, BioKlustering 1) allows for maximally imbalanced settings of partially observed labels including cases when only one class is observed, which is currently prohibited in most semi-supervised methods, and 2) takes unaligned sequences as input, and thus, allows learning for widely diverse sequences (impossible to align) such as virus and bacteria.

THE ONTOLOGY OF REFUGEE

Yingying Xie
Mentor: Darshana Mini

The media narratives around asylee figures are constructed through complex geopolitical dynamics. This project explores the portrayal of asylum seekers by media and how American college students relate to migrant experiences. By analyzing the animated documentary, Flee, directed by Jonas Poher Rasmussen (2021), the study investigates the media techniques used to visualize the trauma and vulnerabilities of refugees. Drawing from a survey and focus group conducted among college-going students in the United States, the project discusses how empathy is constructed around the experience of displacement in the Global South. By studying the discourses around asylee figures, this project explores the paradoxical relationship built through the prism of humanitarian media and the role of film form and aesthetics in creating familiarity and alienation among the viewers.

COLLABORATE2LOSE

Adriana Xiong, Gabrielle Acevedo
Mentors: Corrine Voils, Kara Gavin

In the United States, 40% of veterans have obesity, which heightens the risk for several chronic diseases. This project was created to evaluate the effects of patient-only and (romantic and non-romantic) partner- assisted behavioral interventions on long-term weight loss in veterans. The researchers hypothesize that veterans in the partner-assisted group will lose at least 3 percentage points more in weight, in comparison to the patient-only group, after 72 weeks. The approach points more in weight, in comparison to the patient-only group, after 72 weeks. The approach involves recruiting and randomly assigning veterans who have an adult co-habituating support person to participate in a 72-week weight management program with their support person or alone. The weight management interventions consist of 16 classes focused on weight loss and 9 classes focused on weight maintenance. Participants will view these interventions through a video platform.

UNDERREPRESENTED GROUPS' ATTITUDES, BELIEFS, AND KNOWLEDGE ABOUT RESEARCH, BIOMARKERS, AND SCHIZOPHRENIA

Jianan Xiong
Mentor: Diane C. Gooding

Biomarker research is promising in helping to inform personalized medicine. However, it is not clear whether biomarkers can be applied in the same manner to members of different racial and ethnic groups. To address this question, we need more research participation from BIPOC groups, who are typically underrepresented in studies. We used data from the UBIGR Project to examine possible reasons for low study participation. Nearly 1600 adults were surveyed using the Research Attitudes Questionnaire (RAQ) along with additional questions to look at their beliefs and knowledge about biomarkers and schizophrenia. The groups were compared in terms of RAQ scores, attitudes, and knowledge about schizophrenia and willingness to participate in biomarker research. We extended earlier research by including a more ethnically diverse sample.

UNDERSTANDING MICROBIAL RESISTANCE TO CHLORHEXIDINE GLUCONATE ANTISEPTIC IN SURGICAL PATIENTS

Kayla Xu
Mentors: Elizabeth Townsend, Lindsay Kalan

Chlorohexidine gluconate (CHG) is an antiseptic that is commonly used as a disinfectant to sterilize surgical sites prior to surgery. However, due to the frequency which CHG is used, resistance towards CHG among bacteria species is becoming a growing issue. In this study, we assess CHG resistance through determining the minimum concentrations inhibiting growth of bacteria strains from hospital patients at three time points: prior to surgery, post-operation, and a month after the surgery. By determining the trend in CHG resistance in skin bacteria from surgical patients over time, we hope to determine if the degree of CHG resistance changes between before and after their surgery.

PHYSICIAN'S USE OF VOICE RECOGNITION TO WRITE CLINICAL NOTES

Viona Xu
Mentor: Adam Rule

Physicians use clinical notes to share and record patient information, but the time it takes to write these notes can be long. Voice recognition can help with note writing, but how often physicians use this technology is unknown. This study analyzes de-identified electronic health record (EHR) metadata from 384 health systems using Epic System's EHR (359 of which supported voice recognition), aiming to understand how use of voice recognition associates with physician specialty and visit type. Physicians in surgical specialties used voice recognition more frequently than those in primary care or medical specialties. Physicians with more total visits or more complex visits also tended to use less voice recognition. This variance suggests further effort can be made to improve efficiency in note writing.

THE ROLE OF PROSOCIAL VALUES IN UNDERGRADUATE STUDENTS' ACADEMIC AND CAREER CHOICES IN STEM

Taiming Xue
Mentor: Judith Harackiewicz

Many students today have strong prosocial motives to help others and address societal and global issues, especially for first-generation (FG) and underrepresented minority (URM) college students. However, STEM courses often focus exclusively on basic science at the expense of emphasizing prosocial applications, which may deter prosocially oriented students from continuing in STEM fields. To explore the role of prosocial values in academic and career choices among students who came to college with an interest in STEM, I surveyed a cohort of graduating college seniors and examined whether and how prosocial motives played a role in their career decisions, with a particular focus on FG and URM students' responses. Examining prosocial values in students' educational and career plans will help educators to design course materials that meet students' needs and broaden participation in STEM.

CHARACTERIZING DEMENTIA FAMILY CAREGIVER INCLUSION PRACTICES IN HOSPITAL CARE

Andrea Yahr
Mentor: Beth Fields

Caregivers of hospitalized people living with dementia (PLWD) frequently report feeling excluded from care, which often results in being unprepared to fulfill caregiving tasks. To better prepare caregivers for their caregiving roles, this descriptive study sought to characterize caregiver inclusion practices in hospital care. A total of 30 hours of direct observations in a large academic hospital were conducted. Descriptive statistics were completed in Microsoft Excel. When the caregiver was included, there were 0 instances of caregiver hands-on training and 3 examples of verbal/written training, 2 initiated by the caregiver and 1 by the provider. Information gleaned from this study can be used to improve caregiver inclusion practices in the hospital setting. In turn, caregivers may feel better prepared to fulfill their dementia caregiving tasks.

THINKponics NET-ZERO EMISSIONS MODULAR AQUAPONIC SYSTEM: UNDERSTANDING SUSTAINABLE FOOD SYSTEMS THROUGH HANDS-ON LEARNING AND CAREER EXPLORATION FOR UNDERREPRESENTED YOUTH

Ben Yang, Corbin Neutgens, Alec Inman
Mentor: Lesley Sager

Under research with the Wisconsin Idea Fellowship, our project objective was to provide Troy Community Gardens and Badger Rock Middle School with an interactive, solar-powered modular aquaponics system. Troy Community Gardens and Badger Rock Middle School serve a large BIPOC and economically disadvantaged youth population to which they provide agricultural programming. Our project examines how engagement with our aquaponics project improves STEAM literacy, understanding food systems, sustainability, and systems thinking. The development of the prototype entailed engineering design principles, while utilizing community partnerships to evaluate overall impact during and after project execution. Ultimately, our project is a framework for underrepresented youth to engage with local food systems and explore careers in STEAM and sustainability.

QUANTIFICATION AND OPTIMIZATION OF BIOMIMETIC CIRCULATING TUMOR CELL (CTC) PURIFICATION

Elizabeth Yang
Mentor: Michael Poellmann

Circulating tumor cells (CTCs) have great promise as minimally-invasive biomarkers for cancer. Next generation sequencing (NGS) of CTCs would be a powerful tool for cancer treatment selection. However, routine NGS will require consistently high purity. This work employs a highly sensitive CTC purification approach that incorporates biomimetic cell rolling on recombinant E-selectin and capture by tumor-specific antibodies conjugated to nanoparticles. CTC purity is influenced by the fluid shear rate and the relative density of E-selectin, antibodies, and nanoparticles. In this project, we will develop methods to efficiently quantify CTC rolling velocity and capture efficiency, then systematically evaluate capture purity across a wide range of surface configurations and flow rates. The results will be used to optimize and validate novel CTC purification approaches for NGS.

ADAPTING RECURSIVE SEEDING EXPERIMENTS TO EVALUATE THE EMERGENCE OF SEED-DEPENDENT AUTOCATALYTIC SYSTEMS

Justin Yang, Keeley Kuru, Ronan Montgomery-Taylor
Mentor: David Baum

A key goal of origins of life research is to identify the earliest system capable of adaptive evolution. It's often assumed that evolution requires informational polymers to "remember" past events, a phenomenon called heritability. Our research tests the idea that non-polymer chemical systems can encode memories via the expansion of autocatalytic networks via introduction of chemical species ("Seeds"). We adapted a recursive seeding framework called Chemical Ecosystem Selection to detect the emergence of seed-dependent autocatalytic systems. We observed some differences in chemical composition between seeded and non-seeded lineages, indicating a change in long term chemical composition even after removal of an exogenous seed. Future work is needed, however, to confirm that the differences are repeatable and the result of activation of self-sustaining autocatalytic reaction networks.

PAIN ASSESSMENT INFORMATION VISUALIZATION INTERVENTION TO IMPROVE QUALITY OF MEDICAL INTERPRETING FOR HMONG-SPEAKING PATIENTS AND HEALTHCARE PROVIDERS

Mai Nhia Yang
Mentor: Maichou Lor

This study’s purpose was to assess the impact of a pain assessment information visualization (InfoViz) intervention on Hmong medical interpretations during pain visits in primary care. We analyzed audio-recordings of 6 triadic consultations of Hmong patients, interpreters, and providers during the usual care and 6 during the intervention phases. Using Lor & Chewning’s coding method, we coded data for omission, addition, and substitution committed by medical interpreters. The results showed that during the intervention phase, there was a decrease in substitution (32% vs 36%) and addition (17% vs 20%), but not omission (29% vs 24%) compared to usual care, respectively. These findings demonstrate a potential positive impact of the pain InfoViz intervention on the quality of medical interpreting during pain communication.

TARGETING PARVALBUMIN INTERNEURONS USING Sun1-GFP/PV-Cre MICE

Paofue Yang
Mentor: Xinyu Zhao

Lysine acetyltransferase 6A (KAT6A) is a chromatin regulator that helps haematopoietic stem cells function. Our lab found that KAT6A increases in parvalbumin interneurons (PVIs) in the frontal cortex in response to chronic stress in mice. However, whether KAT6A upregulation leads to stress-induced behavior deficits and the molecular pathways underlying this effect has not been identified. To address this, we decided to use Sun1-GFP/PV-Cre mice to label the PVIs. Because Sun1 is an inner nuclear protein, Sun1-GFP fusion is localized to the nuclear membrane. In Sun1-GFP/PV-Cre double transgenic mice, PV promoter-driven Cre recombinase leads to Sun1-GFP expressed only in PVIs. This mouse model can be used to isolate PVI nuclei by flow cytometry or co-immunoprecipitation, helping identify the downstream targets of KAT6A.

WHAT IT MEANS TO BE "ASIAN AMERICAN": PERSPECTIVE OF ASIAN AMERICANS' YOUNG ADULTS ON IDENTIFICATION AND ITS MEANINGS

Lucie Yao, Jiaxin Li, Stephanie Zhang
Mentor: Pauline Ho

The current study explored Asian Americans' understanding of their racial and ethnic identity (REI) and its meanings. In one-on-one interviews, 49 undergraduates self-identifying as Asian Americans (38 U.S.-born and 11 foreign-born) shared their definitions of their REI. Interviews were transcribed, coded, and peer reviewed. Preliminary findings suggest that both the individual's identification and meanings may change over time and across contexts. Individuals' choice of the self-identification label was often affected by their social contexts, which also influenced how they understood their identity. These factors shifted from the individual level ("me being Asian American") to group ("being a part of the Asian American community") and societal levels ("being Asian American in the U.S."). Implications for future research will be discussed.

TECHNOLOGY AND ALCOHOL USE AMONG LGBTQ ADOLESCENTS

Fenghang Yao
Mentor: Marina C. Jenkins

Alcohol use among LGBTQ adolescents and young adults (AYAs) is a significant public health concern, as studies have shown that LGBTQ AYAs are more likely to report alcohol use and related problems compared to their non-LGBTQ peers. This study aimed to examine the relationship between technology use and alcohol use behavior among LGBTQ AYAs. Participants were recruited from Qualtrics panels and were social media users between ages 18-25, identified as sexual or gender minorities, and consumed alcohol in the past month. An online survey was completed on technology use and alcohol use behavior, including frequency and quantity of alcohol use, types of technology used, and the role of social media in alcohol use behavior. Inferential statistics such as regression analysis will be used to analyze data.

UNDERSTANDING SPATIAL INEQUALITY TO HEALTHCARE ACCESS IN WISCONSIN THROUGH DEEP LEARNING-BASED NETWORK ANALYSIS

Wen Ye
Mentor: Song Gao

Spatial inequality in healthcare access compromises the health and well-being of communities. Previous studies have shown the superiority of deep learning-based community detections in various fields, but its effectiveness in unlabeled data in the context of healthcare has not been verified yet. This project aims to fill the gap and examines where the regions deprived of convenient healthcare access are located in Wisconsin through deep learning-based network analysis. Delineation of communities is done using Deep Attentional Embedded Graph Clustering (DAEGC). The partitioned communities are evaluated on their healthcare accessibility and availability in each region. The socioeconomic and demographic makeup are further examined to better understand healthcare access disparities between different racial and ethnic groups and income groups from a spatial perspective.

DID FLIGHT EVOLVE TWICE IN DINOSAURS? AN ANALYSIS OF PENNARAPTORAN THEROPOD FEATHERS

Jacob Yoder
Mentor: Scott Hartman

Over the past few decades, the exceptionally preserved fossils from northeastern China have continually shown that pennaceous feathers and bird-like wings emerged in dinosaurs prior to the evolution of avian flight. The purpose of these wings in flightless species, however, has been the subject of much debate. Here, I implement morphometric analysis using images and measurements of fossil specimens to study indicators of aerodynamic adaptations in both flightless and volant taxa. These feathered dinosaurs display remarkable variation in primary feather structure and overall wing structure between related clades, suggesting wide-ranging lifestyles and a low degree of phylogenetic constraint. Furthermore, convergently evolved characters in the genus Microraptor closely mirror early steps in the evolution of flight in birds, indicating multiple transitions toward wing-assisted locomotion in dinosaurs.

TGF-β2 EXPRESSION IN A CONGENITAL MODEL OF GLAUCOMA DUE TO LTBP2 MUTATION

Andrew Young
Mentor: Julie Kiland

Glaucoma is an ocular disease that leads to progressive vision loss and irreversible blindness. Though over 76 million people are affected worldwide, the biochemical mechanisms behind the disease are not known. Previous studies have found that some congenital forms of glaucoma are associated with latent TGF-β binding proteins (LTBPs), a family of TGF-β signaling regulators. In this project, the relationship between LTBP2 and TGF-β2 expression was studied during development in normal cats and cats with LTBP2 mutation using immunofluorescence staining and fluorescence microscopy in relevant structures of the eye including the trabecular meshwork, sclera, and ciliary body. These findings will provide a deeper understanding of the pathophysiology of the disease, which will aid in the future development of diagnostic tests and treatments for affected individuals.

AUTOMATIC BODY REGION LOCALIZATION IN WHOLE BODY MRI DATASETS USING DEEP LEARNING

Kevin Yuan
Mentor: Alan McMillan

This study aims to develop tools that can automatically localize body regions from whole body MRI datasets. This has the potential to introduce viable ways to utilize deep learning models in clinical workflows, specifically to help direct specialized algorithms to the proper locations in medical image datasets. A body region localization approach was developed for whole-body MRIs using axial slices as input. This study explored the use of various convolutional neural network structures to determine the best performance for an MRI body region localization task.

BIOCHEMICAL AND GENETIC EVIDENCE SUPPORT FYV6 AS A SPLICING FACTOR INVOLVED IN EXON LIGATION

Natalie Zeps
Mentor: Aaron Hoskins

Removal of introns and ligation of exons via splicing of pre-mRNAs are essential processes for regulation of gene expression in all eukaryotes. Splicing is carried out by the spliceosome, a highly dynamic complex. Mutations resulting in splicing mis-regulations are responsible for various diseases in humans. Therefore, identifying splicing factors and analyzing their interactions is essential for understanding human gene expression and health. Through cryo-electron microscopy (cryoEM), human protein FAM192A was recently identified as a new splicing factor in catalytic spliceosomes and Fyv6 was the predicted FAM192A homolog in S. cerevisiae (Zhan, X. et al., Mol Cell 2022). However, no biochemical evidence was provided to confirm Fyv6's role. Herein, we show that Fyv6 is a splicing factor and likely a component of the catalytic yeast spliceosome.

PLANNING ONE SYLLABLE AT A TIME?: TRANSFER OF SYLLABLE ADAPTATION TO POLYSYLLABIC CONTEXTS

Katherine Zettel
Mentor: Caroline Niziolek

When we hear errors in the syllables we produce, our brain compensates by changing the way we produce those syllables, demonstrating adaptation, or learnability, of speech motor plans. This study investigated how adaptation of a monosyllabic word would transfer when the same syllable is part of a polysyllabic word or phrase. Previous studies have tested adaptation using monosyllabic words. Twenty participants produced the words "pen" and "ten" while receiving opposing perturbations in auditory feedback. Preliminary results demonstrate that learned changes to "pen" and "ten" transferred to the phrase "pen a ten", while the multisyllabic word "penitentiary" shows limited transfer. This demonstrates that a polysyllabic word is planned differently from monosyllables, but a polysyllabic phrase may exhibit similar motor learning present in monosyllables.

EXPANDED UTILITY OF METAL-FREE RING-OPENING METATHESIS POLYMERIZATION VIA ION PAIRING EFFECTS

Shuyi Zhang
Mentor: AJ Boydston

Metal-free ring-opening metathesis polymerization (MF-ROMP) is a recently reported reaction to synthesize alkene metathesis polymers. An additive study was designed to screen compatible anions to MF-ROMP. The compounds of interest included carboxylates (acetate, benzoate) and sulfonates (tosylate, triflate, bistriflimide). Guided by the additive study, pyrylium salt catalysts with different counterions were prepared. It was hypothesized that certain counterions might stabilize the photocatalyst in bulk media while providing better stereocontrol of the polymers. Moreover, experiments showed that varying the pyrilium salt counterions could be a potential approach to achieve precise polymer synthesis. Ultimately, this study allowed our research team to establish a better stereocontrol of MF-ROMP and would eventually lead to precise polymer synthesis with MF-ROMP.

THE EFFECT OF SPACED LEARNING ON SECOND LANGUAGE VOCABULARY ACQUISITION

Zechun Zhao
Mentors: Yi Tong, Haley Vlach

The spacing effect is a well-established phenomenon that suggests distributing learning events across time produces better memory retention after a delay. The current study aims to investigate the effect of learning schedules (spaced vs. massed) and corrective feedback on incidental contextual L2 vocabulary acquisition. We will use a within-subjects design with 64 Mandarin Chinese native speakers divided into two groups, where each participant will read three sentences about a target pseudoword in either a spaced or a massed schedule for a total of 48 pseudowords. Participants will be tested both immediately and two days after the learning session. Data will be collected using psychopy. The study results will provide valuable insights to L2 learners and course developers on designing learning schedules that optimize learning.

EVOLUTIONARY HISTORY AND MOLECULAR EVOLUTION OF THE α-CARBONIC ANHYDRASE GENE FAMILY IN ARTHROPODS

Yifei "Joye" Zhou
Mentor: Carol Eunmi Lee

Members of the α-Carbonic Anhydrase (α-CA) gene family have been found to show strong signals of natural selection in aquatic organisms in response to climate change. This gene family, encoding the α-CA protein, is an abundant metalloenzyme present in most organisms. Despite its vital role in ionic regulation, acid-base regulation, and respiration, little is known about the α-CA gene family in the phylum Arthropoda. This study aims to explore the evolutionary history of α-CA gene family by (1) reconstructing the phylogeny of α-CA paralogs from 15 arthropod taxa, (2) identifying patterns of molecular evolution along phylogenetic branches, and (3) revealing the evolutionary changes within α-CA protein. This study will constitute a crucial foundation for further investigation into CA paralog's role in adaptation to climate change.

CONNECTING IDENTITY PROCESS AND CONTENT: AN EXPLORATION OF ASIAN AND ASIAN AMERICAN

Ziyan Zhou, Wandi Jiang, Samantha Srichai, Xinxuyang Zhao
Mentor: Pauline Ho

Data from a larger, mixed-methods study were used to explore the link between racial-ethnic identity process and its content among Asian and Asian American young adults. Participants completed the Multi-group Ethnic Identity Measure-Revised and did an interview reflecting on their understanding of their REI and lived experiences that have significantly contributed to their understanding of their identity. This study has three goals: 1) explore the identity status model with Asian and Asian American young adults, 2) understand the turning points in their REI development, and 3) explore similarities and differences across identity statuses in turning point narratives. Advantages and disadvantages of using a narrative approach in combination with the identity status model approach will be discussed.

THE SELLER'S DILEMMA: TO WITHHOLD OR REVEAL INFORMATION WHEN COLLUSION IS POSSIBLE

Jun Zhu
Mentor: Raymond Deneckere

This paper studies collusion in the first-price common-value auction by setting up a two-period game. There are two asymmetrically informed bidders who can choose whether or not to collude before the final auction. There are only two possible Perfect Bayesian Nash equilibrium outcomes, one resulting in a collusion and one leading to competition. To prevent collusion and also increase the revenue, the seller should only publicize partial information when there is a high signal, which is not the full knowledge he has, as indicated by the Linkage Principle.

COMPANION SPECIES AND INSECT DIVERSITY

Chloe Zimmer
Mentor: Shelby Ellison

Companion crops live in association with a primary crop providing various ecosystem services such as attracting beneficial insects for pollination and pest control. The relationship between companion species and insect diversity in cannabis production is not well understood. This study aims to explore the relationship between companion species and insect diversity in agricultural practices. We examined six companion plant treatments in cannabis, collecting data on the presence, abundance, and type of insect diversity across two years and two locations. Selecting the best companion crop for cannabis will help producers enhance ecological resilience of their farms, improve pollination and pest control services, support conservation, and improve agricultural processes.

INTEGRATING CULTURALLY RESPONSIVE TEACHING INTO THE MULTICULTURAL FIELD EXPERIENCE

Kaycia Zimmerman
Mentor: Daniel Timm

The foundational belief of culturally responsive teaching (CRT) is that students are more involved in their education when teaching is situated in their lives and frames of reference. The Multicultural Field Experience (MFE) is a component of Kinesiology 353 Health and Physical Education in a Multicultural Society. In my MFE, I implemented the five aspects of CRT — cross-cultural communication, developing a cultural knowledge base, developing cultural connections, building a cultural learning community, and examining and responding to cultural curricula — as I worked with students from a cultural background different than my background. Through CRT, I developed connections with students which enhanced my confidence while teaching, resulting in students having high engagement, positive interactions with others, and being comfortable in the Physical Education setting.