Undergraduate Symposium

ABSTRACT 2021
Celebrating research, creative endeavor, and service learning

VIRTUAL  
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As we near the end of an academic year made difficult by the ongoing COVID pandemic, the 24th Annual Undergraduate Symposium highlights the resilience of our campus community and reminds us of our enduring commitment to "that continual and fearless sifting and winnowing by which alone the truth can be found." In the midst of myriad challenges, our amazing students have carried on our long tradition of undergraduate scholarly and creative endeavors, guided and supported by dedicated mentors. Thank you for joining us in acknowledging their diligent work and celebrating their achievements.

John Zumbrunnen, Vice Provost for Teaching and Learning
University of Wisconsin–Madison

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Cover photo by the Office of University Communications.
DAVID ABBOTT  Professor David Abbott joined the Department of Obstetrics and Gynecology and the UW Primate Center in 1992. During his time as a mentor, Abbott has published co-authored work with 17 undergraduates. He has a consistent and impressive record of mentoring undergraduates throughout his nearly 30 years on campus. Abbott meets weekly with each of his mentees, supporting them on an individual basis, in part by challenging them to continue to deepen their understanding and practice of science. He convenes a weekly Journal Club, exploring the most recent literature with his students in a welcoming atmosphere with lively discussions. One of his mentees describes Abbott as “a compassionate mentor who loves teaching and encourages his students to pursue their research interests and to never stop asking questions.”

CLAUDIA CALDERON is an Associate Faculty Associate in the Department of Horticulture. Calderon’s colleagues and students praise both the mentoring relationships she develops with students in the various classroom courses she teaches and the continuation and deepening of many of those relationships in study abroad programs she has developed. One student recalls frequently hearing Calderon emphasize in her Tropical Horticulture course that “a teacher can engage with and learn from a student in the same way that students learn from instructors.” The same student went on to participate in Calderon’s two-week field experience in Costa Rica, describing it as “an inspiring experience and a pivotal moment in my educational career.” Through such experiences, which include diverse groups of students, Caledron helps her students and mentees explore new fields of knowledge, develop skills as researchers and as citizens of the world, and grow in confidence.

LIZA CHANG received her Ph.D. in Psychology from UW-Madison in 2019 and is currently a Postdoctoral Fellow in WISCIENCE. In her current role in WISCIENCE, Chang coordinates and implements a variety of programs, both helping undergraduates explore and engage in STEM research (she is currently working on co-authored papers with 9 of them) and training other students and colleagues to be better mentors themselves. Chang’s students praise her clear communication, her compassionate support and her ability to challenge them to pursue continual growth and development. One mentee writes that she has “an amazing ability to connect with student no matter their background by sharing her knowledge, passion and love for helping and making everyone feel safe but most importantly, accepted.”

S.E. (FRANKIE) FRANK is a Ph.D. candidate in the Department of Sociology. Frank leads her own research group (“Menstruation Nation”), which is notable for the diversity of its members, including students from diverse ethnic and racial background, LGBTQ+ students, and students from programs as different as social work, pre-med and pre-law. Her current and former mentees say that she makes students feel seen, heard and included (for example, by learning how to pronounce the name of every student – whether in the research group or in a 100 person class). After graduation, she helps them find jobs, guides them in pursuing graduate student, and supports them on an ongoing basis. One of Frank’s mentees writes that “her endless trust and respect helped me grow immensely as an academic and as a person.” Not surprisingly, Rank serves as a role model for other mentors and teachers in her department and serves on the department’s committee on teaching professional development.

SASHA SOMMERFELDT is a Ph.D. student in the Department of Psychology and a Principal Investigator in the Center for Healthy Minds. Each semester, she works 15-20 undergraduates working on the Stress-physiology Coherence, Interoception, and Mindfulness study. Her students laud her ability to balance guidance and independence, “fostering a welcoming and supportive community” while “implementing rigorous standards and high-quality education.” When the COVID-19 pandemic disrupted worklife, Sommerfeldt adapted to virtual meetings and renewed her focus on students’ development, creating Individual Development Plans for each of her mentees. In response to the ongoing struggle for racial and social justice, she created an anti-racism study group among her mentees, which read and discussed work on the influence of racism on health and well-being.
RESEARCH ON THE MENTAL HEALTH OF COLLEGE STUDENTS OF MIDDLE EASTERN DESCENT IN AMERICA: DEVELOPING A SCOPING REVIEW

Mukadas Abdullah, Alberta Gloria (Mentor)

The literature lacks focus on immigrants of Middle Eastern (M.E.) descent in the U.S., in particular there is a lack of attention on children of these immigrants who are navigating higher education despite conceptual and practical evidence that they experience substantive educational challenges. To assist the understanding of these students’ experiences in higher education, a scoping review was conducted focusing on M.E. individuals to gain a broad scale understanding of their discourse in the psychological and educational literature. The scoping review included categories of M.E. immigrants/refugees of different generational background as well as M.E. students in (higher) educational settings both in the U.S. and the Middle East. Limitations and practical implications of the study are provided.

ASSESSING BENTHIC MACROINVERTEBRATE COMMUNITY STRUCTURE IN OREGON STREAMS IN CONTEXT OF THE RIVER CONTINUUM CONCEPT

Luis Manuel Abreu-Socorro, Daniel Preston (Mentor)

The River Continuum Concept (RCC) predicts how biotic communities change along a stream gradient in relation to changes in several abiotic factors, such as stream order and riparian vegetation. One important biotic factor that is predicted to vary with stream order is the abundance and composition of aquatic macroinvertebrates, including the relative amounts of organisms within functional feeding groups. To determine whether the aquatic macroinvertebrate community structure aligns with what is theorized in the RCC, we collected dip net samples from 130 sites along a gradient of first-to-eighth order streams in the Willamette River Basin, Oregon. Preliminary results show that changes in the composition of functional feeding groups coincide with the RCC predictions, including the higher richness of predatory species in lower-order streams.

APPLICATION OF MACHINE LEARNING METHODS TO PREDICT THE AIR QUALITY IMPACT OF WILDFIRES IN NORTHERN CALIFORNIA

Gautam Agarwal, Eliot Kim, Shreyans Saraogi (Mentor)

Modern anthropogenic climate change and global warming have led to continuous growth in wildfire intensity and frequency, consequently resulting in increased emission of air pollutants. Timely and accurate predictions of air quality in the aftermath of wildfires is necessary to curtail growth of cardiovascular and respiratory diseases. This study aims to compare deep learning techniques in predicting air quality in Northern California from 2010 through 2019. Four categories of input features were selected: wildfire, air quality, meteorological, and land cover. Machine learning and deep learning models were trained to predict air quality for the next day across a spatiotemporal domain. Although the accuracy of the models was insufficient for real-world applications, results from deep learning models indicated potential for providing predictions at high spatiotemporal resolution.

TOBACCO USE AND NICOTINE ADDICTION IN PEDIATRIC CARDIOLOGY PRACTICES

Asiya Ahmed, John S. Hokanson (Mentor)

The objective of this project is to gather information on the number of pediatric cardiology providers who offer nicotine treatments to patients and their household members. The amount of preventable deaths related to tobacco is staggeringly high, and this project will show how ill-prepared most providers are to address this. We sent out surveys to organizations like Pediheart and the American Academy of Pediatrics and initial findings seem to support our hypothesis. We believe this research project is significant because it would be the first step towards helping incentivize pediatric cardiologists to take a stronger stance against nicotine use.
ROLE OF SPERM/TESTIS SPECIFIC GENES AND CANCER DEVELOPMENT
Rabia Ahmed, Hasan Khatib (Mentor)
Cancer is one of the leading causes of death in the developed world and causes immense strain on an individual. The current treatments for cancer are expensive and have harmful effects. Cancer testis antigens (CTAs) are a multifunctional protein group with specific expression patterns in reproductive tissue; however, when expressed abnormally may cause cancer. The study aims to both characterize the CTAs and then devise an inventive way to suppress/manipulate their expression in cancer cells. DNA methylation changes are correlated with irregular expression of CTAs in cancer cells. Currently, the characterizations, normal versus cancer expression, of the CTAs and research on epigenomic experimental design using CRISPR has been completed. Thus, the final product will be a novel method for cancer treatment using epigenome editing.

COMPUTATIONAL MODELING OF SIZE DEPENDENT SUPER DOMAIN STRUCTURES IN FERROELECTRIC NANOTUBES
Aiden Ross, Jiamian Hu (Mentor)
Domain structures in ferroelectric lead zirconate titanate nanotubes under different height and wall thickness conditions were simulated using phase-field models. The simulation results show the emergence of a complex domain structure described with an array of periodic flux-closure and anti-flux-closure domain patterns formed to minimize elastic and electrostatic energy. Our results demonstrate that this complex domain structure can be controlled and modulated through the nanotube's height and wall thickness.

USING GENOMICS TO UNDERSTAND THE LINK BETWEEN MATERNAL AND CHILD DEPRESSION
Grace Albright, James Li (Mentor)
Depression impacts millions of children in the United States. Researchers have long established a relationship between parental and child depression, suggesting a genetic link. However, little is known about how this genetic risk is inherited by the child, especially given that depression is a polygenic disorder that is also influenced by the child’s environment. This study applied cutting-edge genetic methods to a causal framework to examine how a mother’s genetic risk for depression might impact her child's depression through their parenting behaviors. While results from this study did not indicate a full mediation effect of parenting between parent and child depression, significant relationships were found between maternal depression and negative parenting traits. Future studies with a larger sample population will likely yield more significant results.

COLLEGE STUDENT VIRTUAL LEARNING AND MENTAL WELLNESS
Quinlan Alfredson, Megan Moreno (Mentor)
The COVID-19 pandemic has impacted college students, specifically through the transition to virtual learning. The effects of COVID-19 on mental health have been investigated, but thus far less research has explored the impact of virtual learning. The purpose of this study is to explore how virtual learning due to COVID-19 has changed college students’ mental health. In this qualitative study, UW–Madison undergraduates will be recruited for semi-structured interviews focusing on motivation, loneliness, and isolation from virtual learning. Thematic analysis of interviews will be completed. Because virtual learning could become a permanent part of college education, themes present in the interviews can aid in the planning of course and academic policies while generating awareness of mental health in education plans.
ADAPTATION OF CERATOZAMIA SPECIES TO WET V. DRY CONDITIONS
Ayah Amer, Christopher Krieg (Mentor)

Cycads are a group of seed-plants with origins in the Jurassic Period (ca. 270 mya), and today they are found in various ecoregions across the world. However, due to global climate change and illegal poaching, cycads are the most endangered plant group on earth. To conserve these species and predict how they will evolve in the future, we must understand how they have adapted to their native habitats. This research aims to understand how Ceratozamia, a genus of cycads distributed throughout Mexico’s Sierra Madre Oriental, have evolved traits to survive in habitats that vary in water availability. Specifically, we are leveraging a common garden to measure vein anatomy and using GIS tools and statistical approaches to compare trait data to each species’ native environmental conditions.

BABY’S FIRST YEARS
Sileen Alomari, Iris Lor, Sarah Halpern-Meekin (Mentor)

Recent evidence reveals a difference in the development of children raised in a low-income environment compared to a high-income environment. In the Baby’s First Years (BFY) project, 1,000 mothers with incomes below the federal poverty line are randomly assigned to receive a monthly, unconditional gift of $20 or $333 for the first 40 months of their children’s lives. The project includes a qualitative sub-study, which consists of repeated, in-depth interviews with mothers to gain a more holistic understanding of their viewpoints and experiences during this time in their children’s lives, particularly providing context to how mothers make financial decisions, including in allocating the BFY money. Thus, the project can inform public discussion and evidence-based policymaking around the impact of additional income on children’s development.

A GEOMETRIC MORPHOMETRIC ANALYSIS OF HUMANS AND RECENT GREAT APES
Quinn Anderson, Carrie Semenas, Asha Coy, Lauren Gitzlaff, Isabel Montes de Oca, John Hawks (Mentor)

The theory of evolution suggests that all organisms share some degree of relatedness. As a result, anthropologists have taken an interest in understanding the relationship between our species, Homo sapiens, and our closest relatives, Pan troglodytes, Pan paniscus, Gorilla gorilla, Gorilla beringei, Pongo pygmaeus, Pongo abelii, and Hylobates lar. Relatedness between species can be inferred from certain traits used in phylogenetic analysis, particularly by assessing their variation. By recording 3D landmarks of the skull of each species and performing geometric morphometric analyses, the covariation of 3D shape across species can be determined, and thus illustrate the phylogenetic relationships of interest. Using morphological analysis allows us to map the evolution of our species reflected in the biology of humans today.

UNDERSTANDING NEUTROPHILIC EVASION OF FUNGAL PATHOGEN
CANDIDA AURIS THROUGH CELL WALL DISRUPTION
Brody Andes, Jeniel Nett (Mentor)

Emerging pathogen Candida auris displays multi-drug resistance to existing antifungals and poses a public health threat. The ability of C. auris to evade innate immune responses in humans has demanded further research into its unknown pathogenesis, specifically its ability to avoid human neutrophils, white blood cells which engulf invasive microbes. In this study, we examine the viability of C. auris after disruptions are made to its cell wall structure, specifically the disruption of mannan structures, the outermost component of the wall. We show that the absence of mannan results in C. auris being more susceptible to neutrophilic engagement, suggesting that its natural ability to evade neutrophils is a surface-level recognition involving mannan.
THE RELATIONSHIP BETWEEN NEIGHBORHOOD DISADVANTAGE, VASCULAR RISK FACTORS, AND MEMORY IN COGNITIVELY HEALTHY VETERANS

Victoria Angenent-Mari, Cynthia Carlsson (Mentor)

Neighborhood disadvantage has been linked to risk factors for Alzheimer’s disease (AD). elevated ASCVD risk scores and waist-to-hip ratio (WHR) increase risk for AD; Montreal Cognitive Assessment (MoCA) and Preclinical Alzheimer’s Cognitive Composite (PACC) are memory tests which measure cognition. ASCVD risk scores, MoCA, PACC and WHR were collected for each veteran. Outcomes were compared between participants living in the 30% least advantaged neighborhoods and those living in the 70% most advantaged neighborhoods. ASCVD risk scores were higher (p=0.02, N=139) and MoCA (p=0.05, N=139) and PACC (p=0.004, N=100) were lower in participants living in disadvantaged neighborhoods as compared to those living in advantaged neighborhoods. WHR was not significantly different (p=0.4, N=100). Veterans living in disadvantaged neighborhoods may experience higher vascular risk, as well as lower cognitive function.

INVESTIGATING WHETHER THE LOSS OF HAPLN1 IN MACROPHAGES MODULATES MULTIPLE MYELOMA DRUG RESISTANCE

Evanka Annyapu, Shigeki Miyamoto (Mentor)

Macrophages are reported to secrete various cytokines and exacerbate the multiple myeloma (MM) tumor microenvironment where they can induce the NF-kB signaling pathway. Hyaluronan and proteoglycan link protein 1 (HAPLN1) is a cartilage-linking gene that plays a critical role in MM drug resistance. Although preliminary results have indicated that HAPLN1 is expressed in macrophages, the relationship between the factor, cytokines, and the cell type have yet to be established. The purpose of the project is to look at how the functional loss of HAPLN1 in macrophages influences cytokine production and consequently MM drug resistance. The results of this study may provide new insight on the critical role of HAPLN1 in modulating macrophage-influenced drug response in MM.

ESTABLISHMENT OF VASCULAR NETWORK IN SEXUALLY DIMORPHIC REPRODUCTIVE TRACTS: THE FEMALE REPRODUCTIVE TRACT

Obinna A. Anyamele, Fei Zhao (Mentor)

The establishment of sexually dimorphic reproductive tracts from a common progenitor requires the correct formation of a sex-specific vascular network for supporting male and female reproductive functions. However, how the sexually dimorphic vascular networks are established in the reproductive tract remains unknown. Here, I propose to employ light-sheet fluorescence imaging combined with 3D analysis for tridimensional visualization of the vascular network during embryogenesis of the female reproductive tract. We expect that our experiments will reveal novel aspects of vascular establishment in the female reproductive tract. In the future, we will analyze vascular network establishment in 3D for different genetic mutants and pathological conditions to uncover novel molecular pathways and global structural changes that contribute to the successful establishment of the vascular network.

GENETIC CHOLESTEROL DISEASE IN PEDIATRIC CARDIOLOGY

Aurora Arce, John Hokanson (Mentor)

Genetic cholesterol diseases are the most common serious inherited disease in children. Although adult heart disease is the most common cause of death in the U.S. and has its origins in childhood, pediatric cardiologists may not be consistently addressing the issue in their clinical practice. By composing a survey that addresses how pediatric cardiologists approach cholesterol screenings, we can determine what if any barriers exist to better management of genetic cholesterol diseases of children.
INVESTIGATION OF CRANBERRY FRUIT ROT FUNGI FROM POST-HARVEST DEBRIS

Ishita Arora, Jyostna Mura (Mentor)

Cranberry fruit rot (CFR) is a disease that diminishes fruit quality and threatens productivity. Multiple fungal pathogens cause CFR. Some overwinter in debris accumulated on cranberry beds perimeter during flood-harvest, which can be a potential inoculum reservoir. The study’s objective is to determine CFR fungal pathogens in post-harvest debris that might act as inoculum leading to re-infection in the growing season. The approach includes a molecular PCR technique using CFR-specific primers with DNA extracted from collected post-harvest debris, allowing rapid and accurate CFR pathogen detection. The research will provide evidence on CFR pathogens as a latent infection in cranberry post-harvest debris. This knowledge would provide better insights into CFR diagnosis, improve cultural practices to control fruit rot, and maximize cranberry production.

IMMUNOLOGICAL EFFECTS OF ATTENUATING DNA-DAMAGE ACTIVATED NF-KB

Ren Babu, Nakacia Hutson, Donna Li (Mentor)

The NF-κB pathway plays integral roles in cellular functions, which it is able to carry out through different modifications of the NF-κB essential modulator (NEMO) protein. In β cells, CD40 stimulation activates the NF-κB pathway, producing various outcomes. Experiments show CD40 stimulation of NEMO-DK β cells results in a lack of NEMO monoubiquitination, highlighting a role for DNA damage activated-NF-κB in β cell activation. We hypothesized that CD40 stimulation generates DNA damage to lead to NEMO monoubiquitination and subsequent NF-κB activation. However, we’ve learned that CD40 stimulation does not generate DNA damage. We are beginning to identify stimuli that are not involved in CD40 induced NEMO monoubiquitination in hopes of revealing the true mechanism and elucidate the role DNA damage-activated NF-κB in β cell activation.

TEMPORAL DISTRIBUTION OF PHOSPHORUS AND MICROBIAL COMMUNITY DYNAMICS IN LAKE MENDOTA

Samantha Bachand, Karthik Anantharaman (Mentor)

Microorganisms play a vital role in the cycling of phosphorus in freshwater lakes; however, anthropogenic causes like overutilization of fertilizers, industry and household pollution, and sewage have caused phosphorus to exceed its normal concentration and disrupt microbial communities. Despite a large body of literature on the role of phosphorus in eutrophication, less is known about the involvement of microbes and their metabolism of phosphorus in the natural environment. Through the collection of environmental data at different time points in Lake Mendota ranging from the years 1981–2020 and metagenomic data from 2008–17, we have looked at how changes in phosphorus concentrations over time are linked to microbial communities to provide a new perspective on eutrophication.

LEXICAL TRENDS IN AMERICAN LEGAL ENGLISH

Henry Barford, Joe Salmons (Mentor)

I examine trends in the lexicography of American legal English over the past 80 years. By analyzing the frequency of key terms in SCOTUS decisions from the 1940s and the 2010s, I show how the usage of those key terms in American legal English has changed over that period, in particular, a tendency in their usage to become less idiosyncratic, with terms such as “persons,” “prohibit,” and “determine” being much less concentrated in the opinions of specific justices in the contemporary era. I also draw generalizations about the relative presence in legal English of the external languages that have influenced English as a whole, such as French and Latin, compared to English’s West Germanic base.
EXPLORING THE SOLAR CYCLE’S EFFECTS ON THE UPPER ATMOSPHERE THROUGH HYDROGEN EMISSIONS

Olivia Barr, Susan Nossal (Mentor)

The solar cycle process of high and low activity creates an eleven year period. It’s a major source of natural variability in the Earth’s thermosphere. Hydrogen gas makes up a large portion of the thermosphere, reacts to changes in the solar cycle, and is predicted to react to greenhouse gases. Geocoronal hydrogen (hydrogen from the outermost regions of the atmosphere) emissions of light are collected through the Wisconsin H-Alpha Mapper Fabry Perot Interferometer (WHAM). Using Voigt-Fit fitting code, I’m able to fit this data which provides information regarding the brightness of hydrogen emissions. These data aid in understanding the effects of the solar cycle in the upper atmosphere. Future plans include comparing emission changes in the northern hemisphere with observations from the southern hemisphere.

ARE WE BUILDING PLASTIC SAND CASTLES?

Kallyn Batista, Nimish Pujara (Mentor)

From placentas of unborn babies to your seafood, microplastics are everywhere. These are tiny particles < 5mm in size and result from weathering large plastic debris. Using NOAA’s guide to sample these pollutants and an SMI unit—a portable device which separates plastics from various sediments—we can sample local beaches to reveal how concentrated microplastics are in sand deposits and what kind of plastic is residing in in-land water sources such as lakes Mendota and Monona. I expect to retract microplastics via the SMI unit but with unknown quantity. Playing with sand is childish, but in this case, shoveling sand and separating the contaminants will only better our comprehension of the in-land water quality of the lakes we swim, walk, and fish.

THE IMPACT OF SENSORIMOTOR ADAPTATION ON SPEECH INTELLIGIBILITY

Emma Baumgardt, Carrie Niziolek (Mentor)

In a previous study, speakers were presented with altered auditory feedback that decreased their vowel contrast, and learned to oppose the perturbation by increasing their vowel space. Here, we determine whether this sensorimotor adaptation also impacts speech intelligibility by asking participants to identify words from recordings masked by additional noise, made before and after speakers adapted their speech to increase their vowel space. Because adaptation resulted in more acoustically distinct vowels, we hypothesize that the words produced after adaptation will be more perceptually distinct than words produced before adaptation. Because individuals with motor speech disorders have less distinct vowels and lower speech intelligibility, studying whether sensorimotor adaptation increases speech intelligibility will allow for a greater understanding of how speech intelligibility can be intentionally increased.

ADULT SIBLING RELATIONSHIPS

Gari Beidner, Janean Dilworth-Bart (Mentor)

The purpose of this study is to examine associations between childhood competitiveness, age difference, gender, and adult sibling relationships. It is hypothesized that adults who shared similar extra-curricular activities, who were closer in age, and of the same gender will report higher quality adult relationships. Data from 100 participants will be gathered using an online survey. Findings from this study can inform what is known about adult sibling relationships.

OVARIAN FOLLICLE QUANTIFICATION IN A PCOS-LIKE NON-HUMAN PRIMATE MODEL IN RELATION TO DIFFERENT REPRODUCTIVE HORMONAL VALUES

Danielle Bellino, Gabby Greeley, Sarah Shaw, David Abott (Mentor)

In this study, we hypothesized that estrogen receptor alpha () knockdown in the ventromedial nucleus (VMN) of adult female rhesus macaque monkeys will produce a polycystic ovary syndrome (PCOS) phenotype. The proposed mechanism is characterized by increased LH levels, which increase the production of ovarian androgens and lead to an excess of growing ovarian follicles, as found in women with PCOS. Following knockdown (n=6), we quantified and classified ovarian follicles in comparison to a control group (n=5). We aim to determine how these ovarian follicle counts correlate to different hormonal values including AMH, FSH, testosterone, E2, or luteal P4.
LEVERAGING SOCIAL NETWORKS AND TRUSTED INFLUENCERS TO DISSEMINATE AN ACCURATE AND UP-TO-DATE UNDERSTANDING OF COVID-19 IN LATINX COMMUNITIES

Ashley Benitez, Maria Mora Pinzon (Mentor)

The rise of COVID-19 resulted in usual routes of health communication to become unsafe to distribute information. Consequently, the Latinx community was target of miscommunications because official sources of information are not culturally or linguistically appropriate. The objective of this project is to elucidate strategies that engage Latinx communities and disseminate culturally appropriate COVID-19 information through influencers’ social media platforms. As an influencer for Instagram, I’ve created 16 posts, including 4 videos and 12 images. Between October and December 2020, we’ve reached over 1,500 users with an engagement rate of 6.5%. Overall, engagements have increased if posts include a person communicating information via video rather than images. Future research is needed to determine if these engagements and impressions are surrogates for changes in knowledge and behaviors.

THE DEGREE PROJECT

Ana Bermudez Alonso, John Diamond (Mentor)

Public policy is a cornerstone of how minorities are treated. In The Degree Project, $12000 was given to students across 18 schools to encourage continuing education. Methodology consists of analyzing longitudinal surveys and interviews with students and faculty. The study has been going on for a decade, resulting in 3 interesting preliminary findings. Students that are able to meet the performance requirements seem to be reflected as students that have higher household incomes, with less environmental stressors. This only serves to reinforce the existing disparity. This suggests performance requirements need to be eliminated. Secondly, the temporary design of the experiment did not allow for the full potential of results. Other theory and evidence in the discourse suggest free college would address several concerns at once.

INFORMATION AND POLARIZATION IN WISCONSIN

Nilay Bhadra, Michael Wagner (Mentor)

Politics in the United States has become highly nationalized, leading to polarization along the left-right divide. My role in this project focuses specifically on a case study in Wisconsin. I learn about the deal that Foxconn made with the state of Wisconsin to increase job growth by analyzing national and local sources of news and understanding the differences in the type of reporting. As this deal was championed by President Trump as one of his greatest accomplishments, understanding the reporting on the true details of this deal has become very important. By exploring how conversations about Foxconn flowed through Wisconsin’s communication ecology, we can shed light on how public sentiment toward the project changed over time.

SYNTHESIS OF VERTICALLY ALIGNED CARBON NANOTUBES AND THEIR CHARACTERIZATION

Dhanvi Bharadwaj, Ramathasan Thevamaran (Mentor)

Carbon has the ability to form chains of interconnecting carbon atoms resulting in a vast variety of arrangements, one of them being carbon nanotubes. Individual carbon nanotubes have remarkable tensile strength and stiffness. On the contrary, vertically aligned carbon nanotubes (VACNTs) have foam-like compressibility. These properties make VACNTs an optimal choice for protective equipment in extreme environments. We aim to study the process-structure-property relation of VACNTs using different experimental techniques. In the lab, CNTs of different densities are grown using chemical vapor deposition, then the mechanical properties of these CNTs are characterized by performing compression tests at different strain rates. This research will guide the development of revolutionary materials for various applications—from impact protection to controlling mechanical waves and vibrations in unprecedented ways.
DETERMINING THE IMPACT OF PUBLIC COMMENTS ON POLICY OUTCOMES
Samiha Bhushan, Maximillian Lewis Linse, Hailey Patel, Devin Judge-Lord (Mentor)

American political institutions are designed to uphold democratic ideals of government. One of the ideals is an individual’s right to voice opinions on proposed policies. For executive-branch policymaking, this right is enabled by the public comment phase in the rulemaking process. The purpose of our study is to understand how lobbying, by the public and interest groups, affects policy outcomes. The data compiled for this research includes drafts and final policies and comments submitted by individuals and organizations. For each comment we determine the arguments and demands. We then compare the demands to changes in policy text to determine whether the policy changed. We also classify commenters, such as businesses and public interest groups, to assess patterns of policy influence between lobbying groups and campaigns.

UNDERSTORY PLANT COMMUNITY RESPONSES TO VARYING FIRE INTERVALS IN SUBALPINE FORESTS OF GLACIER NATIONAL PARK
Harrison Bielski, Monica Tuner (Mentor)

Climate change is driving increased wildfire in western U.S. forests. Understory plants in Glacier National Park are well-adapted to infrequent high-severity fire (100–300 year return intervals), but it’s unclear if forests will remain resilient to more fire. We investigated plant communities in areas that burned under varying fire-return intervals (FRI; 15 to 212 years) to understand how FRI impacts understory diversity and cover. We compared species diversity metrics and relative abundance of plant functional types and tolerance traits among 81 plots in 5 fires. Higher diversity and shade-tolerant cover was associated with long FRI, whereas lower diversity and more grass and drought-tolerant cover was associated with shorter FRI. Results suggest understory communities are likely to change with altered fire regimes in the 21st century.

LETROZOLE INHIBITION OF LUTEINIZING HORMONE SURGES IN MALE NONHUMAN PRIMATES
Ben Bochenski, Ei Terasawa (Mentor)

Previous work done on female nonhuman primate blood samples has shown that letrozole attenuates the luteinizing hormone (LH) surge in an artificially stimulated estrogen cycle. However, previous results from male nonhuman primate blood samples have shown inconsistent patterns of LH surge inhibition. Once an estrogen-based capsule is implanted surgically in a castrated male nonhuman primate, an estradiol benzoate treatment is injected to stimulate a natural LH surge, and letrozole is given after to examine its negative feedback cycle on LH levels within the blood. I will attempt to clarify the relationship between estradiol-benzoate-induced LH surges and letrozole inhibition in male nonhuman primates based on previous data from male nonhuman primate blood draws while also comparing previous data from female nonhuman primate blood draws.

EFFECTS OF PRENATAL ZIKA VIRUS EXPOSURE ON REGULATION, ANXIETY, AND RELATED MOTOR BEHAVIORS IN INFANT RHESUS MACAQUES IN A FAMILIAR SOCIAL ENVIRONMENT
Ben Boerigter, Karla Ausderau (Mentor)

Prenatal exposure to Zika virus (ZIKV) can cause neurological abnormalities affecting cognition, social communication, motor skills, and behavior. However, the full spectrum of deficits has yet to be identified. The specific aim of this study is to identify differences in regulation, anxiety, and related motor behavior between infant rhesus macaques with prenatal ZIKV exposure and a control group while infants are accompanied by their mothers. ZIKV-exposed infants are expected to demonstrate increased nipple contact, mutual ventral contact, stereotypies, self-directed behaviors, and hostility. Behaviors from three videotaped observations will be coded for sixteen mother-infant dyads using a predefined coding scheme. This study will be the first to characterize behavioral differences in infant macaques with prenatal ZIKV exposure within mother-infant dyads in a familiar social environment.
INCREASING PARENTS’ MOTIVATION TO REDUCE CHILDREN’S RACIAL BIASES

Meredith Bone, Patricia Devine (Mentor)

Children display racial biases starting in the preschool years. Many have suggested that their parents intervene to counteract the development of racial bias. In order to successfully address children’s biases, parents first require education and training. We developed an intervention focused on parents’ (1) awareness of, (2) concern about, (3) motivation to regulate, and (4) self-efficacy in addressing their children’s racial biases. We pilot tested the intervention and outcome measures with White parents and their 5–7-year-old children. In the final study, families were randomly assigned to either the intervention or control condition and we longitudinally evaluated children’s racial bias. This intervention may create a better environment for racial minorities by addressing children’s biases before they are deeply entrenched.

CLOT DYNAMICS IN TRANSPLANT POPULATIONS

Christopher Bou-Saab, Stephanie Savage (Mentor)

Coagulation is the process by which blood changes from liquid to gel, forming a blood clot. Prior to transplant, patients with liver failure have abnormal clot formation which results in coagulopathy before entering the operating room. The process of transplanting involves massive blood loss, so it is of great importance to understand the mechanism of coagulation and the dynamics that surround this process for effective blood transfusion. Data will be collected for analysis to understand how patients form clots before and after liver transplantation. Database design will then allow for organization of this data so that proper analysis can be done. The hypothesis for this study is that massive blood loss during transplant will result in a more severe coagulopathy in patients with liver failure.

THE ROLE OF AUTOPHAGY IN THE RESISTANCE TO CETUXIMAB AND RADIATION IN HEAD AND NECK CANCERS

Samantha Bradley, Randall Kimple (Mentor)

Autophagy plays a protective role in cells by degrading damaged organelles and recycling them to create cellular energy. Cetuximab, a cancer therapy drug, attempts to target the epidermal growth factor receptor (EGFR) overexpression common in head and neck cancers (HNC), but can inadvertently induce autophagy in the process. Radiotherapy, another primary treatment of HNC, may be similarly inducing autophagy, leading to the proliferation and survival of the tumor. Autophagy induction can provide some resistance to further attempts at treating the cancer; understanding this mechanism of resistance is essential to improve treatment. We hypothesize that autophagy is a major factor in providing HNC cells resistance to chemotherapy or radiation therapies, and that control over this resistance may come by utilizing autophagy-blocking drugs.

EVALUATING THE ASSOCIATION BETWEEN BIOMARKERS THAT CHARACTERIZE OBESITY AND COLORECTAL CANCER RISK

Ronni Brent, Shaneda Warren Andersen (Mentor)

Colorectal cancer (CRC) has a tremendous burden on the U.S. with high morbidity and mortality rates. Colorectal cancer is largely amenable to prevention by modification of several environmental factors. Obesity has a well-documented association with increased CRC risk but the mechanism by which it influences risk is poorly characterized. We aim to evaluate this association between colorectal cancer risk and obesity using obesity biomarkers related to inflammation, insulin and adiposity. To evaluate the association between colorectal cancer risk and obesity conditional logistic regression will be performed to calculate odds ratios of CRC incidence among obese and non-obese individuals with 95% confidence intervals. Our results will further understanding of the mechanism between colorectal cancer risk and obesity can help guide prevention tactics to lower CRC risk.
HOW DOES SPEECH GRAMMATICALITY INFLUENCE CHILDREN’S ABILITY TO PROCESS FAMILIAR WORDS?

Paige Bruggink, Jenny Saffran (Mentor)

In this study, we manipulate the type of speech that infants hear while recognizing familiar words. Some of the objects are labeled by telegraphic speech (i.e., the elimination of articles and other nonessential words) while others are labeled with fully grammatical speech. We use a standard measure of word recognition in which infants will see two side-by-side images and will hear one of the objects labeled with either telegraphic or fully grammatical speech. We look at how quickly and accurately the infant looks at the labeled object and then compare the results for the telegraphic versus fully grammatical labels. We will then analyze our results looking for a statistically significant difference in speech accuracy and recognition between the telegraphic and fully grammatical speech types.

INVESTIGATING THE CORRELATION BETWEEN ALZHEIMER’S DISEASE (AD) PROGRESSION PHENOTYPES AND NEUROINFLAMMATORY RESPONSES OBSERVED IN COVID-19 AND AD

Jonathan E. Bryan, Daifeng Wang (Mentor), Saniya Khullar (Mentor)

COVID-19 considerably affects elders with Alzheimer's Disease (AD). Several Alzheimer’s risk genes, like APOE4, correlate with increased susceptibility to severe COVID-19. While the immune system plays an important role in aging and neurodegeneration, underlying gene functions linking the immunological functions from COVID-19 to Alzheimer’s Disease are unknown. To address this, we examined how genes are related to immunological functions/pathways including COVID-19 in key AD clinical phenotypes (ex. Braak stages and cognitive impairment). We first pinpointed Alzheimer’s genes that were significantly correlated with our phenotypes and then, for each phenotype, performed enrichment analysis for associated genes, identifying enriched pathways/functions in immunology and COVID-19. Through this analysis, we aim to provide a potential novel map for understanding the functional interplay between the immune system and Alzheimer’s Disease.

ADAPTING OF INDIVIDUALS WITH IDDS AND THEIR CAREGIVERS DUE TO COVID-19

Victoria Buisson, Jina Chun (Mentor)

The purpose of our research is to understand the service needs, utilization, and satisfaction for families and individuals with intellectual and developmental disabilities (IDD) in the context of the COVID-19 pandemic. Using a cross-sectional online survey (Qualtrics), we will collect data from caregivers who have a child with IDD (ages 3 to 30) across the states in the U.S. and China. In our collaborative work, we will compare data to examine similarities and differences in the unique needs of caregivers and individuals with IDD and service utilization satisfaction before, during, and after the pandemic lockdown. The results will help researchers and clinicians to determine support approaches and develop service systems that can help families and individuals with IDDs have a successful transition to life post-COVID.

PYINSEQ, A LIGHTWEIGHT SNAKEMAKE-BASED PIPELINE FOR TRANSPOSON INSERTION SEQUENCING ANALYSIS

Emanuel Burgos, Mark Mandel (Mentor)

Methods that utilize transposon mutagenesis and high-throughput deep sequencing are becoming more common for elucidating gene fitness in any environmental condition simultaneously across an organism’s genome. However, these experiments generate vast amounts of sequencing data that can be challenging to computationally process and analyze. Here we present pyinseq, a bioinformatics platform written in Python for analyzing transposon sequencing data. The tool utilizes Snakemake, a Python-based workflow manager which allows for concurrent execution of different computational steps of the pipeline. We aim to implement this tool in a computation cluster for parallel execution by using the HTC services at UW–Madison.
INCORPORATING GOLD NANOPARTICLES INTO PASSIVE SAMPLERS FOR POLLUTANT DETECTION
Craig Butler, Haoran Wei (Mentor)

The goal of my research project is to incorporate gold nanoparticles into passive samplers for P-FAS detection. The plan is to use gold nanoparticles as a transfuser to enhance chemicals attached to the surface of the membrane to observe pollutants located on the membrane within the passive sampler. This device would allow people around the world to be able to detect concentrations of P-FAS located in drinking water and avoid it if necessary. So far, we know that activated carbon is an effective adsorbent for pollutants located in the water. Currently, we are going to experiment how well activated carbon can absorb PFAS and decide whether or not this would be the best membrane to apply onto the passive sampler.

EFFECTS OF GESTATIONAL TESTOSTERONE EXCESS ON PANCREATIC ISLET MORPHOLOGY IN MALE ADULT RHESUS MONKEYS
Nicole Byington, David Abbott (Mentor)

Although polycystic ovary syndrome (PCOS) is a women’s reproductive disorder, it is commonly accompanied by metabolism dysfunction with unknown origins. Adult female rhesus macaques exposed to gestational testosterone (T) excess, a known model for PCOS, manifest PCOS-like metabolic disorders, including insulin resistance and type 2 diabetes. Male macaques subjected to the same gestational T excess exhibit insulin resistance and deficient pancreatic beta cell insulin responses to glucose in adulthood. The latter may arise due to oxidative stress and apoptosis, resulting in extracellular fibrin and plaque accumulation in pancreatic islets that can lead to increased metabolic defects. Gestational T excess may provide a common origin for metabolic dysfunction in women with PCOS and their male close relatives.

MACHINE ASSISTED SCREENING FOR DEPRESSION USING FACEBOOK PRIVATE MESSAGES
Diane E. Camarda, Sarah Sant'Ana (Mentor)

Depression is a widespread issue among young adults that may significantly harm both current and future functioning. However, many depressed young adults are unable to recognize their need for treatment until their symptoms become severe. Current screening misses a large portion of depressed individuals, particularly lower severity cases that may benefit most from early intervention. This project aims to utilize Facebook private messages (which contain fluctuations in mood, social interaction, etc.) to develop a dynamic, scalable approach for young adult depression screening. 836 undergraduates provided downloads of their Facebook messages that were assessed for depression. The optimum combination of natural language-based features, tuning parameters, and classification algorithm was selected using nested k-fold cross validation. Results demonstrate predictive utility within Facebook messages for depression classification.

IDENTIFYING THE EFFECT OF CARD ON HOUSEKEEPING GENE EXPRESSIONS IN CLOSTRIDIODES DIFFICILE UNDER VARYING IRON SATURATING CONDITIONS
Noelle Candler, Sherry Cao (Mentor)

*Clostridioides difficile* (*C. diff*), a lethal pathogen in the human gut, is the most prevalent cause of infections in hospitals and nursing homes. Of particular interest are two global transcription regulators CarD1 and CarD2 which facilitate competitively binding *C. diff* RNA polymerase. Comparing the expression levels of these regulators with highly expressed genes encoding housekeeping proteins, a potential correlation between expression of CarD and other genes can be determined in various conditions. Data analysis using R and Python will be completed to determine and visualize any correlations. We can better understand the transcription mechanism of *C. diff* in stressful and nutritious environments by analyzing prior data of the expression patterns of CarDs and other housekeeping genes in iron saturating versus limiting conditions, potentially improving future treatments.
PILOTING AND VALIDATING A METACOGNITIVE TEACHING STRATEGIES SURVEY FOR SURGEONS
Shannon Carnahan, Sarah Jung (Mentor)

MAISE, a metacognitive awareness teaching inventory, prompts surgeons to consider their roles as educators, encouraging self-reflection for professional development and teaching strategies within the medical field. The MAISE is designed to assess seven sub-dimensions of metacognitions. Participants rate statements about their self-perceptions of their teaching skills on a scale of 1 to 5, from strongly disagree to strongly agree. Recruitment strategies involve the use of social media to recruit surgical attendings as participants. This study will report on the structure of the MAISE survey as validated by factor analysis. This tool provides a framework for surgeons to reflect on potential areas for self-improvement in their teaching, and ultimately improve the learning environment in surgery.

USING EXPERIMENTAL EVOLUTION IN YEAST TO UNDERSTAND THE FITNESS EFFECTS OF NEW MUTATIONS
Alexandra Chan, Nathaniel Sharp (Mentor)

Most mutations are negative biological processes that cause issues like cancer and aging. By using experimental evolution in *Saccharomyces cerevisiae* (yeast cells) we can understand the fitness effects of new mutations and confirm whether the populations have adapted to the new conditions that were created. Three different harsh environments were made to test the hypothesis and all reduce yeast growth rate by about 50%. Formulating media, diluting yeast, plating and performing growth assays is used to find data since growth is used as a proxy for fitness. Preliminary results show that the yeast is adapting to the media predictably. Conducting more experiments and figuring out the conditions of the yeast cells can be an important step to see if mutations can adapt to climate change.

DIOXIN EXPOSURE INCREASES NORADRENERGIC AXON DENSITY IN DEVELOPING MOUSE PROSTATE BY UPREGULATING ARTEMIN
Thrishna Chathurvedula, Anne Turco (Mentor)

Aging men experience urinary voiding dysfunction is costly and reduces quality of life, and the causes are not known. My laboratory showed that exposure to a persistent environmental contaminant (dioxin) during fetal development causes voiding dysfunction in adult mice, which shows how fetal environment influences this disease of advancing age. We hypothesize that fetal dioxin exposure drives the formation of excessive noradrenergic axons in the prostate. We found that in utero exposure to dioxin increases noradrenergic axon density in neonatal and adult mouse prostate, demonstrating a persistent phenotype. My goal is to define the fetal period as the critical window of dioxin action and test the hypothesis that dioxin acts within the critical window to increase the abundance of neurotrophins in the mouse prostate.

DEVELOPMENT AND CHARACTERIZATION OF A HISTOLOGY-COMPATIBLE MICROFLUIDIC MODEL OF THE RENAL CELL CARCINOMA MICROENVIRONMENT
Jiong Chen, David J. Beebe (Mentor)

Renal cell carcinoma (RCC) is a common genitourinary cancer characterized by large tumors with a harsh and nutrient-depleted tumor microenvironment (TME). This harsh TME induces high selective pressures, resulting in resistance to systemic therapies. However, most in vitro models lack these TME features and are not comparable to standard histopathological readouts. Hence, in vitro testing is not performed in relevant conditions. We optimized a microfluidic device compatible with histological techniques and real-time fluorescent readouts to reproduce the 3D RCC TME. Further, we used this device to investigate the effect of photodynamic therapy in the RCC TME. The high relevance of these micro-environments and their compatibility with histopathological techniques will provide insight into the development and evaluation of new RCC treatments.
MODELLING SENSORIMOTOR ADAPTATION IN SPEECH THROUGH ALTERATIONS TO FORWARD AND INVERSE MODELS

Taijing Chen, Ben Parrell (Mentor)

Previous work has shown that sensorimotor adaptation of a particular vowel can be transferred to other, untrained, vowels. Moreover, the magnitude of this transfer decreases as the acoustic distance between the training and the transfer vowels increases. In this study, we developed a neural-network based architecture to computationally simulate behavioral results of speech motor learning and transfer and assess whether updates to internal control models could account for the observed generalization patterns. Our results replicate behavior in previous experiments: the model produced changes in speech production that counteracted the imposed perturbation, and the model showed gradient transfer of learning dependent on acoustic distance. These results suggest that updating paired forward and inverse models provides a plausible account for speech motor learning.

A NOVEL MEASURE OF SOCIOECONOMIC STATUS (SES) USING HOUSING DATA TO ANALYZE THE ASSOCIATION OF SES AND TRAUMATIC INJURIES: A POPULATION-BASED CROSS-SECTIONAL STUDY

Tony Chen, Stephanie A. Savage (Mentor)

The association of socioeconomic status (SES) and health outcomes has raged unabated for decades in the U.S. Common databases such as medical records often lack data on SES but include address information. A housing-based socioeconomic index (HOU.S.ES) was developed to overcome an absence of individual SES measures in common databases. This study is aimed to assess whether HOU.S.ES is associated with traumatic injuries in the adult population. Using a random sample of adult patients with traumatic injuries (n=500) from different counties, home address information and public property data were merged to formulate HOU.S.ES. Other SES measures are included educational levels, income, Hollingshead and Nakao-Treas index, and injury mechanism. HOU.S.ES index makes a unique contribution to the measurement of individual SES in epidemiologic studies.

INTRA-COUNTY MODELING OF COVID-19 INFECTION WITH HUMAN MOBILITY AND SPATIAL HETEROGENEITY: A STUDY ON PARAMETER CALIBRATION AND DATA ASSIMILATION

Yile Chen, Qin Li (Mentor)

The coronavirus disease pandemic is a serious global threat and the relationship between its spread and human mobility is vital in policy making. Many existing SEIR models rely on the assumption of population homogeneity, which is typically unrealistic. In [Hou et.al, 2020], the authors developed a new SEIR model that differentiate subregions with different cultural and socioeconomic features. They reconstructed the historical spread of COVID-19 in subregions in Dane County and Milwaukee County in Wisconsin, tested the model using the data, and assessed the spatial heterogeneity of the spread with business traffic, age and race. We will study the model with a thorough parameter calibration. We will investigate different data assimilation approaches for the parameter tuning and study the stability of the tuning process.

THE PREVALENCE OF SPORE-FORMING PATHOGENS IN SPICES

Suraj Chetty, Wendy Bedale (Mentor)

Food companies are liable for the ingredients they use in the products they sell to consumers. They often include spices, which can have spore-forming pathogens that may cause food poisoning to the purchaser. The purpose of this research is to provide food companies with microbiological profiles of different spices originating from different parts of the world. To find the answer we reviewed multiple relevant studies, extracted relevant data, and input it into a Microsoft Excel spreadsheet for analysis. From this process, we will learn what factors affect the microbiological quality of different spices such as origin, bacterial strain, enterotoxin formation, etc. This information will help companies produce safer products for consumption and prevent outbreaks of food-borne illnesses.
IDENTIFYING RUSTY PATCH BUMBLE BEE HABITAT AND AGRICULTURE OVERLAP

Daisy Chew, Tyler Lark (Mentor)

The rusty patch bumble bee (*Bombus affinis*) is a keystone species responsible for pollination through sonication. Since 2000, it has only been found in 13 states across the U.S. and was listed as endangered in 2017. The largest reason for its population decline is agriculture and one of the high potential zones which provide suitable habitat is southern Wisconsin. Therefore, better understanding of local intersections in Wisconsin is needed. This research seeks to map the intersection of high potential zones and agricultural land use using a compilation of existing local data sets and statistics.

CODING NEWS STORIES ON THE INSTITUTIONAL RESPONSE TO SEXUAL VIOLENCE

Pamela Chidera Elubiaozor, Nona Gronert (Mentor)

In this presentation, I will compare how UW–Madison and the University of Lagos use policies to address sexual violence and how activists have tried to shift institutional response. Using newspaper articles from *The Daily Cardinal*, *The Badger Herald*, and *X*, I will show the differences between UW–Madison and the University of Lagos, such as differences in free speech and having different perspectives heard. This research sheds light on how UW–Madison and the University of Lagos address sexual violence. With this project, the audience will learn about activism and policy in two different country’s universities and how the U.S. and West African contexts impact those differences.

STUDYING THE EPIGENETIC CHARACTER OF HISTONE MODIFICATIONS

Anna Christenson, Zena Jensvold (Mentor)

Histone modifications play an important role in the regulation of genetic expression. While these modifications are frequently referred to as "epigenetic," little is known about if and how these modifications are carriers of information across cell divisions. Utilizing a catalytically-dead CRISPR-Cas9 tool, we plan to deposit histones at specific locations of the genome. Through the use of chemical tags, we will then determine where these histone modifications end up after replication. This cutting-edge, single-location-targeting tool has the potential to uncover more details about histone modification inheritance. Understanding histone modification inheritance and nucleosome turnover is critical if we want to delve deeper into the underlying causes of many diseases.

SCHOOL INVOLVEMENT AND COPARENTING DYNAMICS

Macayla N. Church, Janean Dilworth-Bart (Mentor)

Parental involvement in children’s childcare and early elementary education can have a positive long-term impact on academic achievement. Supportive coparenting is associated with fewer behavioral difficulties in children, particularly in nonmarital families, and it is positively associated with father’s school involvement. Yet, little is known about the extent to which school involvement and coparenting interact to affect child outcomes in childcare and early elementary school. The purpose of this study is to determine associations between coparenting quality, parents’ school involvement, and children’s socio-emotional and academic competence. Publicly available data from the Fragile Families dataset will be used to test the hypothesis that children whose parents who have greater coparenting quality, and greater involvement in their children’s education will have higher academic achievement and socioemotional competence.
DISCOVERING MECHANISMS OF POLYPLOIDY INDUCED ECOLOGICAL DIVERSIFICATION IN FERNS USING VEIN TRAIT MEASUREMENTS
Ellie Coppock, Kate McCulloh (Mentor)
Polyploidy can drive ecological diversification and lead to separation of species distributions between polyploid and parental taxa, but the underlying physiological mechanisms remain unknown for many species. Polyploid offspring may have functional traits that differ from parental taxa and can help explain how organisms are better suited for particular environments relative to other species. We hypothesize this may be the case in the *Polystichum scopulinum* polyploid complex which occupies hotter and drier habitats relative to the parental species, *P. lemmonii* and *P. imbricans*. Studies show survival in these areas may be linked to optimization of vein characteristics which impact photosynthesis and water-use. By measuring these traits in the polyploid and diploid parents, we can understand better the mechanisms underlying ecological diversification in wild polyploid populations.

ION TEMPERATURE GRADIENT TURBULENCE IN TOROIDAL FUSION PLASMAS
Brandon Cortez, Audra Hernandez (Mentor)
Thermonuclear fusion research seeks to harness a carbon free, plentiful energy source that could contribute to solving the energy crisis. Confining and heating plasmas to fusion temperatures makes them turbulent, a poorly understood dynamical plasma state that causes rapid losses of particles and heat, and therefore has been a major impediment to achieving fusion. This work seeks to better understand the spatial fluctuation characteristics of ion temperature gradient driven turbulence, specifically understanding how fluctuations extend along the magnetic field lines that provide plasma confinement. A set of five coupled partial differential equations is solved that describes how fluctuations are localized within a plasma by the spatial variation of the magnetic field and the free energy sources that drive instability.

THE POETICS OF KISSING: EROTIC LATIN POETRY AND SIR PHILIP SIDNEY'S "ASTROPHIL AND STELLA"
Ashe Courtemanche, Elizabeth Bearden (Mentor)
Classical themes and references to antiquity can be seen throughout European Renaissance literature, but where's the vulgarity, the irony, the erotic? The traditions of Latin erotic poetry have been purified by past scholars, erasing all the erotica from the erotic, but it is there in themes, attitudes, and a long, long lineage from antiquity to 16th century England. Through intertextuality I will be tracing the erotic tradition from the poetry of Catullus to Sir Philip Sidney's "Astrophil and Stella" to recognize how the erotic prevailed and adapted in the European Renaissance.

TRANSCRIPTIONAL ANALYSIS OF PROMOTERS IN ZYMOMONAS MOBILIS
Allison Czora, Robert Landick (Mentor)
Quantification of gene expression using RNA-seq enables the linkage of biological processes to gene function and regulation. RNA-seq is typically quantified at the gene-level; however, since bacteria often transcribe many genes together on a single mRNA, transcript-level analysis is desirable. Using a computational pipeline we designed to infer transcript boundaries in bacteria and quantify expression at the transcript-level, we analyzed promoter usage relative to oxygen regulation in *Escherichia coli*. We found that our inferred transcript units closely match a curated database of known transcripts, validating our inference of transcription units in *E. coli*. Confident in our methodology, we applied it to Zymomonas Mobilis—an ethanologenic bacteria with applications for biofuel production—to learn more about the transcription units and promoters in this promising bacteria.
CHARACTERIZING THE ROLE OF PRKA-DEPENDENT GPSB PHOSPHORYLATION ON LISTERIA MONOCYTIOGENES VIRULENCE
McKenzie E. Daanen, JD Sauer (Mentor)

The mammalian cytosol restricts growth of non-pathogenic bacteria and vacuolar pathogens, yet professional cytosolic bacteria such as Listeria monocytogenes (Lmo) possess adaptations that promote their survival and replication in this environment. PrkA is a cell wall stress-sensing kinase previously identified as essential for Lmo to replicate in the cytosol. Phosphoproteomic analysis of Lmo during cell wall stress indicates that PrkA phosphorylates GpsB, a protein conserved in Gram-positives that regulates peptidoglycan synthesis. Here we demonstrate that GpsB is necessary for antibiotic resistance and survival in the macrophage cytosol. These data suggest that PrkA phosphoregulation of GpsB may be important for the cell wall stress response in the cytosol and potentially virulence, and more broadly informs us about the adaptations cytosolic bacteria utilize to promote infection.

UNDERSTANDING GENE EXPRESSION PATTERNS USING STATISTICAL APPROACH
Sahas Dandapantula, Daifeng Wang (Mentor)

Machine learning is drastically changing medicine and has shown promise in identifying diseases and helping diagnose patients faster. Specifically, its promise in helping patients who suffer from brain disorders such as autism is enormous. It is imperative to study these disorders because ultimately the brain is the highest product of our evolution and is second to none in determining our quality of life. Understanding how gene function is affected by various conditions can help improve treatments and disease prediction capabilities. RNA-sequencing provides us with expression patterns of various genes for each individual. This research aims at identifying highly expressed genes among healthy and autistic individuals using differential expression analysis, which involves statistical methods to discover the change in expression levels between conditions.

PARENT INFORMATION SHARING ABOUT ASTHMA MANAGEMENT THROUGH FACEBOOK
Habib Danioko, Bradley Kerr (Mentor)

Six million children are affected by asthma in the United States. Consequences include 1.8 million emergency room visits per year. Facebook may be used by parents and guardians to learn about asthma management; few studies have examined this content. This study sought to understand what parents share on Facebook groups focused on asthma management strategies. The content analysis study evaluated 105 posts from three Facebook groups focused on asthma management for parents. Posts were evaluated for number of likes, shares, comments, references to asthma action plans (written tools for management of asthma), alternative asthma management tips, and guidance for identifying asthma in children. Descriptive statistics were calculated. Findings will inform pediatric providers of the type and quality of asthma information on Facebook.

INSPECTION OF THE EFFECTS OF OPTIMAL HUSBANDRY CONDITIONS AND OXYGEN AVAILABILITY ON THE SURVIVAL AND PHYSIOLOGY OF CALIFORNIA BLACKWORMS (LUMBRICULUS VARIEGATUS)
Abdel Rahman Daoud, Michelle Harris (Mentor)

Lumbriculus variegatus, more commonly known as the California blackworm, is an annelid species characterized by a transparent body wall which enables the inspection of its vascular system via light microscopy. Additionally, this species can facilitate the study of neuromuscular functioning via its photosensitive escape behavior. Recently, the interest in the use of this species as an educational tool in the understanding of fundamental physiological principles has been increasing. Here we describe our two-tiered research on optimal husbandry conditions, such as temperature, lighting and cleaning frequency that would enable biology educators to maintain this species for long periods of time and in various environmental conditions. Furthermore, we study the effects of oxygen availability on the vascular and neuromuscular functioning of Lumbriculus variegatus at optimal husbandry conditions.
USING AN ECOLOGICAL FRAMEWORK TO INFORM CONVERSION RESIDUE DEGRADATION
Timothy Davenport, Cameron Currie (Mentor)

Lignocellulosic ethanol (LE) production is a novel source for biofuel-based renewable energy. However, this process results in the formation of a waste product known as conversion residue (CR). Microbial communities capable of degrading CR into usable bioproducts are of great interest for sustainable development and bioremediation initiatives. The purpose of my investigations has been to understand how a community derived from a leafcutter ant dump capable of degrading CR can be shaped through pH adjustment and nutrient supplementation. Efficiency was measured through relative CR degradation via a chemical oxygen demand (COD) assay and community growth as measured through a diphenylamine assay. Future investigations aim to analyze sequencing data to uncover prospective changes in community dynamics during treatment exposure.

REGIONAL SENSITIVITY OF ATRIAL MYOCARDIUM TO MECHANICAL STRESS AS A MECHANISM OF ATRIAL FIBRILLATION TRIGGERS
Frank Charles DeGuire III, Alexey Glukhov (Mentor)

Despite the high prevalence of atrial fibrillation (AF), the mechanisms of its initiation are poorly understood. Conditions associated with elevated blood pressure increase AF risks, and mechano-electrical feedback is proposed to trigger AF. Caveolae represent invaginated membrane structures that reserve “extra” membrane and buffer mechanical forces. Stretch-induced incorporation of caveolae into the cell membrane has been linked to the activation of caveolar mechano-sensitive chloride channels, which provide depolarizing current to trigger AF. These studies have not considered, however, why different atrial regions are more prone to stretch-induced arrhythmogenesis, as was shown in patients. We investigated how caveolae impact mechano-electrical feedback in different atrial regions. Stretch was mimicked by cell swelling. Disruptions of caveolae simulated diseased conditions. Measurements of calcium transients estimated cell response to stretch.

SEXUAL VIOLENCE AT UW–MADISON
Ella Deitz, Nona Gronert (Mentor)

This research aims to gather a timeline of sexual violence and the institutional and cultural responses to this issue at UW–Madison. Through a manuscript of poetry, I plan to educate people on the history of laws and events related to sexual violence at UW–Madison while also considering the individual and emotional impacts that these events had and how they affect us today. I chose poetry because of art’s ability to reach a wider audience and communicate emotion more easily than academic writing. I will inform this project through academic research and archived campus articles. I hope to teach patterns of sexual violence at UW–Madison and how institutions (the university and state and federal governments) react to this violence through performing excerpts from my manuscript.

YOUTH PERSPECTIVES ON SEX TRAFFICKING INDICATORS
Maria del Carmen Rosales, Lara B. Gerassi (Mentor)

Sex trading (exchange of sexual contact for money or financial compensation) is a public health concern. It is critical that professionals (e.g., social workers, teachers) be prepared to screen and assess young people for sex trading. The purpose of this project is to understand the language and practice frameworks that professionals can use to facilitate sex trading disclosures in a person-centered way and test the face validity of sex trafficking indicators from the perspectives of young people with lived experiences of sex trading and housing insecurity. This community-based participatory project partners with a group of young people with lived experiences employed through Youth Collaboratory to disseminate a web-based survey to young people (ages 16–29) with lived experiences.
NO EVIDENCE FOR BEHAVIORAL DYSREGULATION IN VIDEO GAME ADDICTION

Zachary Demko, C. Shawn Green (Mentor)

There is current interest in whether to categorize video game addiction as a mental disorder. This study hypothesized that people who met criteria for video game addiction wouldn’t decrease their gaming when they had exams, which would suggest a lack of self-control. We identified two groups of gamers among college students: one who met criteria for video game addiction and one who did not. They completed weekly self-report surveys assessing their time spent studying and gaming. There were no significant differences between the groups in gaming time during weeks with and without exams. Yet, participants also massively underestimated the amount of time they spent gaming, which adds uncertainty to the findings. The underreporting of gaming hours has relevance for research that relies on self-reports.

MULTI-PHYSICAL AND MULTI-DIMENSIONAL SIMULATION OF NUCLEAR POWER PLANT

Zachary Denzer, Jun Wang (Mentor)

In recent years, there has been an increasing need for a new generation of nuclear reactors. Nuclear reactors are capable of generating a large amount of energy without the harmful byproducts produced commonly by fossil fuels. Microreactor concepts have recently been in testing due to the demand for adaptable, reliable, and sustainable power to provide electricity to suburban and industrial areas. Before these micro nuclear reactors are produced, extensive research and testing must be carried out. This primary objective of this research involves analyzing plausible ways to provide electrical supply to suburban areas and remote locations. In addition, improving the economic and safety of the current micro-reactor design is necessary. However, in order to achieve this, three dimensional multi-physical calculations must be made using different applications. This research will bring us closer to the upcoming generation of nuclear power.

SYNAPTIC CONNECTIVITY OF THE DIM-LIGHT NEURAL CIRCUIT IN THE PRIMATE RETINA

Paul J. Derr, Raunak Sinha (Mentor)

Vision is a preeminent factor in forming a holistic perception of the world. The retina is the neural tissue lining the back of the eye that first absorbs and processes light. Rod photoreceptors, cells that initially capture photons in dim-light conditions, and their downstream partners change in density and morphology from the center of the primate retina to the periphery. Although the differences in densities and morphologies of rod photoreceptors across retinal locations is known, the differences in the wiring/connectivity of the dim-light neural circuitry remain unexplored. This study uses serial electron microscopy to identify differences in synaptic connectivity at different retinal locations providing much-needed insight into the arrangement of the dim-light visual pathway across space.

RISK OF PREGNANCY-RELATED MORTALITY OF BLACK WOMEN IN THE U.S.: A META-ANALYSIS AND SYSTEMATIC REVIEW

Maanasa Devabhaktuni, Fauzia Osman (Mentor)

Maternal mortality (MM) is death of a mother that occurs during pregnancy or within 42 days post-delivery. Increased risk for mortality can be contributed by race and ethnicity. Our study aimed to identify racial disparities of pregnancy related mortality (PRM) and we hypothesized that Black women would be at greatest risk for MM. We conducted a systematic review and meta-analysis using STATA software on a total of 17 observational studies. We found that Black women were at a higher risk for mortality when compared to White women: [RR 1.59 [95% CI 1.10, 2.30] and to Hispanic women: [RR 2.64 [95% CI 1.81, 3.84]. Our studies show a disparity in maternal mortality, indicating a need for policies addressing MM risk in Black mothers to improve health.
DEATH AND SEXUAL VIOLENCE: CONSTRUCTING FEMALE IDENTITY IN ITALIAN RENAISSANCE ART
Tanvi Dhariwal, Jennifer Nelson (Mentor)
Visual depictions of female identity in the Italian Renaissance art were largely constructed by male artists. There was, however, a large disparity in how women were imagined. An ideal woman was expected to be chaste and virtuous, but women were simultaneously expected to satisfy male desires. These paradoxical conceptions of women, however, converged as they emphasized female suffering. Depictions of both exemplary chastity and female sexuality seem to generally be entangled with ideas of violence and unequal power structures, and female suffering seems to become an integral part of female identity. Through the case studies that visualize Ariadne and Dido, I will explore why female suffering was emphasized in representations of women and how these rhetorics of violence and death change with different contexts.

MATRIX METALLOPROTEINASE-2 CLEAVED COLLAGEN IV TARGETED NANOPARTICLE FOR SUSTAINED RELEASE OF PD-L1 BLOCKING PEPTIDE IN THE TUMOR MICROENVIRONMENT
Steven Do, Seungpyo Hong (Mentor)
In the tumor microenvironment (TME), matrix metalloproteinase-2 (MMP-2) cleaves collagen type IV (Col-IV). The peptide sequence TLTYTWS selectively binds to this cleaved collagen, and conjugating this peptide to dendrimers may improve drug delivery to the TME. We have developed a PD-L1 peptide (pPL1) that has comparable immune checkpoint inhibition to full monoclonal antibody PD-L1. We believe conjugating pPL1 and MMP2 cleaved collagen IV targeting peptides with an internal MMP-2 cleavable sequence onto dendrimers will have targeted and sustained delivery to the cancer cells. We will perform signal separation and in vitro assays to measure our nanoparticles’ ability to target MMP-2 cleaved col-IV and to have immune checkpoint inhibition. The results from these experiments will detail how targeting specific collagen subtypes will affect drug delivery.

DATA-DRIVEN DESIGN OF A NOVEL POLYMER-CERAMIC COMPOSITE SOLID ELECTROLYTES
Juan Carlos Dorrejo Paulino, Jiamian Hu (Mentor)
Solid electrolyte is considered to be a promising candidate for lithium-ion batteries since it is safer than the conventional organic liquid electrolytes. Our main objective is using machine learning tools to accelerate the calculation of ionic conductivity of polymer-ceramic composite solid electrolyte with different microstructures. The plan is to train a CNN (convolutional neural network) with 1000 microstructure-property data points generated through phase-field simulations. We try to get a good CNN model that accurately predict ionic conductivity values for unknown microstructures with <15% relative error. The success of this research would mean a good tool to quickly design a safer solid electrolyte with high ionic conductivity.

SUPPLY CHAIN OPTIMIZATION OF BIOGAS PRETREATMENT PROCESS
Shay Doty, Yicheng Hu (Mentor)
With recent knowledge of the shortage of fossil fuels, sustainable resources are playing an increasingly important role in energy generation. Previous research has proved biowaste is suitable for producing electricity through a process called anaerobic digestion. Experiments have shown proper pretreatment can significantly increase this yield of biogas. To combat the shortage, we analyzed four different methods of producing electricity from biowaste: three treated with different chemicals before the process and one without. We conducted case studies by locating the farms for the biowaste, generators to produce the electricity, and our consumers. Using the website optimization tool, ADAM, we plan to determine which of the four pathways produces the greatest quantity of electricity in the cheapest way possible along with the most efficient transportation routes.
EFFECTS ON COORDINATION AND GROSS MOTOR MOVEMENT DEVELOPMENT IN INFANT Rhesus Macaques Prenatally Exposed to Zika Virus

John Drew, Karla Ausderau (Mentor)

Prenatal Zika virus (ZIKV) exposure causes about 10% of children to have Congenital Zika Syndrome (CZS), impacting muscle movements. Recent studies have found 30–40% of children born without CZS can have late onset developmental deficits. With rhesus macaques (Macaca mulatta) as non-human primate analogues, this study aims to analyze subtle and gross motor development by observing stride length in the control and ZIKV exposed groups. The gait and coordination of the infant monkeys was observed at 3 timepoints using CatWalk™ XT 10.6. It is hypothesized that infants exposed to Zika virus prenatally will have diminished coordination and a more difficult time managing gross motor movements due to developmental deficits. This study helps understand late onset deficits to children prenatally exposed to ZIKV using a controlled environment.

MOLECULAR AND GENETIC ANALYSIS ON NERVE AND SCHWANN CELL RENEWAL DURING ZEBRAFISH FIN REGENERATION

Sheila Duong, Junsu Kang (Mentor)

Schwann cells (SCs) are the primary glia cells found in the peripheral nervous system (PNS). They have several key roles within the PNS, but one particular role that is of medical and scientific interest is its role in promoting limb regeneration. It is well known in the scientific community that regeneration results from the interaction between substrates and receptor sites on cells signaling growth factors to promote cell proliferation, differentiation, and growth. However, it remains unclear whether SCs themselves are regenerative due to the lack of knowledge in their biology and dynamism. As a result, we will investigate this by generating a transgenic zebrafish line to visualize SC behavior. Further, we will conduct an in-situ hybridization experiment to elucidate its exact roles during fin regeneration.

HOW THE COVID-19 VACCINE IS BEING DISCUSSED ON SOCIAL MEDIA

Lucas Ebert, Bradley Kerr (Mentor)

Over 1.47 million deaths have been associated with COVID-19. About 49% of adults report hesitance about receiving the COVID-19 vaccine. Twitter conversations may contribute to misinformation and vaccine hesitancy but have received little research attention. This content analysis study’s purpose was to explore discussions of the COVID-19 vaccine on Twitter. The hash tags #COVIDVaccine, #COVID19Vaccine, #Antivax, and #Antivaxx were used to identify 160 relevant tweets. Tweets were evaluated to assess users’ background/role (e.g., healthcare worker, celebrity, etc.), position on COVID-19 vaccine and rationale, and position on vaccines in general. Descriptive statistics and Chi squared tests were used to assess differences in content across hash tags. Findings will inform physicians about COVID-19 misinformation on Twitter in order to provide better education to patients.

THE EFFECTS OF MINDFULNESS MEDITATION ON PREGNANT WOMEN

Rhys Enderle, Gudrun Bühnemann (Mentor)

Research suggests mindfulness meditation has the potential to be a cost-effective and non-pharmacological treatment for various physical and mental conditions. Whether or not mindfulness-based intervention groups improve the mental and physical well-being of women during pregnancy is still up for debate. Because meditation has the potential to help many women without access to affordable prenatal care, research around the subject should be a priority. Although current findings suggest mindfulness meditation may improve stress and anxiety in pregnant women, I argue the methodological flaws in the current pool of research combined with the lack of evidence for long-term improvements suggests doctors should refrain from prescribing mindfulness meditation as a prenatal care option until more research is done.
ENERGY POLICY IMPACTS ON RENEWABLE BIOENERGY MARKETS IN WISCONSIN
Evan Erickson, Victor Zavala (Mentor)

Renewable energy is critical to a sustainable economy, but steps must be taken to make sure it is fully utilized within the logistics of power grid systems. U.S. Federal Energy Regulatory Commission (FERC) Order 2222 works toward this goal by allowing renewable energy providers to compete on the open market instead of selling to nonrenewable intermediaries. Energy grids have been studied before by applying concepts from supply chains and graph theory. Using proof-of-concept models, as well as a model of the coordinated market for biogas recovery and energy production in the state of Wisconsin, we find that the policy does increase social welfare for an average U.S. household and the biogas market, and suggest further research into other policy measures for increasing renewable energy access.

ENHANCED FATTY ACID OXIDATION IN RETINAL PERICYTES DRIVES THEIR METABOLIC STRESS AND LOSS DURING DIABETES
Owen Erpelding, Nader Sheibani (Mentor)

Diabetic retinopathy (DR) is a major cause of vision impairment and is closely linked to diabetes. Loss of perivascular supporting cells/pericytes (PC) is recognized as an early event. Previous results showed that retinal PC, unlike endothelial cells (EC), exhibit enhanced sensitivity to the oxidative stress (OxS) in response to high glucose conditions. Since a major source of intracellular OxS is the mitochondria, we propose retinal PC utilize oxidative metabolism as their energetic source. Preliminary results indicate increased expression of Cpt1a, the major rate limiting enzyme in fatty acid metabolism, supporting a role for enhanced oxidative metabolism in retinal PC. Here we are testing the hypothesis that the inhibition of Cpt1a activity will protect PC from enhanced sensitivity to OxS, especially under high glucose conditions.

A NOVEL APPROACH TO IDENTIFY ENVIRONMENTAL DRIVERS OF DIVERSITY IN HUMAN GUT BACTERIAL COMMUNITIES
Sarah Ertmer, Ryan Clark (Mentor)

The human gut microbiome is a determinant of host health, and understanding factors influencing its diversity will lead to novel disease preventions and treatments. This complex system relies on the metabolism of its members and environmental substrates to perform important functions. Evidence suggests that bacterial diversity tends to enable necessary microbiome functions. Although it is understood that healthy individuals have diverse gut microbiota compared to unhealthy individuals, a generalizable scheme to enhance this diversity for biomanufacturing applications is elusive. Here, we aim to identify environmental components affecting community diversity by examining a model gut microbiome’s response to varied metabolic precursors. Overall, experimentally screening for optimal media composition and starting density of individual strains resulted in a generic method for establishing evenness in complex bacterial communities.

TRANSPORT OF MICROPLASTIC FIBERS IN WAVES: THE EFFECTS OF FIBER AND WAVE PROPERTIES
Gabby Every, Nimish Pujara (Mentor)

Microplastic fibers that are shed from clothing, fishing lines, and the breakdown of other plastic waste contaminate lakes and oceans. This contamination poses a threat as plastic debris can be ingested by small aquatic organisms and transferred across the food web causing harm to fisheries and humans. We study microplastic fiber transport by surface waves using mathematical models that apply slender body theory and linear wave theory. The numerical results show that the drift velocity decreases exponentially with fiber position in the water column and is bound by the Stokes drift for extremely small fibers. We will use these models and wave tank experiments to explore how increasing fiber length and initial position/orientation changes the transport and orientation patterns of fibers under different wave conditions.
DEVISING NEW STRATEGIES FOR DESIGNING PROTEINS BY DEEP MUTATIONAL SCANNING AND MACHINE LEARNING
Sarah Fahlberg, Philip Romero (Mentor)
Engineered proteins have proven useful in fields from medicine to industrial chemistry. Deep mutational scanning (DMS) is a high-throughput method for determining how a protein’s sequence influences its function, and machine learning (ML) can identify patterns between sequence and function. However, it is not well understood how these methods should be used to engineer novel proteins. We have devised a strategy for engineering proteins by extrapolating ML models trained on DMS data to find distant protein variants predicted to be highly functional. To test our strategy, we aim to engineer the B1 domain of protein G (GB1) for improved binding to IgG (Immunoglobulin G). We synthesize and experimentally test a number of designed GB1 variants to determine if they display improved binding.

THE VOICES HEARD SURVEY: CORRELATIONAL DIFFERENCES AMONG BLACK AND WHITE RESPONDENTS
Mia Farias, Jennifer Dykema (Mentor)
Medical research literacy (MRL) is a measure of one’s ability to understand aspects related to informed consent and participation in medical research studies. Quality of data measured from the survey process may vary depending on an individual’s level of MRL. The Voices Heard Survey can be used to uncover important variables associated with an individual’s MRL score. I examined how MRL varies by respondents’ demographics, level of trust in medical researchers, and expressed likelihood of participating in a medical research study. Analysis of these factors associated with MRL could give insight to the underlying differences that researchers could use to improve how they recruit their samples for studies.

GALECTIN-3 PROMOTES MESENCHYMAL STEM CELL SURVIVAL UNDER ISCHEMIA AND ALTERS GENE EXPRESSION
Matthew Fischer, Uma Wesley, PhD (Mentor)
Focal ischemic stroke is the leading cause of functional disability and death worldwide. When stroke occurs and neurons begin to die, they release many growth factors and cytokines in an attempt to regenerate and restore damaged neurons. Galectin-3 (Gal-3) is a pro-angiogenic cytokine released during this process. Gal-3 is associated with angiogenesis, neurogenesis, and cell migration. Mesenchymal stem cells (MSCs) are gaining interest in cell therapy for stroke repair. In this study, we subjected rat MSCs to oxygen glucose deprivation (OGD) to create an ischemic environment. We show that Gal-3 treatment increased MSC survival under in-vitro ischemia (OGD) in association with decreased levels of caspase-3, a pro-apoptotic molecule. Furthermore, our results show that Gal-3 is associated with alterations in angiogenesis-related genes including Igf1 and Egf.

PSYCHOLOGICAL AND PHYSICAL FUNCTION IN HEMATOPOIETIC CELL TRANSPLANT SURVIVORS WITH CHRONIC GRAFT-VERSUS-HOST DISEASE
Mikayla Foster, Erin Costanzo (Mentor)
Chronic graft-versus-host disease (cGVHD) is a complication of hematopoietic cell transplantation (HCT). While clinical manifestations are well characterized, little is known about the impact on psychological and physical function. HCT patients who did and did not develop cGVHD (N=251) were compared on measures of psychological function (depression and anxiety) and physical function (fatigue, pain, and sleep disturbance), at 6 months and 1 and 3 years post-HCT using t-tests. Those with cGVHD reported greater fatigue at 6 months and 3 years, greater pain at 1 and 3 years, and shorter and more disturbed sleep at 6 months and 3 years post-HCT (all p values <.05). There were few differences in psychological measures, suggesting relatively resilient psychological function.
**MIDWEST PRESCRIBED FIRE MANAGEMENT**
Michael Fritz, Christy Lowney (Mentor)

The ecological process of natural wildland fires has been hindered due to habitat fragmentation since European settlement. Many fire-dependent ecosystems are experiencing changes in the amount of burning. The goals of this prescribed fire research project are to work with land managers throughout Wisconsin to determine whether management objectives are being met, and track the effectiveness of prescribed burns at preserving and restoring fire-dependent ecosystems. Land management objectives include invasive species control, reducing dead fuel, and supporting growth of native vegetation, while measuring burn characteristics such as temperature, fuel loading, and fire behavior, to determine the extent that the burn is meeting said objectives. Findings inform land managers about outcomes of the practices they use, and their impact on ecosystems.

**ADENO-ASSOCIATED VIRAL GENE DELIVERY OF WILD-TYPE HUMAN TAU INDUCES PROGRESSIVE NEURODEGENERATION AND FORMATION OF INSOLUBLE TAU SPECIES IN THE HIPPOCAMPUS OF MIDDLE-AGED RATS**
Graham Gabrielson, Corinna Burger (Mentor)

Tauopathies, including Alzheimer’s disease, are a class of neurodegenerative disorders characterized by abnormal phosphorylation and aggregation of the microtubule associated protein tau. To address challenges with transgenic tau models, we used adeno-associated viral gene delivery of human tau in the hippocampus of middle-aged rats as a model that better reproduces tau pathology observed in human tauopathies. Using behavioral, western blot, and immunohistochemical analyses we have observed progressive neurodegeneration in CA1 and CA2 from 2-12 weeks post injection. Degeneration is accompanied by an increase in total tau; tau hyperphosphorylation and aggregation. We see degeneration without significant abnormalities in behavioral assays including MWM, NOR, and fear conditioning. Further plans include a 16 week cohort for followup on behavior in addition to investigating intrinsic and extrinsic apoptotic mechanisms.

**THE RELATIONSHIP BETWEEN CAREGIVER BURDEN AND COMMUNICATION: A SYSTEMATIC REVIEW**
Marissa Gall, Kimberly Mueller (Mentor)

Aims: The purpose of this systematic review was to evaluate the evidence-based relationship between caregiver burden and communication. Methods: A systematic review of databases, including PubMed, CINAHL, PsycINFO, and Scopus were conducted. One thousand and one articles met the search terms and after two rounds of exclusionary evaluation, twenty-eight articles met the inclusionary criteria. Results: After analyzing the twenty-eight articles included in this review, fourteen studies were intervention studies and fourteen studies were observational. Both communication and caregiver burden outcomes were heterogenous among the studies. Conclusion: Relationships between communication and caregiver burden were examined from multiple angles. This project will outline these relationships and recommend areas of need for future research.

**SURVEILLANCE THROUGH TECHNOLOGY: UNDERSTANDING UNDERREPRESENTED STUDENTS’ EXPERIENCES WITH SURVEILLANCE TECHNOLOGIES DURING THE COVID-19 PANDEMIC.**
Sofia Garcia Garbuno, Kathryn Moeller (Mentor)

This project examines the different ways in which students are monitored or surveilled through technology and software while completing schoolwork, in school and/or during extracurricular activities during the COVID-19 pandemic. The data collection will consist of semi-structured interviews with recent graduates to understand their experiences with surveillance technologies and to compare their experiences across different identities.
DISCUSSION OF HALLUCINOGENS (LSD, PSILOCYBIN, PEYOTE, DMT, AND AYAHUASCA) ON TIKTOK
Amrutha Garimella, Bradley Kerr (Mentor)

About 2.9 million individuals aged 12–25 used hallucinogens in 2019. Hallucinogens are associated with acute and long-term psychological harm. Little is known about how social media promotes hallucinogen use on the youth-dominated site TikTok. This study explored the content and engagement of hallucinogen-related videos on TikTok. In this content analysis, the most popular hashtag was determined for each of the five types of hallucinogens. The first 20 TikTok videos located within each hashtag were evaluated for video type (e.g., humor), engagement (e.g., number of comments and likes), and attitude towards hallucinogens. Descriptive statistics were calculated. T-tests and ANOVAs assessed differences in engagement across hashtags and video types. Findings will inform prevention efforts focused on influences surrounding adolescent and young adult hallucinogen consumption.

UW–MADISON’S LANGUAGES: AN INITIATIVE TO RAISE AWARENESS OF THE VALUE OF MULTILINGUALISM AND OF LANGUAGES AS A KEY ASPECT OF DIVERSITY
Maria Gleason, Kristin Dalby (Mentor)

UW–Madison’s Languages is an initiative to raise awareness of the value of multilingualism, of the many languages spoken/used by the UW–Madison community, and of language as a key aspect of diversity. Language is included in the University’s working definition of diversity; however, languages are often left out of discussions pertaining to diversity, and multilingualism is not always valued. The campaignOur Campus, Our Languageswill be launched to spread awareness of the value of our multilingual campus. Through interviews, the campaign highlights the value of language by sharing perspectives and stories of diverse campus community members. I contributed to the development of interview questions, conducted interviews, edited them for brevity and clarity, and helped create interview profiles to be published on the campaign’s website.

INTERACTIONS BETWEEN LPP MEASURES OF EMOTIONAL RESPONSES AND AGING
Viktorria Glissendorf, Anna Finley (Mentor)

Theories of emotion and aging suggest that younger adults allocate more attention to negative stimuli, whereas older adults attend relatively more to positive stimuli, due to age-related changes in motivation and goals. We examined a subset of the Midlife in the U.S. (MIDU.S. II) study, in which electroencephalography (EEG) was recorded as participants (n = 331, aged 36-84) viewed positive, negative, and neutral pictures. We measured an EEG waveform sensitive to attention and emotional information, known as the late positive potential (LPP), to examine how the brain responds across adulthood when an emotional picture is on the screen and how this persists after picture offset. Based on previous findings and theories, we expect older adults will show bigger LPPs to positive compared to negative images.

PEA APHID (ACYRTHOSIPHON PISUM) STRESS-ALARM PHEROMONE INDUCES WING PRODUCTION
Lauren Godfrey, Anthony Ives (Mentor)

Induced defenses are mechanisms expressed by species that are advantageous to survival. I investigated the possibility that pea aphids (Acyrthosiphon pisum) have an induced defense mechanism against predators. When pea aphids are in the presence of predators, they produce offspring that have wings (alates). When stressed, aphids produce a pheromone that can induce winged offspring in surrounding pea aphids. My experiment tested whether stresses caused by predators will elicit the alarm pheromone and induce production of alates. Understanding the mechanisms of induced defenses will allow for a better understanding of the costs and benefits of alate production for pea aphids, and possibly other insect species as well.
A ROBUST, HIGH RESOLUTION TECHNIQUE FOR RECORDING OF IMPACT BRAIN SENSORS VIA NV DIAMOND MAGNETOMETRY

Yash Gokhale, Tsani Rogers, Aviad Hai (Mentor)

Implantable active coil based transducers (ImpACTs) are wireless microelectronic devices integrated with non-invasive modalities, such as MRI, for precision imaging of electromagnetic fields in the brain. A relatively new modality, nitrogen vacancy (NV) magnetometry, can optically detect sub-nT magnetic fields and opens the opportunity for rapid validation of next-generation ImpACT devices. To validate devices, a thin layer of NV implanted particles was plated between two slides adjacent to the ImpACT sensor and excited by a 532nm laser and 2.87GHz microwave to observe local changes in magnetic fields. This enabled nanoscale characterization of device sensitivity to neuronal fields via fluorescence measurements. Novel image analysis and pulse sequences revealed electromagnetic characteristics of devices during sensing without a need for special conditions or expensive equipment.

WHITE MATTER MICROSTRUCTURE IN THE ONE-MONTH HUMAN BRAIN AS A PREDICTOR OF BEHAVIORAL OUTCOMES AT 24 MONTHS OF AGE

Patrik Goncalves Rodrigues, Douglas C. Dean III (Mentor)

The development of the white matter (WM) microstructure serves as a foundation for complex neural connections, while deviations in WM maturation may have a significant impact on future behaviors. Quantitative magnetic resonance imaging (MRI) techniques sensitive to WM microstructure were utilized to investigate the relationship between WM development and measures of emotions at an early stage of neurodevelopment. Typically developing one-month infants underwent MRI during non-sedated sleep. At 24 months, measures of behaviors were acquired through the Toddler Behavior Assessment Questionnaire. Results highlight significant correlations between one-month WM tracts and behavioral outcomes at 24 months. These findings suggest that the one-month human brain may already be sufficiently developed to predict future behaviors.

PARENT'S PERCEPTIONS OF THEIR ABILITY TO CARE FOR THEIR CHILD NEWLY DIAGNOSED WITH CANCER EPTIONS

Zoe Gormley, Kitty Montgomery (Mentor)

Parents of children newly diagnosed with cancer often feel uncertain in their ability to care for their child at home following initial hospital discharge. Cancer specific discharge education is not standardized across institutions, leading to significant variability in the quality of education parents receive following their child’s diagnosis. A quantitative descriptive longitudinal design was employed for this study to describe parents’ perceptions of their ability to care for their child newly diagnosed with cancer during the first two months after initial hospitalization. Surveys were administered to collect information on parents’ perceptions of their ability to care for their child newly diagnosed with cancer after initial hospitalization and monthly for two months.

EFFECTS OF MICROBIAL EXPOSURE ON LARYNGEAL MUCOSAL BARRIER INTEGRITY

Madhu Gowda, Susan Thibeault (Mentor)

Maintenance of epithelial and mucosal barrier integrity is an important component of the body’s first-level innate immune response to prevent antigen exposure and access to deeper mucosa. As a crossroads between the gastrointestinal and respiratory systems, the laryngeal mucosa forms an intersecting barrier between the host organism and external environment which is often exposed to inhaled or ingested microbial challenges. The purpose of this experiment is to utilize a physiologically relevant three-dimensional vocal fold (VF) induced pluripotent stem cell mucosal model, previously developed in the Thibeault lab, to elucidate the effects of a commensal and pathogenic bacterium on VF mucosal integrity and function. This will provide insight to mechanisms of pathogenic infection and inflammation in laryngeal disease allowing for future investigation with directed therapeutics.
COOKIES AND COGNITION  
Samantha Greco, Max Rivkin, Joe Austerweil (Mentor)  

Longstanding research describes memory impairment as one of the earliest cognitive symptoms of Alzheimer’s Disease (AD); however, diagnosing AD from this symptom remains expensive and only somewhat effective. This study aims to explore whether novel behavioral tasks, the “grocery fluency” and “event recognition” tasks, can effectively serve as early diagnostic tests for AD. Both longitudinally assessed, the grocery fluency task observes participants’ recollection of recently purchased grocery items, whereas the event recognition task analyzes participants’ descriptions of recently-watched video clips. Participants’ episodic memory is tested for impairment using these data; comparative analyses of the diagnosticity of these tasks versus existing clinical tests may yield an affordable means of both predicting and diagnosing AD-related cognitive impairment.

THE PREVALENCE OF BODY IMAGE AND DISORDERED EATING AMONG STUDENTS AT THE UNIVERSITY OF WISCONSIN–MADISON  
Alexa Guelig, Hanna Jens, Julianna Brandt, Madison Mueller, Theresa Duello (Mentor)  

Studies indicate disordered eating and body image issues are prevalent among college students. This study was undertaken to assess the prevalence of the body image dissatisfaction related to disordered eating patterns for undergraduate and graduate students attending the University of Wisconsin–Madison. A survey was compiled that combined questions from King’s College Body Image Questionnaire of Veale et al. and the Weight-Related Abuse Questionnaire of Salwen and Horowitz to quantify the prevalence of specific body image and disordered eating issues. It was distributed by email to 36,519 undergraduate and graduate students three times and responses were collected anonymously through Qualtrics. Findings will be analyzed and shared with Associated Students of Madison to assess campus services.

A NONIONIC, PHOTOCLEAVABLE SURFACTANT FOR MS ANALYSIS OF INTACT MEMBRANE PROTEOFORMS  
Morgan Gugger, Ying Ge (Mentor)  

Membrane proteins comprise the majority of therapeutic targets due to their high involvement in intracellular signaling pathways and accessible location, thus developing effective therapeutics requires extensive knowledge of their structure and sequence. Intact protein sequencing using mass spectrometry is a powerful tool that can help elucidate these aspects; however, about one percent of known protein structures belong to this protein class, owing to their hydrophobicity and instability in aqueous media. Surfactants, or amphiphilic molecules, are regularly utilized to address these issues, yet several commercially available surfactants are incompatible with mass spectrometry and pose additional challenges. Hence, we have developed and characterized a novel class of energetically labile surfactants that are compatible with top-down mass spectrometry and show prospects for intact membrane protein analysis and purification.

REGULATION OF THE SHIKIMATE PATHWAY AMONG PLANT SPECIES  
Anika Gupta, Hiroshi Maeda (Mentor)  

The shikimate pathway is a metabolic pathway in plants and microorganisms that produces aromatic amino acids, which are precursors of high-value natural products. The first enzyme in this pathway, 3-deoxy-D-arabino-heptulosonate 7-phosphate synthase (DHS), has been studied in microorganisms and the model plant Arabidopsis thaliana. Arabidopsis DHS2 (AtDHS2) is feedback inhibited by AAAs to limit shikimate pathway activity, and a mutation of the AtDHS2 gene deregulates this inhibition, allowing mutant plants to enhance the production of pathway-derived chemicals. However, it remains unclear whether DHS2 inhibition by AAAs is evolutionarily conserved and if the mutation functions in other plant species. This research investigates how DHS inhibition has evolved in related plants, such as cucumber (Cucumis sativus) and if the analogous mutation increases AAA production in important crops.
Isolated human pancreatic islets can be used in research to study islet function and clinically to treat diabetes. In this study, islets were cultured for 0, 2, and 7 days in suspension or in decellularized human pancreatic ECM hydrogel (hP-HG). Islets were fixed and stained for different hormones and ECM proteins. We observed changes in the arrangement of the endocrine (alpha, glucagon-secreting) (beta, insulin-secreting) (delta, somatostatin-secreting) cells and the supportive cells (endothelial cells, smooth muscle cells, fibroblasts), as well as the deposited ECM of the isolated islets. The rearrangement of cells in the islets after isolation from the pancreas may alter both the supportive microenvironment of the tissue, as well as disrupt the gap junction connections between the endocrine cells, and hinder islet function.

The formation of sexually dimorphic reproductive tracts from a common primitive tissue requires the correct establishment of a sex-specific vascular network for supporting male and female reproductive functions. However, how the sexually dimorphic vascular networks are established in the reproductive tract remains unknown. Here, I leverage online databases, including single-cell expression datasets of mouse embryos undergoing organogenesis and a molecular atlas and anatomy of gene expression for the developing urogenital organ, to identify candidate genes that are specifically expressed in blood vessels in the male reproductive tract. My work provides a list of biologically relevant candidates for future functional studies, providing entry points for understanding the molecular mechanism underlying the sex-specific establishment of vascular networks in the reproductive tract.

The goal of this research is to understand damage of polycrystalline metals. Research explores why pores form at the boundaries between crystals when they are deformed in tension. This work will contribute to the creation of a mathematical model of what affects the stress at the grain boundaries of these metal crystals and thus understand and predict damage at these grain boundaries. Method includes a plate impact experiment where a metal disk is launched at a stationary metal disk to observe the porosity field in refractory metals such as tantalum. The audience will learn ways we arrange the data for analysis of large datasets. They should care because organizing data efficiently is applicable to any field and distilling understanding from large datasets remains a challenge.

The purpose of our project is to create an easy to use, comprehensive program to visualize the transfer of nuclear materials from origin to destination. We want to create something that the UN tasked with preventing the spread of nuclear weapons, the International Atomic Energy Agency can use easily, bringing more transparency to the nuclear energy and materials sector. Our research is important for identifying potential diversions away from peaceful uses of nuclear energy, based on transfer of nuclear materials essential to their construction. We are using Python to create our program, as it is the most widespread and easy to use coding language. The visualization tool will be flexible to model generic countries and representations of real-world facilities for nuclear energy systems worldwide.
CHARACTERIZATION OF METABOLIC CHANGES OF ACTIVATED NEUTROPHILS TO ESTABLISH OPTICAL METABOLIC IMAGING AS A NEUTROPHIL ACTIVATION IDENTIFIER

Stephen Halada, Melissa Skala (Mentor)

Neutrophils are abundant cells of the immune system responsible for responding to infections and cell injury. While the functionality of activated neutrophils relies on energetic compounds, the metabolic landscape of activated neutrophils is only just beginning to be studied. Additionally, there is clinical need for a reliable, efficient, and non-interfering way to monitor longitudinal neutrophil activation within small cellular samples. Optical metabolic imaging (OMI) utilizes the endogenous fluorophores of the metabolic cofactors nicotinamide adenine dinucleotide (NAD(P)H) and flavine adenine dinucleotide (FAD) to monitor cellular metabolism in a nondestructive manner. Using OMI, we investigate the metabolic changes in neutrophils during activation with a variety of chemical activators, and we hope to provide evidence for OMI as a tool for detecting activated neutrophil populations.

THE ROLE OF THE INTEGRATED STRESS RESPONSE PATHWAY ON AMINO ACID REGULATION DURING MURINE LACTATION

Steven Halderson, Sebastian I Arriola Apelo (Mentor)

Essential amino acids (EAA) are the substrate for milk protein synthesis in the mammary gland. However, some amino acids play a supplementary role by signaling on cellular pathways that regulate lactation. The integrated stress response pathway, through GCN2, senses unacetylated tRNAs and correspondingly inhibits protein translation initiation. We hypothesize that a GCN2 depleted mouse would not respond to protein restriction. In this experiment, we used a genetic model in which GCN2 is deleted in mammary epithelial cells during lactation. We then restricted dietary protein in both wild type and GCN2 KO dams. We aim to determine the extent that GCN2 has on lactation.

CHARACTERIZATION OF MUTATIONS RESPONSIBLE FOR SUPPRESSION OF METABOLIC RESPONSE TO REDUCED TYROSINE PRODUCTION IN ARABIDOPSIS

Andrew Hall, Hiroshi Maeda (Mentor)

Aromatic amino acids, including tyrosine, are vital compounds synthesized in planta utilizing complex biosynthetic pathways. Imbalances of tyrosine resulting either from natural occurrences or targeted human interference provokes plants to modulate metabolism in order to maintain homeostasis. This is exemplified in the knockout mutant of the TyrA2 (tyrosine biosynthetic) enzyme in Arabidopsis thaliana, which results in severe slow growth and reticulation of the leaves to accommodate reduced tyrosine availability. The mechanistic intricacies of this phenotypic modulation remain poorly understood. This study focused on investigating and characterizing mutations in the Arabidopsis gene At2g24100 (Asg1) which are hypothesized to elicit suppression of endogenous homeostatic response mechanisms in tyra2 knockout plants.

THE MECHANISMS OF ACTION OF INHALATIONAL ANESTHETIC AGENTS

Josh Hall, Richard Lennertz (Mentor)

Anesthesia is a medically induced state of unawareness categorized by immobilization, unconsciousness, learning and memory impairment, and sedation. One way anesthetics act on the body is through GABA receptors. Using mice with loss-of-function mutations in their GABA receptor subunits, we can study how GABA receptor subunits contribute to the action of inhalational anesthetic agent isoflurane. To understand the role of GABA receptor subunits, the mice in the study are tested to see if, and when, the threshold to enter a state of unconsciousness is reached. Thus far in the research, there have been no changes in this threshold for the state of anesthesia when induced with isoflurane. Future research will expand to envelope assessments of sedation and the anesthetic agents' effect on pain in mice.
**PROSOCIAL BEHAVIOR ACROSS THE MENSTRUAL CYCLE AND ITS RELATIONSHIP WITH SOCIAL DOMINANCE IN FEMALE RHEUS MACAQUES**

Emma Hammond, David Abbott (Mentor)

Prosocial behavior, which refers to behavior intended to benefit another, promotes bond formation and benefits group survival in social species. Spontaneous prosocial behavior such as grooming has been observed in rhesus macaques, non-cooperative breeders, suggesting an evolutionary role for prosocial behavior beyond breeding. Estradiol (E2) influences prosocial behavior. Social subordination in rhesus macaques impairs the anxiolytic effects of E2, thus subordinate rhesus macaques are less likely to engage in prosocial behavior. I propose that female rhesus macaques will be more likely to engage in prosocial behavior during their late follicular phase than luteal phase, and that dominant females will engage in more prosocial behavior than subordinate females.

**FUNCTION AND LOCALIZATION OF SCD2 HOMOLOGS IN ARABIDOPSIS THALIANA**

Fang Hao, Sebastian Bednarek (Mentor)

The proteins stomatal cytokinesis defective, SCD1 and SCD2, are required for cell division and plant growth in *Arabidopsis*. Recent studies showed SCD1 and SCD2 form a complex regulating membrane trafficking necessary for cytokinesis and cell expansion. Homozygous loss-of-function scd2-1 mutants display developmental defects which are rescued by expression of a SCD2 transgene driven by its native promoter. The *Arabidopsis* genome contains two additional genes encoding SCD2-related proteins, SCD2b and SCD2c which previous studies have shown to associate with SCD complex. However, it is unknown if SCD2 homologs can substitute for SCD2 function. I will test whether expression of SCD2 homologs transgene can rescue scd2-1 mutants. Tissue and subcellular localizations of SCD2 homologs, and how their localizations are impacted by loss of SCD2 will be determined.

**A SOCIOLOGICAL APPROACH TO CLINICAL RESEARCH PARTICIPATION**

Kiley Harju, Jennifer Dykema (Mentor)

In 2014, the UW Survey Center administered telephone-based Voices Heard Survey to 410 respondents. The survey asked about factors that could influence a person's likelihood to participate in medical research. Specifically, through analysis, I examine whether expressed likelihood to participate in a clinical trial is associated with several other self-reported health measures. One measure in particular is whether or not the participant or their family member has a chronic illness. I examine if there is a significant association with their likelihood to participate in a clinical trial. Understanding these associations could be used by medical researchers to help recruit people in medical research studies. More participation in medical research can only benefit the outcome of the studies.

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

Grace Haugstad, Lisa Arendt (Mentor)

Obesity, a risk factor for development of breast cancer as well as worsened prognosis, is rising in prevalence in the United States. Obesity causes a state of chronic inflammation in adipose tissue, demonstrated by an increase in the number of crown-like structures formed by recruited macrophages, as well as inflammation-associated fibrosis demonstrated by collagen deposition. Inflammation and fibrosis are both factors that can increase risk of breast tumor formation, as well as aggressiveness. Using a diet-induced obesity mouse model, we quantified macrophage recruitment and collagen deposition in the mammary tissue. Crown-like structures as well as collagen deposition around mammary ducts are both significantly increased in the obese mouse mammary tissue, modeling what is observed in obese patients.
DARK MATTER IN OUR BACKYARD
Ben Havlicek, Aaron Bailey, Alex Pigarelli, Patrick Selep, Maicen Stuart, Jordan Sischo, Snezana Stanimirovic (Mentor)

Using the UW Small Radio Telescope (SRT), we measure the Milky Way rotation curve by observing hydrogen clouds in the disk of the Milky Way. We measure the 21-cm atomic hydrogen (HI) emission line in 3 degree longitudinal intervals (23 < l < 68). In our data reduction, we calibrate HI spectra and convert frequency into radial velocity, to extract orbital velocity information corresponding to a subset of HI clouds. Our rotation curve agrees with similar studies that used more robust techniques and equipment. Our observed velocity curve in the outer region of the Galactic plane does not agree with the density of visible matter observed. The balance of mass we can’t see implies the existence of dark matter.

STRANGE PARADOX: SENTIMENTAL REFORM AND THE COMMERCIAL GAZE
Veronica Hayes, Kristina Huang (Mentor)

During the 18th century, the culture of sentiment and the movement of abolition merged to create a new subculture of sentimental reform. These groups were made up of White, bourgeois women who could participate in the culture of sentimental literature from within the feminized private sphere. Eliding the male and the colonial gaze, proponents imagined that feminine-centric abolition could effectively divest from the commercial gaze. This presentation will explore the ways that Mary Prince’s *The History of Mary Prince*, exposes the practical limitations of this political project. Drawing on tropes from sentimental literature, Prince challenges binaristic readings of the colonial and male gaze, underscoring the continuity between sentimentalism and colonial commercialism. In doing so, Prince emphasizes the necessity of reading reform literature through contradiction.

VORTEX SHEDDING PATTERNS FOR SEAL WHISKER-INSPIRED GEOMETRIES
Kirby Heck, Jennifer Franck (Mentor)

Harbor seals have an extraordinary ability to track their prey in murky waters. Prior research asserts the importance of physical undulations along the seal’s whiskers to suppress vortex-induced-vibration and improve the signal-to-noise ratio of disturbances in fluid flow. This research studies the vortex shedding patterns in seal whisker-inspired geometries through direct numerical simulation. Visualizing the wake behind the whisker geometry shows unique patterns of vortex shedding that arise from modifications to the nominal whisker geometry. The formation of alternating, adjacent, three-dimensional vortices behind the nominal whisker geometry contrasts the familiar, two-dimensional tandem vortices shed by smooth cylinders and some modified whisker surfaces. Mimicking the flow characteristics around whisker-inspired geometries may lead to improved sensors, sturdier turbine piles, and other applications utilizing vibration and drag reduction.

BELOIT EARLY CHILDHOOD LITERACY BOOKMOBILE PROJECT
Gloria Heiss, Christopher Dakes (Mentor)

In the span of fifteen weeks, May 17–August 23, I along with my community partner, the Beloit Literacy for Life Initiative (BLFLI), and a summer intern will help under-resourced children enjoy reading and get access to new books in Beloit. Our target is to give 2,000+ books away at events sponsored by organizations throughout the summer to reach seven hundred kids ages 4–10 years old. On the surface, Beloit is one of the most underperforming school districts in Wisconsin with a wide achievement gap accompanying its low performance in reading, language arts, and math. It's proven that early childhood reading and academic success are intrinsically linked. I know that Beloit is more than a report card score and I want to show that in this project.
RELATIONSHIP BETWEEN APOE GENOTYPE AND THE CEREBROVASCULAR RESPONSE TO COGNITIVE STIMULI IN MIDDLE-AGED ADULTS

Gissel Hernandez Zepeda, Jill Barnes (Mentor)

The cerebrovascular response to a cognitive challenge is associated with cognition. Specifically, an impaired cerebrovascular response may predict cognitive decline and future risk of Alzheimer’s disease (AD). Additionally, apolipoprotein E4 (APOE4) is a genetic risk factor for developing AD. This study aimed to investigate the impact of APOE4 genotype on the cerebrovascular response to cognitive challenges. Middle-aged adults (age 55–69 years) with and without a copy of the APOE4 gene completed the n-back working memory and Stroop color and word tests while middle cerebral artery velocity (MCAv) and mean arterial pressure (MAP) were continuously measured. We hypothesized that participants with the APOE4 gene would demonstrate an impaired cerebrovascular response to cognitive stimuli presenting as irregular changes in MCAv and MAP compared to participants without the gene.

SELECTIVE AGGRESSION ACROSS MAMMALS: A REVIEW OF BASIC BEHAVIOR, NEUROBIOLOGY, AND TRANSLATION IMPLICATIONS.

Zach Herro, Catherine Marler (Mentor)

Selective aggression, aggression directed towards particular members of a species but not others, functions to preserve the pair bond in monogamous mammals. Aggression towards individuals outside of the bond supports territory and resource defense, while at the same time maintains the fidelity of bonded individuals. While crucial to the pair bond, a broad review across monogamous mammals has never been conducted. In this review, we highlight selective aggression across a wide range of mammals from primates to prairie voles. We also consider the neurobiological underpinnings of this aggression, as well as translational implications for human mental health. In doing so, we seek to understand aspects of selective aggression that have been less studied and synthesize them into a more comprehensive overview of the topic.

UPDATING THE PRIMATE INFORMATION NETWORK

Natalie Hintz, Anusha Ray Dey, Sophia Finn, Kevin Teye-Yalley, Milo Agosto, Graham Banes (Mentor)

Forests are being destroyed, primate populations are decreasing, and no one is talking about it. As an effort to get more information out about primates to raise awareness, the UW Primate Center, developed a collective database containing primate information called the Primate Information Network (PIN). Five undergraduate students were tasked with evaluating and updating the current website factsheets. Students turned to derived/compiled data as their research methodology as they used scholarly articles, journals, and studies to find pre existing data from numerous sources to create new data that could be used to update the outdated factsheets. Through PIN, individuals of all backgrounds can inform themselves and then others about the ways in which people can help save primates from extinction.

IMPROVEMENTS FOR LANGMUIR PROBE IV-CURVE-FITTING PROTOCOL

Drue Hood-McFadden, Cary Forest (Mentor)

Plasma parameters in the Big Red Ball are measured with multi-tip Langmuir probes. These sixteen tip probes measure the current drawn from the plasma for given bias voltages. Each tip results in a data point and this information is fed into a curve-fitting Python code to generate an IV-curve. This IV-curve can be used to estimate electron density, plasma potential, and electron temperature. Not all data points are equally valid. Outliers from noise or arcing skew the data causing overestimation of electron temperature by broadening the IV-curve. This project seeks to address this issue by embedding into the curve-fitting code methods to discriminate outlier data from the curve-fitting procedures. The theory, methods, and progress will be presented.
UNDERSTANDING STING-DEPENDENT TYPE I IFN PRODUCTION IN CALCIUM-DEPENDENT ER STRESS
Tiancheng Hu, Judith Smith (Mentor)

Interferons (IFN) are important signaling proteins within the innate immune system. Although IFNs are traditionally thought of as a response to viral infection, ER stress through SERCA pump inhibition has been shown to increase type one IFN production. While this effect has been observed, the exact mechanism still remains unclear. Here we show that inhibition of the SERCA pump, through ER stress agent thapsigargin, causes the release of double stranded DNA from the mitochondria. This DNA is then recognized by the pattern recognition receptor cyclic GMP-AMP synthase (cGAS) and ultimately leads to activation of Stimulator of Interferon Genes (STING). STING then phosphorylates transcription factors that promote type one interferon production.

DEFINING THE ROLE OF GAGA FACTOR IN FORMING SUB-NUCLEAR CHROMATIN DOMAINS
Hao-Yu Steven Huang, Melissa Harrison (Mentor)

During embryonic development, two specified germ cells need to be reprogrammed to generate totipotent cells. These cells divide and eventually give rise to all cell types necessary for an adult organism. Transcription factors, proteins that bind DNA, drive transcriptional programs that determine cellular identity. However, the mechanisms by which reprogramming transcription factors initiate a global shift in gene expression during development remain uncharacterized. Studies have demonstrated that the GAGA factor (GAF) regulates gene expression in the Drosophila embryo during periods of dramatic reprogramming. GAF may not only regulate gene expression at the local chromatin level but also facilitates the formation of global three-dimensional chromatin architecture through localization to sub-nuclear foci. The primary investigation is to determine what regions of GAF are required for sub-nuclear localization.

ELEVATED MICROTUBULE-ASSOCIATED PROTEIN 1B LEVELS IN HUMAN PLURIPOTENT STEM CELL-DERIVED NEURONS IMPAIR NEURONAL DEVELOPMENT
Sabrina Huang, Xinyu Zhao (Mentor)

Fragile X Syndrome (FXS) is a genetic disorder that causes intellectual disability due to a loss of fragile X mental retardation protein (FMRP). The absence of FMRP results in overexpression of microtubule-associated protein 1B (MAP1B), a protein vital for the development and function of the nervous system. Our lab found that MAP1B overexpression resulted in reduced dendritic complexity in mouse primary neurons. Therefore, we sought to investigate whether pathologically upregulating levels of MAP1B in human embryonic stem cell (hESC)-derived neurons using the dCas9 activation method similarly impacts neuronal development. Our findings indicate that MAP1B overexpression correlates with decreased dendritic complexity. Additionally, dendritic complexity deficits in patient-induced pluripotent stem cell (iPSC)-derived neurons with elevated MAP1B levels can be partly rescued by knockdown of MAP1B.

INTRODUCTION INTO ALGEBRAIC NUMBER THEORY
Kai Huang, Peter Bryant, Ananth Shankar (Mentor)

Working closely with a mentor who is currently conducting research in the topics of arithmetic geometry and number theory, this project served as an independent learning experience offering two undergraduates the opportunity to develop the algebraic background to take on an analytical research problem. The initial months of the project saw us developing the necessary prerequisite language to define commutative algebras, a tool that is essential for our further progress into more advanced topics in algebraic number theory. Research in this area most obviously impacts the field of discrete mathematics, where solutions to one problem are often generalized to be applicable to a wider class of problems.
HYPOTHALAMIC ESR1 GENE KNOCKDOWN INDUCES WEIGHT GAIN IN ADULT FEMALE Rhesus Macaques
Siti Hydara, David Abbott (Mentor)
Declining serum estradiol (E2) levels during menopause are associated with a heightened risk for metabolic disease. Estrogenic effects on female rodent metabolism are primarily mediated by estrogen receptor alpha (ESR1) activation within the mediobasal hypothalamus (MBH). The role of MBH ESR1 in regulating metabolic function in female primates, however, remains unclear. We, therefore, employed RNAi technology to assess ESR1 gene knockdown in the MBH of the adult, ovary intact female rhesus macaques. We hypothesized the ESR1 knockdown would lead to weight gain and increased fat mass, characterized by fewer, albeit larger, inflamed adipocytes compared to the control.

THE IMPACT OF COVID-19 ON FAMILY DYNAMICS
Natalia Iding, Simran Gandhi, Janean Dilworth-Bart (Mentor)
Factors such as stress, beliefs, puberty and everyday conflicts can impact parent-child relationships (Bradford et al., 2007). Conflicts like a global pandemic could play a crucial role in the mental health of both adults and their children. For example, anxiety symptoms have tripled and depression symptoms quadrupled (Wallis, 2020) during the COVID-19 pandemic. We want to investigate the relationship between COVID-19 and family dynamics, specifically young adults and their parents. We aim to do this by distributing a survey to young adults, ages 18–22, that assesses their overall relationship with their parents during COVID-19. Questionnaires included Likert scales, multiple choice, and short answers. We predict that there will be a significant negative correlation between young adult and parent relationships.

THE EFFECTS OF THE DISCRIMINATOR ON TRANSCRIPTION INITIATION IN E. COLI
Takahiro Ishikuri, Tom Record (Mentor)
Transcription initiation is the first step of synthesizing RNA from DNA which is essential to gene expression in all life. The discriminator region of bacterial promoter DNA, located between the transcription start site and -10 element, has been recently shown to dramatically affect transcription initiation. Fast-mixer in vitro transcription assays were performed at 19°C, 25°C, and 37°C to obtain initial transcription kinetics for λPR and T7A1 promoters, and hybrid promoters where each discriminator region was swapped. Comparison of short nonproductive RNA buildup between λPR and T7A1 confirmed different promoter escape points, signifying a dependence of polymerase-DNA escape on the discriminator. A significant deviation from the expected rate of full-length RNA production occurs at 37°C for both promoters, indicating temperature-dependent open complex rearrangement prior to initiation.

PEDIATRIC CARDIOLOGY SURVEY ON CHOLESTEROL DISEASES IN CHILDREN
Belinda Islami, John Hokanson (Mentor)
The Cholesterol Screening in Pediatric Patients study investigates the practice patterns in pediatric cardiology focusing on cholesterol screening. We created a survey that will analyze the practice patterns of pediatric cardiologists. These include diagnoses, medications, and viable treatment options for specific cholesterol diseases. In this field there is not a lot of data available to determine the best method of care for children with lipid diseases. This survey may help to solve this problem of missing data. I, another scholar, and our mentors created a lipid disease screening survey. We created questions for our survey and edited and revised them. The survey will soon be sent to the membership of the American Academy of Pediatrics Section on Cardiology and Cardiac Surgery and we await the data.
FGF8 TREATMENT INCREASES THE AMOUNT OF GNRH NEURONS PRODUCED: INSIGHT INTO THE EFFECTS OF FGF8 ON OTHER NEURONS

Jessica Jacobs, Ei Terasawa (Mentor)

While fibroblast growth factor (FGF8) has been shown to increase the proliferation of GnRH neurons, little research has tested the effects of FGF8 on other neurons. This research aims to study the effects of FGF8 treatment on GnRH, AVP, and CHAT neurogeneration from human embryonic stem cells (hESC) and induced pluripotent stem cells (iPSC). Data was collected through hESC differentiation, immunocytochemistry, and lastly, microscopy where half the slides were stained with the control NDM. Although both CHAT and GnRH were shown to increase in FGF8 treatment, only GnRH neurons increased in the GnRH/AVP culture. By presenting differences in cell abundance between FGF8 and control cultures, proliferative mechanisms for these neurons and their relationships with GnRH can be better understood.

TEMPLATING AND CATALYSIS IN THE POLYMER MODEL

Emily Jacobson, David Baum (Mentor)

The development of a simulation modeling a polymer network is an important aspect of the theoretical research to understand the origins of life. The model used previously employed a single reaction depicting catalysis of an autocatalytic cycle, in addition to utilizing a highly simplified version of templating. However, this does not accurately reflect real-world chemistry and detracts from the credibility of the data. To rectify this, the method of depicting catalysis was changed from the single catalysis reaction into multiple reactions to represent the catalytic process more accurately, and the simplified templating model was changed to utilize reverse complementary templating. These additions increase the accuracy of the data and ultimately increase the credibility of the polymer model within the origins of life community.

UNDERSTANDING DIFFERENCES IN MOTHER AND FATHER SLEEP PATTERNS IN PARENTS OF CHILDREN WITH AUTISM SPECTRUM DISORDER

Cameron Jacobson, Sigan Hartley, Jessica Greenlee (Mentor)

Little is known about the association between children's autism spectrum disorder (ASD) symptoms and parental sleep and how that may differ between parents. This study examined differences in self-reported sleep (i.e., number of hours, length of time to fall asleep, overall sleep quality) between mothers and fathers of a child with ASD (N=375) and associations between parental sleep and ASD symptom severity. Mothers reported lower sleep quality compared to fathers, and fathers reported fewer hours of sleep. Lower sleep quality was associated with more severe ASD symptoms in both parents (r = -0.286 to -0.212, p < .05). This study demonstrates that parents of children with ASD may experience sleep differently and highlights the need for more research around parental sleep quality and ASD symptoms.

INVESTIGATING THE ROLE OF INFLAMMATORY MOLECULE OSTEOPONTIN ON PROSTATIC FIBROGENESIS AND LOWER URINARY TRACT DYSFUNCTION

Asha Jain, William Ricke (Mentor)

Chronic inflammation induces the accumulation of extracellular collagen, which likely leads to prostate fibrosis and subsequent lower urinary tract dysfunction. This study investigates the role of osteopontin (OPN), a pro-inflammatory and pro-fibrotic molecule, in prostate inflammation and fibrogenesis, and its effects on voiding. To induce prostatic inflammation, uropathogenic E. coli was transurethrally instilled in WT and OPN knockout (OPN-KO) mice. We found a similar level of inflammation and collagen in WT and OPN-KO mice one week after instillation. After two months, percent collagen in OPN-KO mice was significantly lower compared to WT. Void spot assay showed increased voiding frequency in WT but not in OPN-KO mice at Day 33. These data suggest that loss of OPN may prevent collagen accumulation in chronic inflammation.
**WISCONSIN IRVINE RIVERSIDE COGNITIVE STUDY**  
Hiya Jain, Jocelyn Parong (Mentor)

WIRCS is investigating the effects of a custom cognitive training game. Participants undergo a pre-test battery assessing cognitive skills. Then, they are randomized into 1 of 2 groups: the experimental group is assigned a cognitive training game aimed at improving working memory and the control group is assigned a trivia game that has been previously shown to not improve cognitive skills. Both groups are asked to complete twenty 20-minute sessions of their game over 2 weeks. They then complete a post-test battery that includes the same tasks as the pre-test. It is hypothesized that the experimental group will improve their performance more than the control group. The results of this study may have implications for designing cognitive training games, particularly for those with cognitive deficits.

**XENOPHOBIC POLICIES IN THE NAME OF GRATITUDE: REFUGEE EXPERIENCES WITH THE GERMAN AND AUSTRIAN GOVERNMENTS**  
Emily Janicik, B. Venkat Mani (Mentor)

The 2015 refugee “crisis” in the EU prompted various responses from national governments in order to help manage large flows of refugees and migrants, as the EU was considered a safe place for refugees to flee violence and persecution. More than 1.3 million refugees came to the EU, with 800,000+ people travelling through Germany and Austria. The German government has created language and culture courses, placed refugees in apprenticeships, and provided public benefits. In contrast, the Austrian government has decreased funding for German language education, imposed stricter asylum rules, and forced “Austrian values” on refugees. In this thesis, I examine differences in government policies, media coverage, and economic impact of refugees in Germany and Austria, demonstrating tensions between acceptance and xenophobia.

**UNCOVERING THE HISTORIES OF SUPERMASSIVE BLACK HOLES IN GALAXIES**  
William Jarvis, Eric Hooper (Mentor)

Galaxies often contain a supermassive black hole (SMBH) at their center. When feeding, plasma is ejected from an SMBH’s accretion disk in relativistic jets. This may impact the host galaxy and affect star formation. Taking a subset of galaxies with active SMBHs observed at radio wavelengths, we generated maps of the ages of plasma deposited by the jets and compared these to simulations of jet propagation. Utilizing a Monte Carlo approach using Python, we estimated the errors of both the observed and simulated ages to help identify a relationship between the age of the material in the jet and when the jet became inactive. This will inform future studies on the impact of SMBHs on the growth and development of galaxies throughout the universe.

**THE RHESUS MACAQUE AND COMMON MARMOSET: TWO HIGHER ORDER ANIMAL MODELS FOR HUMAN OVARIAN CARCINOMAS**  
Hanna Jens, Manish Patankar (Mentor)

Non-human primates (NHP) such as rhesus macaques (*Macaca mulatta*, MM) and common marmosets (*Callithrix jacchus*, CJ) have yet to be used as ovarian cancer research models. To establish similarity between ovarian and fallopian tube tissues in MM, CJ, and humans, we performed immunohistochemistry (IHC) on these tissues with eight markers typically used for evaluation of ovarian cancer and its precursor lesions: MUC16, mesothelin, PAX8, ARID1A, EpCAM, estrogen receptor (ER), progesterone receptor (PR), and WT-1. NHP and human tissues stained similarly for MUC16, mesothelin, PAX8, ARID1A, ER, and WT-1. NHP and human tissues stained differently for EpCAM and PR. IHC staining of ovary and fallopian tube tissues establishes parity between MM, CJ, and human species. This suggests NHPs may be novel models for ovarian preclinical research.
DOES MEDICAID EXPANSION CROWD OUT PRIVATE INSURANCE? AN OPTIMAL MATCHING APPROACH
Susan Jiao, Hyunseung Kang (Mentor)

A debate in the implementation of the Affordable Care Act (ACA) has been whether expansion of Medicaid eligibility, a joint federal and state insurance program, would result in an overall decrease in uninsured people, or would a drop in private insurance offset such desired effect. In this paper, we estimate the amount of reduction or “crowd out” of private insurance from the ACA expansion of Medicaid among low-income people over the 2010–19 period. Using panel data from the American Community Survey, we utilize risk set matching and optimal full matching to estimate the crowd-out effect. We find statistically significant evidence of crowd-out, with places where Medicaid expanded losing 6% of private insurance coverage compared to places where Medicaid expansion did not take place.

INFLUENCE OF GESTATIONAL SLEEP APNEA ON OFFSPRING PUP MAMMARY CANCER RISK IN A RAT MODEL
Jaitri Joshi, Lisa Arendt (Mentor)

Breast cancer is the most commonly diagnosed cancer in American women, and sleep apnea is an underlying risk factor. Sleep apnea causes inconsistent delivery of oxygen throughout the body, leading to intermittent hypoxia, a condition prevalent during pregnancy. Little is known about how sleep apnea during pregnancy, gestational intermittent hypoxia (GIH), impacts long-term health of offspring. Using a rat model, we observed GIH-offspring had slower mammary gland development and decreased estrogen-receptor alpha (differentiated epithelial cell marker) expression. Epithelial cells from GIH-offspring rats showed increased Ki67 (proliferation marker) expression, increased collagen deposition surrounding mammary ducts, and larger adipocyte diameter within the mammary gland. These results suggest GIH alters both epithelial cells and surrounding mammary stroma in offspring. Future studies will examine how these changes contribute to mammary cancer risk.

INVESTIGATING THE ROLE AND MOLECULAR MECHANISM OF DNA METHYLATION IN PLANT HEAT STRESS RESPONSE
Rachel Kabara, Xuehua Zhong (Mentor)

As climate change progresses and plants are faced with heat stress, developing heat-resilient crops becomes an ever-increasingly important aspect in agriculture. One way to address this is using epigenetics, which studies heritable modifications to the genome that do not change the DNA sequence. There are two systems of epigenetic mechanisms: DNA methylation and histone modification. The role and underlying mechanism of DNA methylation in plant heat stress response remain unclear. Our preliminary results indicate that knockout mutants of the DNA methyltransferases responsible for non-CG methylation are more susceptible to heat stress, suggesting that DNA methylation plays an important role in heat response. In this study, we investigate whether DNA methylation is involved in plant heat response and the molecular mechanism behind DNA methylation-controlled heat response.

PHOSPHORYLATION OF SPC29 WITH MPS1 IN VITRO
Bridget Kaiser, Ivan Rayment (Mentor)

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

Fluorescence, the visible light emitted by an object due to the short wavelength of a UV light, is seen in many objects and organisms. It can be easily demonstrated with a UV light, and common household items can be used to exhibit the phenomenon. It is used in fluorescence guided surgery to identify anatomical structures. This project aims to study fluorescence, and design different activities for students and children to interact with. These activities are meant to teach students of all ages. The activities will provide children with early exposure to fluorescent light, focusing on the chemical processes that take place for the phenomenon to be seen. This will expose children and teens to different aspects of chemistry, but help them understand it as well.

**MACHINE LEARNING ON BRAIN DISEASE**  
Difei Kang, Daifeng Wang (Mentor)

In this research project, I have been using different programming languages to achieve various representations using various programming platforms such as R and Python. Using some of the gathered data to perform different ways to unzip data and graphing various data. Looking at data from a wide range of people, we were able to gather data from patients with various degrees of symptoms and try to figure out what has more correlation through collaboration with other students in biological fields. At the same time, we tried to navigate through different options to perform various data on different platforms including remote linux machines and various computing languages.

**THE EFFECT OF INTERACTIVITY ON TODDLERS’ OBJECT-RETRIEVAL PERFORMANCE: COMPARING THE LIVE AND VIDEO SITUATION**  
Bailey Kaplan, Alexandra Nunez, Weijia Cao, Heather Kirkorian (Mentor)

Despite accumulated evidence demonstrating that children typically learn less from screens than from real life, screen media use during early years has been increasingly more prevalent today. To inform effective screen media use, we aim at understanding toddlers’ learning from touchscreens and factors that could influence the learning process. The current study tests toddlers on an object-retrieval task in which toddlers attempt to find an object after viewing it being hidden in a room. The information they receive regarding the hiding place differs in terms of viewing method (live or video) and interactivity (pointing or watching). We hypothesize that children will perform better on object-retrieval tasks when watching a live (vs. a video) demonstration and when the demonstration is interactive (vs. non-interactive).

**A MECHANISM OF COOPERATION BETWEEN CHEMICAL SYSTEMS DURING THE ORIGIN OF LIFE**  
Rahul Kartha, David Baum (Mentor)

A long-lasting puzzle for the origin-of-life research is explaining how different types of molecules, such as DNA, RNA, peptides, and saccharides, began to cooperate to maintain a complex propagating and evolving system. This project, based on the theory that life began as autocatalytic chemical systems consisting of small molecules, will use computer simulations to examine how a classical evolutionary mechanism, group selection, could result in a natural path from prebiotic small molecules to life-like systems with cooperating molecules, thus shedding light upon the long-lasting puzzle. This project consists of multiple modules and requires cooperation between lab mates, where I am responsible for the simulation algorithms of reaction dynamics and the algorithm generating reactions leading from monomers produced by small autocatalytic cycles to catalyst polymers.
**BIOSYNTHESIS OF β-AMINO ALCOHOLS**

Aadhishre Kasat, Andrew Buller (Mentor)

β-amino alcohols are an attractive motif due to their medicinal value. For example, β-amino alcohol cores are found in antifungal drugs such as voriconazole. Existing organic synthesis routes for forming β-amino alcohols often require harsh reaction conditions and suffer low yields and poor enantioselectivity. Several biocatalytic cascades have been developed, which rise above these limitations. However, most can only access one of the two β-amino alcohol stereoisomers and have a limited substrate scope. The native ObiH- tryptophan decarboxylase (TDC) cascade, which we are developing, synthesizes a diverse pallet of both β-amino alcohol stereoisomers in a green manner with high yields and >90% enantioselectivity. I propose to engineer TDC using site-saturation mutagenesis and directed evolution to invert the cascade’s native selectivity and broaden its substrate scope.

**MODERN USE OF ANCIENT PRACTICES: THE LEWIS IRON**

Kathleen Kempson, William Aylward (Mentor)

Civilizations of ancient Egypt, Greece, and Rome were among the first to build monuments in stone. Survival of ancient stone working techniques in modern architecture fills in our knowledge and reconstructs the past. A tool used by ancient builders was the lewis iron—invented for hoisting and setting blocks in large marble structures, like the Parthenon, using gravity and friction. Evidence survives in historical photographs of construction sites found in archives and databases. Investigating modern use of an ancient practices allows us to reconstruct and explain how ancient builders achieved creations like the Parthenon. These monuments are celebrated for what they reveal about religion or social history, but study of their technical aspects can add another layer of information about technology, engineering, and architectural history.

**IMPACT OF DESEGREGATION ON RACIAL DISPARITIES IN MATERNAL MORTALITY**

Amal N. Khan, Britney Patterson, Tiffany Green (Mentor)

Black women experience the highest rate of pregnancy-related mortality of any racial/ethnic group in the United States. The goal of this project is to investigate how Medicare-related hospital desegregation affected White/non-White maternal mortality disparities. We assemble an annual state-level database with information on county-level implementation of hospital desegregation and race-specific maternal mortality rates between 1940 and 1979 and estimate the association between the state-level proportion of counties with at least one integrated hospital and yearly maternal mortality rates. We supplement our empirical analyses with narratives of Black women’s birth experiences pre- and post-segregation. This research highlights the unique struggles of Black women in America while providing evidence for changes that should be made to improve the equity and quality of the medical treatment they receive.

**CIRCLE OF SECURITY INTERVENTION ENHANCED WITH MINDFUL SELF-COMPASSION (COS-MSC): A MIXED-METHODS STUDY**

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

Quality parent-child interactions are crucial for child development. Their absence can result in unstable relationships (Duchesne & Larose, 2007), depression or anxiety in adulthood (Raudino, Fergusson, & Horwood, 2013), and lack of social skills (Koepke & Denissen, 2012). Parent well-being is crucial to parenting as lower well-being is associated with less positive parent-child interaction (Crnic & Ross, 2017). The Circle-of-Security Parenting (COS-P; Powell et al., 2013) Program fosters child attachment by teaching parents reflective functioning skills. This mixed-methods study examined the COS-P program and a version enhanced with mindful self-compassion. Surveys assessed whether interventions effectively improved parent well-being and child outcomes. Qualitatively, interviews were conducted with parents to understand the feasibility of the enhanced COS-P program. This presentation focuses on qualitative findings of this study.
**BLACK STUDENTS’ DESCRIPTIONS AND UNDERSTANDINGS OF RACIALIZED EXPERIENCES IN RURAL, PREDOMINANTLY WHITE WISCONSIN HIGH SCHOOLS**

Aaron Kinard, Linn Posey-Maddox (Mentor)

This research study explores the racialized experiences of Black students who formerly attended rural, predominantly White high schools in Wisconsin through qualitative research methods. Through semi-structured interviews, this research will explore how former students describe the racial climate of their former high school, how racialized experiences in and outside of school impacted their sense of belonging to their former school and community, and how their experiences shaped their perceptions of Blackness. This study hypothesizes that participants will describe their former high school as having a hostile racial climate and will report experiences of microaggressions and racism in and outside of school. As a result of these experiences, this study suspects participants will report lacking a sense of belonging to their former high school and community.

**ALTERED VEGETATION PRODUCTIVITY BY ICE-WEDGE DEGRADATION IN POLYGONAL ARCTIC LANDSCAPES**

Maddy Kobs, Christian Andresen (Mentor)

The Alaskan tundra is rapidly transforming in response to global climate change, resulting in permafrost ice-wedge degradation and thermokarst pit formation. I tested the relationship between different stages of permafrost degradation and its associated tundra vegetation productivity. To compare plant productivity in intact and disturbed thermokarst, I have analyzed the biogeochemistry of tundra plant samples. Here I present my findings on total carbon and total nitrogen contents by plant functional group as related to plant biomass and leaf area index, two measures of plant productivity. I also present results on changes to plant community composition as a result of plant succession after disturbance. I show that plants growing in thermokarst pits are responding to the biogeochemical and successional changes brought on by global climate change.

**EVALUATING GLOBAL ENGLISHES IN SOUTHEAST ASIA**

Kordan Kopp, Tom Purnell (Mentor)

Kachru’s (1996) Three Circles Model of English model differentiates postcolonial global Englishes. The model relies on history and political boundaries but cannot account for intra-country differences and individual learning strategies. A dynamic model is Haswell’s (2013) Global Model, which accounts for more factors than the Three Circles Model. But it hasn’t been tested regarding language acquisition practices (Hino 2020). While Haswell considered East Asia for the model, the region can also help examine local teaching practices. Countries analyzed include: those not colonized by English-speaking countries (Japan); those with contact, but not colonized (China); colonized countries later rejecting English (Malaysia); and colonized countries with local English (Singapore). Consideration is given to language acquisition, maintenance and instructor nativity. The analysis examines implications for localized English education programs.

**ANALYSIS OF COLD RESPONSIVE GENES IN CRANBERRIES WITH AND WITHOUT WINTER PROTECTION**

Madelyn Korbas, Jystona Devi Mura (Mentor)

Cranberry is a perennial crop with many human health benefits. Wisconsin is the top cranberry global producer with frost damage as a critical factor limiting cranberry production. The common winter management practice in cranberries is to create an ice layer as insulation to protect vines from winter weather and minimize damage. The objective is to understand the differences in cold-responsive mechanisms in cranberries with and without winter protection. The approaches are to analyze cold-responsive genes using qRT-PCR for molecular responses and electrolyte leakage to indicate cold tolerance level. This study will provide scientific evidence to understand the cold-tolerant mechanisms adopted by cranberries. This study's information can be used to breed new promising cold-tolerant cultivars and for the growers to make better winter management decisions.
ANCIENT CHINESE SHANG BRONZE CASTING: REFRACTORY CLAYS AND DESIGN PREPARATION OF PIECE-MOLDS

Jacob Kracke-Bock, Jonathan Kenoyer (Mentor)

I researched refractory clays used to make piece-molds for bronze casting, a highly developed technique during the Shang Dynasty in China (1600–1046 BCE). Multiple clay mixtures were prepared on the basis of the ceramic analyses of ancient molds from the site of Anyang, China, to try and replicate the molds used to make a “jue.” Clay shrinkage and refractory features of the experimental molds were tested using petrographic analyses and SEM EDS. The design transference quality was tested to determine the effectiveness of mold composition. Although considerable research has been done on the Shang bronze objects, the precise clay composition of the molds and the processes of mold preparation are unclear. This research will help provide a base line for future research on this topic.

THE ROLE OF ATTENTION IN COMPENSATION FOR ALTERED AUDITORY FEEDBACK

Jenna Krakauer, Ben Parrell (Mentor)

Speech production relies on auditory feedback (hearing one’s speech) to correct for potential errors as they occur in real time. These feedback-based corrections (compensation) can be studied using altered auditory feedback, in which auditory feedback is perturbed in either pitch or vowel formants (the resonant frequencies of the vocal tract). In response, speakers oppose these perturbations. However, the magnitude of compensation varies both within and between participants, and the source of this variability is currently unknown. Previous studies have shown that divided attention modulates feedback responses for vocal pitch control, but not reaching. Here, we examine the role of attention in speech motor control through formant alterations. We hypothesize that divided attention will reduce compensation, suggesting that attention contributes to the observed variability in compensation.

PARENTING AND RACE

Jenna Kroeger, Margaret Kerr (Mentor)

To address racial discrimination, conversations about race must be intentionally discussed with young children. Research indicates race conversations occur later in White families than Black families. White families utilize the “colorblind” approach about “equality” which inadvertently neglects racial injustices. To promote productive conversations about race, the Parenting and Race project will engage young children and their guardians in developmentally appropriate activities and dialogue. This training will be paired with contemplative practices, like mindfulness and self-compassion to navigate difficult realities, as well as caregiver mentorship in order to reduce barriers to understanding racism and recognizing social injustices. Interrupting bias, promoting equity, and ensuring healthy racial identity development with race-talk and parental self-reflection will address and reduce youth bias.

NEIGHBORHOOD EFFECTS IN A MULTIAGENT-BASED SIMULATION MODEL: RESULTS FOR GAME-THEORETIC MODELING OF PRE-DISASTER FLOOD RELOCATION

Tikumporn Kumdokrub, Vicki Bier (Mentor)

Government aid for flood victims typically focuses on post-disaster programs. However, pre-disaster management yields the benefit of preventing or reducing physical and economic losses. I build on past work proposing the idea of governmental subsidies to encourage voluntary relocation of residents away from flood-prone areas. Our model studies a range of incentives, and analyzes the effects on individuals’ relocation decisions as well as government losses. My work incorporates neighborhood effects into the model, where each household becomes more likely to relocate as their neighbors relocate. This community influence accelerates the timing of relocation decisions, and reduces the government’s total losses. Further research could investigate the effects of different assumptions about the impact of neighborhood influence on residents’ decisions.
ENDOGENOUS CHARACTERIZATION OF BETA-ADRENERGIC G PROTEIN-COUPLED RECEPTORS BY TOP-DOWN PROTEOMICS

Andreas Kyrvasilis, Ying Ge (Mentor)

G protein-coupled receptors (GPCRs) comprise the largest group of integral membrane proteins. Beta-adrenergic receptors (Beta-ARs), which belong to the GPCR family, play an important role in cardiovascular and pulmonary physiology. Despite accounting for ~70% of all pharmaceutical targets, membrane proteins like the Beta-AR remain underrepresented in biological research due to their instability and low-abundance. Moreover, post-translational modifications (PTMs) significantly affect the function of Beta-ARs, but direct analysis of these modifications remains challenging. Conventional protein extraction and purification methods are unable to comprehensively characterize GPCRs and their PTMs. Top-down mass spectrometry (MS)-based proteomics has emerged as the most powerful technology to interrogate intact proteins and decipher PTMs. Herein, we develop a novel top-down MS method for the comprehensive analysis of Beta-ARs and their various PTMs.

EXAMINING THE EFFICACY OF ANTIMICROBIALS ON CANDIDA AURIS BIOFILMS IN SKIN CONDITIONS

Brandon Lam, Jeniel Nett (Mentor)

Candida auris has rapidly emerged as a deadly fungal pathogen with mortality rates near 60%. The high rate of mortality of C. auris infections can be attributed to its multidrug resistance and common misidentification; furthermore, its potential for horizontal transmission has impeded control and eradication efforts. Like other Candida species, C. auris exhibits the ability to produce adherent biofilms. The capacity for biofilm formation is pronounced in skin niche conditions, and this trait likely serves as a factor for persistence in the environment and nosocomial transmission. This research aims to determine the susceptibility of C. auris biofilms to common clinical antiseptics and essential oils. Identifying effective topical therapies may help decrease skin colonization for those at risk and reduce the nosocomial transmission of C. auris.

GIVING PARENTAL DIRECTION IN A TIME OF "PARENT SHAMING"

Mariah Larson, Kristen Pecanac (Mentor)

This study aims to explore how pediatric clinicians discuss the need for parental behavior change to benefit the health of the child. We used conversation analysis to conduct a secondary data analysis of 75 video recorded conversations between clinicians and parents of pediatric patients during daily rounds, exploring sequences that could be perceived as parent shaming based on parent response. We identified various approaches to promote behavior change including slow and delicate introduction of the topic, demonstration of the desired behavior, talking to the child, and directly testing parental knowledge, yet parents could still perceive shaming. These findings can help to facilitate future research exploring the effectiveness of approaches to promote parental behavior change and guide productive conversations between clinicians and parents of pediatric patients.

DEVELOPMENT OF A MODEL TO PREDICT HEALTHY KNEE ANATOMY FOR ORTHOPEDIC TREATMENT

Darius Lassiter, Joshua Roth (Mentor)

With the issue of becoming elderly, cartilage/bone deterioration is a real problem. The current solution of measuring the size of the patient’s bone to create a replacement for knees is not enough. It does not custom-fit the patient, resulting in a less than adequate lifestyle post-operation. By using three-dimensional models created by segmenting patient-specific magnetic resonance images to identify signs of osteoarthritis and joint deterioration, custom pre-operative plans for replacements could be made to better suit the patient for a more comfortable result. By following through with this, the clear benefits over the older process, such as comfort and replacement customizations, will arise and lead the way for more custom implants to be produced on a larger scale in the future.
HARD AS IRON, STRONG AS STEEL: INVESTIGATING THE LINKS BETWEEN CARBURIZATION, RITUAL IDEOLOGY AND WARRIOR CULTURE IN IRON AGE SCANDINAVIA

Thomas Lavery, John Mark Kenoyer (Mentor)

The project investigated the links between ideology and technology in the production and use of hardened steel blades using replicas of Viking seax daggers made of carburized iron, medium-carbon steel, and laminated steel. The durability, cutting ability and combat potential of the daggers were tested using 5 animal bones, 2 large ice cubes, and a straw-filled leather dummy, respectively. Both steel daggers showed greater cutting ability and durability, but the laminated steel dagger showed similar combat ability to the iron dagger. The durability of steel weapons can be linked to ideological traditions that used bones-coal to create steel. The association of steelmaking and steel weaponry with religious ideologies promoting a warrior culture were investigated to determine how cultural elites exerted and expanded their power.

GH/IGF-1 AXIS DISRUPTION IN A MAMMARY CANCER MODEL

Michelle Lazar, Paul Marker (Mentor)

Growth hormone (GH) has been implicated in the development of breast cancer (BCa) via the GH/insulin-like growth factor 1 (IGF-1) axis. Animal models with an impaired GH/IGF-1 axis have decreased rates of mammary tumors and prior studies have indicated that impairment of GH can protect these animals from developing mammary tumors. Therefore, we studied the impact of GH impairment on the efficacy of common chemotherapeutic agents in BCa treatment. We found that by impairing the GH/IGF-1 axis we were able to lower the effective chemotherapeutic does necessary to treat these rat mammary tumors.

COMPARISONS OF PAIN TREATMENTS AMONG HMONG, HISPANIC, AND WHITE PATIENTS WITH MODERATE TO SEVERE PAIN

Chee la Lee, Maichou Lor (Mentor)

We compared pain treatments among Hmong, Hispanic, and White patients in a primary care clinic. Retrospective electronic health record of adult patients visits with pain scores ≥ 6 from 2009–15 was conducted. Pain scores and treatment orders were obtained and analyzed using descriptive statistical analysis. Of the 345 adult patient visits, visits were primarily female (69.6%) with a mean age of 51.84. Overall, back pain was the most common pain. Osteopathic manipulation was the most frequently perform in-clinic pain treatments for Hmong compared to White and Hispanic patients. Opioids were prescribed more for White patients than Hmong and Hispanic patients. Steroids were prescribed more to Hispanic patients than Hmong and White patients. Findings highlight the need for further understanding of pain disparities in racial/ethnic minorities.

EXPLORING ASIAN AMERICAN YOUNG ADULTS’ TURNING POINT STORIES ABOUT THE RACIAL/ETHNIC IDENTITY

Meng-Chien Lee, Wenwen Zhong, Yimeng Sun, Lilly Scott, Bradford Brown (Mentor)

Studies of racial/ethnic identity (REI) underscore its salience in well-being of individuals from minoritized backgrounds, but there is still limited understanding of factors shaping REI development. This qualitative project examined turning point narratives and how they shape Asian American young adults’ REI development. Fifteen Asian American young adults (22–30 years old) provided narratives about a major turning point in their life that changed their understanding of their REI. Preliminary analysis identified four types of narratives: positive connection to culture, awareness of difference, awareness of minority status, and experience of discrimination/prejudice. Most turning points happened during the college years, with some stories also spread across participants’ lifespan. Although turning point incidents were triggered by contextual forces, the outcomes and changes to REI varied among individuals.
A TALE OF TWO TELESCOPES: VERIFYING OR INVALIDATING PLANETS AROUND OTHER STARS WITH TESS AND KEPLER DATA

Drake Lehman, Andrew Vanderburg (Mentor)

Exoplanet research is about discovering new planets outside of our solar system. By discovering new planets, we seek a greater understanding of our universe and advance the search for possible life outside of Earth. One method used to discover exoplanets is to search for the dimming of light as a planet orbits in front of its star. Currently there are over 4000 known exoplanets and thousands more that need further investigation. We investigate these planet candidates by combining data from two space telescopes, Kepler and TESS. Combining these two datasets allows us to confirm or rule out more planets than with either dataset by itself. Our goal is to remove false positives from the sample of possible planets and boost confidence in the surviving signals.

SINGLE MOLECULE IMAGING OF THE HUMAN CST COMPLEX DYNAMICS IN VIVO

Eric D. Leisten, Ci Ji Lim (Mentor)

CST (CTC1-Stn1-TEN1) is a human telomeric heterotrimeric protein complex that can form a decameric super complex upon single-stranded DNA binding. How CST’s oligomeric state impacts its functions during telomere length maintenance or stalled DNA replication fork recovery remains unclear. This project aims to study the role of CST complex oligomerization in human cultured cells using advanced fluorescent microscopy techniques. To image CST in cell, CRISPR/Cas9 genome-editing technology was used to knock in a HALO tag at the N-terminus of the CTCl gene. Direct STORM super-resolution fluorescence microscopy will be used to determine the oligomeric structure of individual CST complexes bound to the chromosome. To study the dynamics of CST function in living cells, HILO TIRF microscopy will be used.

CHALLENGES AND BENEFITS OF HAVING A SIBLING WITH AUTISM: A QUALITATIVE STUDY OF PARENT APPRAISALS

Rachel Lentner, Jennifer Putney (Mentor)

Sibling relationships play an essential role in well-being and family functioning. However, little is known about the benefits and challenges of these relationships within the context of autism spectrum disorder (ASD). Evidence suggests that siblings of children with ASD have different experiences from those with typically developing siblings (McHale, Updegraff, & Feinberg, 2017). The current study’s purpose is to explore sibling relationships through parent appraisals, using a qualitative lens. We plan to examine the benefits and challenges associated with having a sibling with ASD, as well as the differences and similarities in the appraisal of these relationships by mothers and fathers (N=154). These findings could serve as an important first step in understanding sibling relationships within families that parent a child with ASD.

CELL TYPE-SPECIFIC SEX-DIFFERENTIAL GENE EXPRESSION IN NEUROTYPICAL AND AUTISTIC BRAIN

Jiaxin Li, Donna Werling (Mentor)

Autism spectrum disorder (ASD) is a developmental disorder with substantially male-skewed prevalence. Characterizing sex-biased gene expression patterns in neurotypical and autistic human brain may help to identify the underlying molecular mechanisms of ASD and its sex skewed prevalence. We perform sex-differential expression analysis in single-cell RNA sequencing data generated from the prefrontal and anterior cingulate cortex of 15 autistic (3 female) and 16 control (4 female) donors (Velmeshv et al., 2019) using MAST and Seurat. We identify sex-differentially expressed genes (sex-DEGs) in 17 cell types in controls, and evaluate sex-differential expression of these sex-DEGs in the ASD group. We also apply functional annotation approaches to compare sex-DEGs to ASD risk genes and ASD-dysregulated genes, to explore the interactions between sex differences and ASD dysregulation.
EXPLORING THE RELATION BETWEEN ENVIRONMENTAL QUALITY AND DIFFERENT SOCIAL INDICATORS USING SPATIAL PROXIMITY REGULARIZERS

Sihan Li, Nicolas Garcia Trillos (Mentor)

Researchers have found substantial evidence of the positive correlations between environment and social indicators. For example, Dalia (2015) defines three environment indicators which are seen to be positively correlated with social life quality—environmental quality, environmentally responsible behavior, and consumption of environmental services. On the other hand, Steve (2008) finds that socio-economic diversity leads to inequality of environment quality. Based on previous research, we further the study of the relationship between environmental and social variables by considering a statistical model that incorporates the spatial proximity of subregions to inform a regularization of standard models. After describing our model, we apply best model fitting, forecast the trend, and develop policy recommendations, in a data set of social and environmental indicators per county in the United States.

CORPORATE GOVERNANCE NO MAN'S LAND (LI)

Zoe Li, Yaron Nili (Mentor)

The project has separate focuses on corporate governance and peer groups. By observing the company’s proxy statements and other financial statements to learn more about its corporate governance and practices, including the board director structure and gender diversity within the board. The second focus is on the company’s peer group. By comparing and analyzing company information from different industries, the company’s peer group has strong implications for the company’s practices and policies regarding financial performance. The main goal of this project is to offer a more clear insight into companies’ corporate governance strategies. Peer groups will affect many aspects regarding the company’s decision-making process and corporate disclosures. Peer groups serve both as a rivalry and cooperation and should be treated importantly.

HOW TO MAKE AI LAUGH

Freya Li, Mauricio Garcia, Alison Cashmer, Jan Miernowski (Mentor)

The increasing tension between machine agency and human agency forces us to explore the boundary of artificial intelligence. We want to know whether the AI could automatically generate laughter through interactions with humans. In order to achieve this, we decided to interact with AI Replika online through chatting and documenting its reaction. We also prepared ourselves to avoid the potential bias that has been proven to exist in AI and human interaction by making specific guidelines before interaction. Readers will acquire a better understanding of AI robots and human connection. It is fundamental for us to understand such relations to avoid unreasonable fear and prepare ourselves for future advancement in AI. Ultimately, we have acquired knowledge on concepts and theories on human and machine agency.

DEVELOPMENT OF THE MATERIALS SIMULATION TOOLKIT FOR MACHINE LEARNING

Minyi Lin, Ryan Jacobs (Mentor)

As machine learning models and data science applications become increasingly relevant in the field of material sciences, there is a demand for machine learning software that is simple to use, provides easy access to important algorithms, and incorporates good machine learning practices. Materials Simulation Toolkit for Machine Learning (MAST-ML) is an open-source Python-based software package designed to simplify and accelerate the use of machine learning in material science research. MAST-ML is designed to accomplish these goals by providing pre-defined structures for input setup, model fitting, post-analysis tasks, and multi-step workflow. I will be improving MAST-ML by adding and testing new features to the code such as better ways to estimate errors, split data by clustering, nested cross validation, and genetic programming for feature generation.
EXAMINING THE CONCEPT OF STRUCTURAL PLASTICITY IN THE MO-FE SYSTEM: CHEMICAL PRESSURE ROLES OF THE M-PHASE UNITS

Yueai Lin, Daniel Fredrickson (Mentor)

The concept of structural plasticity states that intermetallics respond to internal stresses in the atomic packing by performing structural transitions. This concept was explored in the Mo-Fe system to see how the transition from MoFe2 to μ-phase Mo6Fe7 leads to chemical pressure relief, by using density functional theory-chemical pressure (DFT-CP) method. DFT-CP method helps to visualize stress experience by individual atoms stemmed from their coordination environment due to the size effect. The homogeneity range of μ-phase was also examined in the project by predicting sites for Fe substitution on Mo6Fe7 according to Bader charge analysis and CP analysis. The rank of site preferences predicted is consistent with the relative total energies calculated for three different models of Mo5Fe8.

LATERALIZED TAU DEPOSITION AND SPEECH, LANGUAGE, AND COGNITION: A DESCRIPTIVE CASE REPORT

Kelly Longhini, Kimberly Mueller (Mentor)

Asymmetric binding patterns in tau-PET imaging are sometimes observed, but less is known about how this asymmetry might explain clinical phenotypes and AD variants. This work presents two descriptive case studies of participants with opposing laterality of [18F]MK-6240, a PET radioligand for AD neurofibrillary tangles. Two participants from the Wisconsin Registry for Alzheimer’s Prevention were identified based on unilateral MK-6240 deposition. Demographics, diagnoses, speech analyses, and health histories are described. MK-6240 tau-PET imaging revealed right-lateralized tau in Participant A and left-lateralized tau in Participant B. Participant A showed between visit variability on all measures, including language. Participant B showed deficits on memory tests, and declined further across visits. Here, right>left tau PET signal was associated with greater decline in language, particularly connected speech and naming.

UNDERSTANDING THE HEALTH-RELATED GOALS OF OLDER ADULT PATIENTS FOLLOWING EMERGENCY DEPARTMENT DISCHARGE: A RETROSPECTIVE THEMATIC ANALYSIS

Matthew Lukasik, Tikiri Bandara, Manish Shah (Mentor)

Approximately 1 in 4 older adults (age≥60) seek care in U.S. Emergency Departments (EDs) every year, the majority of whom are discharged directly home. It is extremely important for older patients to effectively transition to self-management and outpatient care following ED discharge to promote positive outcomes. Research has demonstrated the importance of goal setting in successful care transitions; however the types of goals set by older adults following ED visits have not been analyzed. We are currently conducting a thematic analysis of open-text notes from a multi-site randomized controlled trial of an ED-to-home coaching intervention delivered by trained community paramedics to understand and describe the most common types and frequency of goals set by older ED patients. Results will be used to guide future interventions.

INVESTIGATING FIBER RESOURCE UTILIZATION DYNAMICS IN SYNTHETIC GUT MICROBIAL COMMUNITIES

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

The human gut microbiome regulates host health through intra-species, inter-species, and species-host interactions. Fiber is a dietary nutrient that is degraded by gut microbes but not by humans. Although the health benefits of fiber are known, how these benefits arise remains under investigation. Fiber is comprised of a variety of chemical bonds and sugar molecules; hence, different concentrations and types of fiber can elicit different ecological dynamics. We elucidated the interactions in which these responses happen in gut microbes using mechanistic models. We measured resource abundance and species abundance in pair-wise and three-member communities to fit mathematical models. The results show that our resource-driven mechanistic model can predict the effect of different combinations of fibers on community dynamics.
COLLECTIVE CULTURE AND LEADERSHIP STYLE
Zheng Ma, Yoshiko Herrera (Mentor)
In this project, we study whether the collective culture rooted in historical rice cultivation in China induced a more collegial leadership style among political elites. Using a large biographical database for political elites in China, we construct cultural background measures based on historical rice cultivation and behavior measures such as promotion and purge decisions. We also build other behavior measures according to different data sources, and we take those behavior measures as proxies for collegiality. We empirically show that political elites who grow up in more rice-intensive areas consistently demonstrate a higher level of collegiality across different behavior measures.

WHAT CAN QUEER WOMEN’S EXPERIENCE TEACH US ABOUT WHAT DRIVES HEALTH CARE DISPARITIES?
Susan Maloney, Madelyne Greene (Mentor)
Sexual minority women (SMW) experience a much different healthcare landscape than their heterosexual peers due to misconceptions about how sexual identity and behavior impact health. The choice to disclose one’s sexual identity to a provider may also influence SMW health care. This presentation will focus on research being done in the UW–Madison School of Nursing regarding the healthcare decisions and outcomes of SMW. As this research is ongoing, this presentation will highlight the work that has been done in this area in the form of a literature review. Findings have been split into the following categories: Health Changes over Lifespan, How Decisions are Made, and Decisions Over Lifespan. This literature analysis will be used to inform ongoing research.

QUANTITATIVE R1 IN THE LOCUS COERULEUS IN ALZHEIMER’S DISEASE DEMENTIA
Deepali Manav Bhalla, Barbara Bendlin (Mentor)
Prior studies have linked neurodegeneration in the locus coeruleus (LC) to Alzheimer’s disease (AD) pathology. Here we test for differences in quantitative R1 relaxometry (R1) in the LC among individuals with and without mild cognitive impairment (MCI-AD) or AD dementia. We hypothesized that R1 would be lower among individuals with AD and MCI compared to unimpaired controls. 103 older adults diagnosed as cognitively unimpaired, MCI-AD, and AD-Dementia underwent MPnRAGE MRI. No significant associations were found between QR1 and age, diagnostic status, and their interaction. The main effect of age on R1 trended toward significance (p=0.059). Future work could test R1 between groups stratified by AD biomarker status and be estimated at a higher resolution.

PROJECT SOLAR FILTER
Akshith Mandepally, Thor Larson, Cara Stanker, Ryan McAdams (Mentor)
Indoor air pollution from biofuel combustion, such as coal, wood, and dung, is a major cause of premature death globally. Most pollution related deaths occur in low- to middle-income countries, with increased prevalence among marginalized people. Solutions to combat this issue are necessary to promote health outcomes in these regions. In collaboration with the Wisconsin Idea Fellowship and the Hope2Others organization in Tanzania, our team is designing a portable and durable air purification system. In addition to the use of solar power to accommodate low-income households, a light source will be incorporated to motivate use and combat adoption difficulties. Previous prototypes have demonstrated effectiveness at reducing particulate matter, with current activities surrounding rapid prototype iteration to optimize our design.
SUPERMARKET ACTIVISM: LOCATING IDENTITY AND RED POWER 
RHETORIC IN PETER B. JONES’ INDIAN BRAND SERIES

Noah Mapes, Anna Andrzejewski (Mentor)

In 1968, Onondaga artist Peter B. Jones produced his Indian Brand Series, three sculptures that mimic the visual language of mass-produced goods featuring Indigenous mascots. Therefore, the series owes a debt to Pop art, an artistic movement that confronts contemporary society and all its triumphs and failures through the appropriation of quotidian and commercial imagery. Yet the series also coincides with the rise of Red Power, as Indigenous activists and advocates leveraged their unique cultures and experiences to assert self-determination in the face of a settler colonial United States. Placing Jones’ sculptures at the intersection of these two movements, this paper examines how the Indian Brand Series utilizes the commodified imagery of Pop to explore identity and reflect the rhetoric of concurrent Indigenous activism.

RESEARCH STUDIES WITHIN THE INTERACTIVE LEARNING AND DESIGN LAB (ILDL)

Srideepi Marada, Sadhana Puntambekar (Mentor)

As technology progresses, researchers are on the verge of innovatively engaging students using cutting edge technology. Studies already showcase that students incorporate more critical thinking and intellectual discussions in a virtual lab compared to an in-person lab. The Interactive Learning and Design Lab (ILDL) is focusing on a project that involves the progression of multiple technological enhancements and devices that will allow middle-school students to learn more effectively when participating in physics laboratories. More specifically, the ILDL is in the midst of constructing virtual lab notebooks and simulations that will refer to student labs and scientific challenges. Studying the written responses from students using NLP techniques will enable a clearer analysis for students’ effective learning within a new virtual setting in contrast to in-class conditions.

ESTROGEN-RECEPTOR ALPHA EXPRESSION IN THE HYPOTHALAMUS PREDICTS 
METABOLIC DYSFUNCTION IN FEMALE NONHUMAN PRIMATES

Rebecca Marrah, Lukas Henjum, Jaclyn Fahey, David H. Abbott (Mentor)

This study explored the effects of viral-vector induced gene knockdown of estrogen receptor-alpha (ERα) expression in the ventromedial nucleus (VMN) of the hypothalamus on metabolic homeostasis within adult female marmoset monkeys. MRI guided neural infusions of shRNA encapsulated within adeno-associated virus 8 (AAV8) were administered to an experimental group of female marmosets to induce translational inactivation of ERα proteins (KD, n=4). A scrambled RNA (shRNA) was administered to controls with no known gene targets (control, n=4). Expression of ERα was quantified ~11 months after knockdown and we associated ERα expression with attenuation of normal metabolic functioning and energy homeostasis. Our findings suggest that ERα mediated estrogen action within the VMN of female primates may play a role in regulating metabolic homeostasis.

ANTI-RACIST PARENTING TOOLKIT & TRAINING

Cassidy Martin, Margaret Kerr (Mentor)

First, I'm going to perform a written poem, created by myself, that will address what having racist parents teaches you or teaches you to ignore, and what the consequences of being colorblind are. My poem is a call to action, and the curriculum is the guideline for that action. Second, I will then present my abstract for the Anti-Racist Parenting Toolkit & Training. Third, I will present an outline for the topic of each module and the activities along with them. Finally, I will then explain what actions we are taking to accomplish creating all this by asking for feedback from experts, applying for grants, and doing strong foundational research.
ANCIENT GRAIN GRINDING
Zainah Masri, Johnathan M. Kenoyer (Mentor)

The purpose of this experiment is to understand how using different types of stone grinding tools effects the amount of grit deposits left in processed grain, which will help archaeologists to differentiate kinds of enamel damage due to grain consumption of ancient people. This will be done by processing barley and wheat through manual stone grinding into flour. There will be six batches of semolina flour, three small samples will be taken from each batch, then suspended in water to dissolve the grain. The grit left in each sample will be taken out and put under a microscope to measure size and frequency and weighed. The remaining flour will be made into an ancient Egyptian bread consisting of water and flour and tested through consumption.

MODELING THE EVOLUTION OF GRAPHENE NANORIBBONS ON GE(001) USING PHASE-FIELD SIMULATION
Celeo Matute Diaz, Michael Arnold (Mentor)
Phase-field models have been utilized to describe how monolayer graphene evolves on copper when synthesized via chemical vapor deposition (CVD). Growth parameters such as carbon precursor flux, surface concentration, and surface diffusion greatly influence the morphology of the resulting graphene crystals. These parameters are also heavily influenced by the growth substrate—for example, graphene grown on germanium (Ge) (001) evolves differently from graphene grown on copper. Under the right CVD conditions, graphene grows anisotropically such that the growth rate in the width direction is much slower than the growth rate in the length direction. This leads to the formation of graphene nanoribbons (GNRs) instead of monolayer graphene. This project aims to develop a phase-field model to understand how graphene evolves into GNRs on Ge(001).

PREPARATION OF AMORPHOUS DRUG-POLYMER SALTS WITH ENHANCED STABILITY AND DISSOLUTION
Erin McCann, Lian Yu (Mentor)
Although amorphous drugs have improved solubility in comparison to their crystalline counterparts, they are much less stable. To improve stability, amorphous drugs can be reacted with a polymer to create a stable amorphous salt using acid-base chemistry. Current preparation methods for these drug-polymer salts require subjecting the mixture to high temperatures, posing a problem for thermally unstable drugs and polymers. This work investigates a new preparation method that uses relatively low heat. The stability, dissolution, flowability, friability, and tabletability were studied for formulations of clofazimine (CFZ), a thermally unstable basic drug, paired with poly(acrylic acid) (PAA). These amorphous CFZ-PAA salts showed improved physical stability against crystallization and enhanced dissolution in biorelevant media, as well as enhanced physical properties.

WHAT DO PARENTS SELF-REPORT AS INDICATORS OF A SUSPECTED CONCUSSION IN THEIR ADOLESCENT?
Kerry McCoy, Traci Snedden (Mentor)
Background/Significance Sport-related concussion in high school student athletes is a significant health concern. Education is assumed to lead to higher levels of self-reporting through improved recognition. However, it’s unknown whether this education translates to accurate recognition of symptoms. Purpose of Study: To examine what symptoms parents indicate as a suspected concussion in their athlete. Study Design: Cross-sectional open text data was collected by electronic survey in 2018. Parents were enrolled during pre-participation sport meetings at high schools in Wisconsin. Data Analysis: Qualitative analysis is underway. Conclusions/Implications for Practice & Future Research: Our results will identify the symptoms parents of high school student athletes identify as potential indicators of concussion. Comparing these findings to evidence-based indicators will identify potential interventions to ensure accurate recognition of concussion.
BODY POSITIVITY CONTENT ON TIKTOK THROUGHOUT COVID–19
Gráinne McDonagh, Megan A. Moreno (Mentor)

Body positive social media campaigns have been trending topics used to address negative health consequences of body dissatisfaction among youth. Little is known about body positivity on TikTok, particularly throughout the COVID–19 pandemic. The purpose of this study was to investigate the frequency of posts and engagement with body positive content on TikTok before and after the emergence of the COVID–19 quarantine. A content analysis of the first 50 videos to appear under #bodypositivity according to the TikTok algorithm will be conducted and analyzed with descriptive statistics. Results will aid in understanding users’ perceptions of body positivity in reference to COVID–19 as many underwent physical change and may highlight messaging needs for adolescent perception of bodies during a pandemic.

HOW WILL WHITE LIGHT WITH ADDITIONAL GREEN LIGHT INFLUENCE BRASSICA RAPA GROWTH?
Lucy McGuire, Kaylynn Imsande, Luke Wheeler, Janet Batzli (Mentor)

How will white light with additional green light (W+GL) influence Brassica rapa Wisconsin Fast Plant growth? Green light alone is insufficient for plant growth. In other species grown under W+GL, green light penetrates deeper into the leaf and stimulates chloroplasts that other wavelengths cannot. We are unsure if we will observe this in B. rapa. We predict that W+GL conditions enhance plant growth in comparison to white light alone. Plants will be grown in a cardboard box fitted with green LEDs (adding 35umol of light intensity) in addition to a white fluorescent bulb. We expect experimental plants to have greater biomass, leaf area, and stem height than control plants. If observed, this indicates additional green wavelengths influence photosynthetic activity in B. rapa.

OLDER ADULT PATIENT EXPERIENCES WITH AMBULATION DURING THE MOVIN INTERVENTION
Meghan McNerney, Barbara King (Mentor)

Background: Ambulation is critical for patient physical function during hospitalization. However, patients infrequently walk, and little is known about how they perceive ambulation as part of their care. The purpose of this study was to explore how older adult patients experience ambulation when admitted to a hospital setting. Method: A qualitative study, inductive content analysis, was conducted. Fifteen (n = 15) older adults participated in face-to-face interviews three months post-discharge. Results: Categories identified were Attributing Value, Ongoing Barriers, and Strategies for Improvement. Ongoing Barriers and Strategies for Improvement seem to influence patients’ value for walking. Conclusion: To design patient-centered ambulation goals, nurses must understand how patients perceive walking during a hospital stay. Future research is needed to improve the patient ambulation experience.

COMMON GESTATIONAL ORIGIN FOR METABOLIC DYSFUNCTION IN PCOS-LIKE FEMALE AND MALE MONKEYS HAS SEX-DEPENDENT CONSEQUENCE
Caitlyn McQuiston-Keil, Kathryn Harris, David Abbott (Mentor)

Polycystic ovary syndrome (PCOS) is an endocrine and metabolic disorder endured by many women from adolescence to menopause. Fathers and brothers of women with PCOS exhibit similar metabolic dysfunction, including hyperinsulinemia, oligospermia, and a reproductive neuroendocrine defect. Gestational exposure to testosterone excess generates a PCOS-like phenotype in female and male rhesus macaque monkeys. We now find that adult male PCOS-like macaques develop pancreatic islets abnormalities and insulin resistance, but little progression type 2 diabetes (T2D), unlike their female counterparts. Fathers and brothers of women with PCOS may therefore be less likely to develop T2D than their female close relatives.
HUMAN-ENVIRONMENT INTERACTIONS AND MENTAL HEALTH OUTCOMES IN THE AGE OF COVID-19
Katelyn McVay, Samuel Dennis (Mentor)

Our concept of perceived mental wellbeing and how we use the built environment has been shaped by the COVID-19 pandemic in the past year. This research will investigate how humans in the city of Madison, Wisconsin, have been using green spaces in the area, and if these places have correlated with better perceived mental wellbeing in the age of COVID-19. We will utilize a variety of quantitative and qualitative research methods and analyses in order to develop a well-rounded theory that will form our understanding of the relationship between mental health and our built environment. Additionally, demographic information will be investigated as well to understand how these data may influence use of greenspaces and possible mental health outcomes.

CLINICAL DIAGNOSIS OF ALZHEIMER’S DISEASE AND CSF AMYLOID AND TAU STATUS
Emily Merkel, Barbara Bendlin (Mentor)

Cerebrospinal fluid (CSF) analysis provides levels of beta-amyloid (A) and phosphorylated-tau (T) proteins which are associated respectively with amyloid plaques and tau tangles in the brain. The AT(N) framework classifies participants on an Alzheimer’s pathology continuum based on the presence (+) or absence (-) of amyloid plaques and tau tangles (amyloid/tau continuum: A-/T-, A+/T-, A+/T+), not upon clinical diagnosis of cognitively unimpaired (CU), mild cognitive impairment (MCI) or dementia–probable Alzheimer’s disease (AD) (clinical continuum: CU, MCI, dementia-probable AD). Chi-square ($\chi^2 = 23.7, p < .001$) results indicated support for the hypothesis of a significant relationship between CSF amyloid/tau positivity and clinical diagnosis. A positive correlation was found between CSF amyloid/tau status continuum and the clinical continuum ($r = 0.31, p < .001$).

MORAL FRAMING ANALYSIS OF SOLITARY CONFINEMENT
Alyssa Meurer, Nicholas Pedriana (Mentor)

According to moral psychologist Jonathan Haidt’s Moral Foundations Theory, political affiliation can strongly predict endorsement of 5 moral foundations, explaining why partisan divides may occur. One issue that highlights the strong political polarization in the United States, particularly in Wisconsin, is solitary confinement, a type of punishment used in corrections settings. This project examines interviews with Wisconsin state legislators about criminal justice, punishment, and solitary confinement, as well as opinion-editorials largely opposing the use of solitary confinement. The arguments are analyzed for word choice relating to the 5 major moral foundations, and discussion is provided on the implications of how Democrats and others who oppose solitary confinement frame the issue.

CHARACTERIZING TRAITS IN FEMALE RHESUS MACAQUES WITH NATURALLY OCCurring POLYCYSTIC OVARY SYNDROME
Cheyenne R. Michelsen, Ava Grotting, David Abbott (Mentor)

Polycystic ovary syndrome (PCOS) is a gynecological condition presenting in reproductive aged women characterized by two of three characteristics: high testosterone levels, polycystic ovaries, and absent or irregular menstrual cycles. In addition to these criteria, PCOS is often associated with increased body fat, abdominal circumference, and mildly virilized genital measures, among other traits. Though present at an increased rate among families, the mechanisms causing PCOS are unknown. Based on genetic and physiological homology, nonhuman primate models likely provide the best insight into PCOS origins and its accompanying health-impairing traits. Using somatometric measures and testosterone levels determined by liquid chromatography-mass spectrometry, we will phenotype females from pedigrees of naturally occurring PCOS-like adult female rhesus macaques in order to better understand the heritability and pathogenesis of PCOS.
GENE EDITING OF THE ARABIDOPSIS VACUOLAR H+-PYROPHOSPHATASE AVP1 BY AN EGG CELL-SPECIFIC PROMOTER-CONTROLLED CRISPR/CAS9 APPROACH

Freddie Mildenhall, Marisa Otegui (Mentor)

The Arabidopsis vacuolar H+-PPase AVP1 has been extensively characterized. Under physiological conditions, AVP1 is specifically localized to the tonoplast. However, H+-PPase also localizes at the plasma membrane of the phloem, where, evidence suggests that it functions as a pyrophosphate synthase and participates in phloem loading and photosynthate partitioning. Mutants for the AVP1 gene have been isolated by screening seeds treated with mutagens or T-DNA insertional lines. The mutants available are not null mutants or may also contain background mutations that can confound the interpretation of the functional role of AVP1. As such, an efficient and convenient way to generate null mutants in the wild-type background would be of great interest. Here, we report an egg cell-specific CRISPR/Cas9 approach to achieve this purpose.

UNDERSTANDING THE NEEDS OF CAREGIVERS AND INDIVIDUALS WITH IDD AND SERVICE UTILIZATION AND SATISFACTION IN THE CONTEXT OF COVID-19 PANDEMIC

Danielle Miller, Jina Chun (Mentor)

The purpose of our research is to understand the service needs, utilization, and satisfaction for families and individuals with intellectual and developmental disabilities (IDD) in the context of the COVID-19 pandemic. Using a cross-sectional online survey (Qualtrics), we will collect data from caregivers who have a child with IDD (ages 3–30) across the states in the U.S. and China. We will compare the data to examine similarities and differences in the unique needs of caregivers and individuals with IDDs before, during the pandemic lockdown, and in preparing them to return to life activities when the community reopens. The results will help researchers and clinicians to support and develop service systems that can help families with a successful transition to life post-COVID.

MACHINE LEARNING: BUILDING MORE TO USE LESS

Nasya Miller, Benjamin Afflerbach (Mentor)

This project examines the process of automatically predicting and identifying defects in microscopic images of materials to accelerate materials characterization research. Within this process, machine learning is used to develop object detection models to automatically label defects in images. The audience will learn how new machine learning techniques can potentially replace previous methods of computation and tedious by-hand defect counting efforts. As machine learning becomes increasingly prevalent in our daily lives, humanity should become acquainted with the benefits and drawbacks of machine learning and the ways in which it increases the speed, efficiency, and reliability of science. There have been a multitude of developments between the theory of machine learning techniques and analysis that, in a new way, can be applied to machine learning.

TEACHING PARENTS STRATEGIES TO REDUCE CHILDREN’S RACIAL BIASES

Olivia Moens, Kristin Shuuts (Mentor)

Children begin displaying harmful racial biases early in development, leading many to suggest strategies for preventing and decreasing such biases. One common suggestion advanced by researchers and the popular press is that parents should be involved in addressing children’s biases before they are deeply entrenched. My proposed research aims to strengthen child-targeted interventions by training parents to implement specific bias reduction strategies with their children over time. Parents will be taught strategies for addressing issues of race with their children and provided with materials to practice the strategies. Pre-test and post-test measures of children’s tolerance for discrimination, social preferences, and prediction of parental attitudes will be taken. Analyses will focus on changes from pre- to post-test in the intervention condition compared to a control condition.
ECLIPSING BINARIES IN THE ANCIENT OPEN CLUSTER NGC 6791
Christopher Moore, Robert D. Mathieu (Mentor)

Open clusters are loose collections of gravitationally bound stars. NGC 6791 is a particularly unique open cluster in the constellation Lyra that is measured to be 8 billion years old. This makes it one of the oldest open clusters known, but it also has other special qualities. NGC 6791 is one of the most massive open clusters at around 10 thousand stars. More importantly however, it is paradoxically abundant with metals. In this study I analyze Kepler Space Telescope lightcurves from Isabelle Colman’s thesis by transforming them into periodograms in order to classify eclipsing binaries in NGC 6791. By learning about the stars in NGC 6791 we create the opportunity to learn more about why it exhibits these remarkable characteristics.

USING FUNCTIONAL NEAR-INFRARED SPECTROSCOPY (FNIRS) TO INVESTIGATE BINAURAL INTEGRATION IN COCHLEAR IMPLANT LISTENERS WITH SINGLE-SIDED DEAFNESS
Liberty Moore, Ruth Litovsky (Mentor)

Many listeners with single-sided deafness (SSD), i.e., profound hearing loss in one ear but normal hearing (NH) in the other ear, choose to receive a cochlear implant (CI); thus, they are known as “SSD-CI” listeners. Research has shown that SSD-CI listeners have difficulty integrating the acoustic sounds from one ear with electrical inputs from the CI and struggle to understand speech in complex listening environments. Using functional near-infrared spectroscopy (fNIRS), a non-invasive optical imaging technique compatible with CIs, sheds light on cortical neural mechanisms of auditory attention and binaural integration in SSD-CI listeners and how these differ from NH listeners. Results from this study will provide insight on how to assess hearing deficits in listeners with SSD-CI objectively.

PUBLIC AWARENESS AND OPINIONS ON THE PINK TAX AND PERIOD POVERTY
Emma Mortensen, Janean Dilworth-Bart (Mentor)

The “pink tax” refers to inflated prices on products marketed toward and needed by women, including menstrual health and general hygiene products. Period poverty is the consequences of the lack of access to menstrual products and clean sanitation facilities needed to manage one's period. The purpose of this study is to assess public awareness of the pink tax, basic attitudes toward the prices of menstrual health products, and their opinions about universal provision of free or cost controlled menstrual health products in an anonymous convenience sample of approximately 100 Facebook members. I propose an anonymous convenience sample of 100 Facebook members crossing all genders and demographics. These findings will add knowledge about public awareness and opinions related to the Pink Tax and Period Poverty.

IMPLEMENTING A PEER-LED CULTURALLY TAILORED MEDICATION ADHERENCE INTERVENTION FOR AFRICAN AMERICANS WITH TYPE 2 DIABETES
Mattigan Mott, Olayinka Shiyanbola (Mentor)

African Americans (AAs) face a greater burden of Type II diabetes compared to Whites, sometimes due to poor medication adherence. Prior research showed limited interventions address sociocultural barriers to adherence. Hence, we developed Peers LEAD, a culturally-tailored, peer-led intervention including support from an AA ambassador with diabetes. Peers LEAD uses a community-engaged, pre-post single group study design testing for feasibility, acceptability, and intervention effectiveness. Twenty-one participants were paired with 16 ambassadors. Blood glucose, medication adherence, and psychosocial measures were assessed. Interviews were conducted with participants upon intervention completion. We observed changes in negative beliefs about diabetes/medicines, and improved adherence. Qualitative themes confirming quantitative results included changed/reinforced beliefs regarding diabetes/medicines, and improved social support. Findings suggest interventions for AAs focus on peer support and health beliefs.
YEAST BIOFILMS IN NOSOCOMIAL INFECTIONS

Memee Moua, David Andes (Mentor)

Nosocomial infections, also known as hospital-acquired infections, are infections contracted in hospitals with no evidence the infection was present or incubating at the time of admission. Nearly 2 million patients are affected each year which results in nosocomial infections being a major source of morbidity and mortality. One of the most prevalent, pathogenic agents are yeast biofilms, characterized by a highly structured community of yeast protected in an extracellular matrix. The complexity of the biofilms provides a layer of protection from the environment and their resistance to chemical and physical treatment facilitates persistent infections. Through literacy analysis and review, the goal is to analyze and stimulate further research on hospital practices and explore feasible, yet effective prevention protocols.

THE RELATIONSHIP BETWEEN CHILDHOOD EXPOSURE TO VIOLENCE AND CRIME IN INCARCERATED ADULTS

Marlina Mueller, Shelby Weaver (Mentor)

Evidence suggests that witnessing violence during childhood can negatively impact mental health, and increase aggression, antisocial behaviors and weapon carrying. However, less is known about how witnessing violence is related to crime. The current study will use self-report data collected from incarcerated individuals. The Exposure to Community Violence (ECV) questionnaire will assess the prevalence of violence exposure across three sources (home, school, and neighborhood) prior to age 18. Information on past charges/convictions will also be collected. Analyses will compare associations between violence exposure and total charges/convictions and assess which exposure sources correlate with greater total charges/convictions as well as specific crimes (e.g., theft vs drug offenses). Associations between witnessing violence and crime can provide evidence of how youth may process and respond to witnessing violence.

PRIMARY P-FRACTURE ARRAYS IN THE CATHEDRAL PEAK GRANODIORITE, SIERRA NEVADA BATHOLITH, CALIFORNIA

Taylor Murphy, Basil Tikoff (Mentor)

It is often considered that fracturing in granitic rocks occurs exclusively by opening mode fractures. We present evidence of the formation of primary P-fracture arrays in the Cathedral Peak granodiorite unit of the Tuolumne Intrusive Suite in California. These P-fracture arrays contain en echelon pull-apart openings connected by fracture segments. Precipitation of chlorite and epidote within pull-apart openings and shear fractures indicate solute-rich hydrothermal activity coincident with fracture formation. Macroscopic bleaching zones occurs centimeters from the main fracture and 10s of centimeters from the margin of the pull apart zone. Work is underway to determine the composition and distribution of mineralization within the bleach zone, within the host rock, and within the pull-apart vein fill to provide information about sources of hydrothermal mineralization.

HOLE PICS: QUEER DISIDENTIFICATION ON SOCIAL MEDIA

Jackson Neal, Ramzi Fawaz (Mentor)

José Esteban Muñoz’s 2009 theory "Disidentifications: Queers of Color and the Performance of Politics" examines how queer and trans BIPOC simultaneously wear and refute stereotypes in the performance arena. These performances are powerful because of their ability to present the multi-modal layers of queer existence. Performers make a garment of their own caricatures which exists in the minds of the majoritarian, thereby refuting its very authority. "Hole Pics" continues Muñoz’s theory into the social media landscape to consider how queer and trans people maintain a complicated multifaceted personhood in an algorithm that favors singular portraits of the self. This research examines queer and trans art and performance on social media which disrupts the algorithm’s demand for a highly filtered, commodifiable self.
THE IMPORTANCE OF PEER REVIEW: INTERPRETING THE DIFFERENCE BETWEEN PREPRINTS AND PUBLISHED VERSIONS OF SCIENTIFIC RESEARCH

Lindsay Nelson, B. Ian Hutchins (Mentor)

COVID-19 has changed the way scientists communicate their findings by skipping over time-consuming quality control steps, such as peer review, because time is of the essence. We are investigating the extent of sacrificed precision when scientists skip quality control steps. Using COVID-19 papers before and after peer review, we can identify key data points in each version for comparison. Determining the degree that COVID-19 manuscripts change during peer review will help the public interpret preprint findings. Do preprints systematically over- or under-estimate disease statistics relative to peer-reviewed versions? To what degree is there attrition of findings through peer review? The recent flood of COVID-19 data has given us an opportunity to research an area that no one has had an opportunity to thus far.

EXPLORING RELATIONSHIPS BETWEEN PHYSIOLOGICAL STRESS AND THE PERFORMANCE LEVELS IN EAST ASIAS AND EUROPEAN AMERICANS

Vivian Nhi Phan, Yuri Miyamoto (Mentor)

Negative emotions such as stress and anxiety are seen as harmful and undesirable in Western societies, whereas positive emotions are considered desirable and sought after. Compared to Western societies, some Eastern societies hold relatively more favorable views of negative emotions and perceive motivational utility of negative emotions. We examine whether such cultural beliefs about stress are reflected in their actual performance. Specifically, we will test if stress levels (documented through cortisol increase) are positively correlated with performance levels for Asian American participants, whereas they are negatively correlated for European American participants. This study seeks to examine the effect of stress on performance levels between Eastern and Western societies based on cultural beliefs surrounding positive and negative emotions/motivators.

TOWARDS PROFILING OF G PROTEIN-BIASED LIGANDS OF THE PARATHYROID HORMONE 1 RECEPTOR USING A STREAMLINED BIOLUMINESCENCE-BASED BINDING ASSAY

Kevin Nguyen, Samuel H. Gellman (Mentor)

We have validated the use of a NanoLuc-parathyroid hormone 1 receptor (PTH1R) fusion protein in improved equilibrium and kinetic competition binding assays involving both the truncated endogenous parathyroid hormone (PTH) ligand and a previously described α/β-amino acid-containing, G protein-biased analogue (PTH-P2). Using our new assay system, we report that this analogue binds PTH1R with lower affinity and induces less internalization by endocytosis than PTH. However, PTH-P2 activates G protein-dependent cAMP generation to a comparable degree as PTH, meaning that it is both selective towards activation of a specific signaling cascade, and selective towards membrane localization.

USING DIRECTED EVOLUTION TO CHANGE SUBSTRATE SPECIFICITY IN ACYLTRANSFERASE DOMAINS OF POLYKETIDE SYNTHASES IN AGROBACTERIUM FABRUM C58

Valerie Nguyen, Michael Thomas (Mentor)

With current antibiotics facing threats of becoming ineffective against resistant strains of bacteria, developing techniques to create new drug variants are crucial to staying ahead of bacterial mutations. Polyketides are natural products that are essential components of our drug arsenal against various infections. They have a broad spectrum of medicinal properties and there is significant interest in reprogramming polyketide synthases (PKSs) to introduce new structural diversity. Acyltransferase (AT) domains of polyketide synthases are responsible for selecting appropriate building blocks in each chain elongation cycle of polyketides. We exploit biosynthesis of Agrobacterium fabrum C58 by using directed evolution. AT domains are reprogrammed using targeted mutagenesis based on sequence alignments to generate substrate changes. These substrate changes are essential to constructing clinically powerful molecules in designer drugs.
EFFECTS OF PSYCHOLOGICAL AND PHYSIOLOGICAL STRESS ON TASK PERFORMANCE
Calvin O'Donnell, Chris Coe (Mentor)
Psychological stress has previously been associated with worse performance in difficult situations, namely exams. Physiological stress, however, has had less investigation. Cortisol reactivity and recovery are two variables that are useful for determining physiological stress. Our study looks to confirm prior links with psychological stress, as well as investigate physiological stress as a predictor of test performance. The Trier social stress test is used as a means to induce stress, and as a measurement of how well an individual performs in a stressful environment. We hypothesize that the results for physiological stress will parallel the pattern of psychological stress in dampening test performance outcomes. If the hypotheses are supported, this idea could have implications for understanding how stress is related to performance.

EFFECTS OF KNOCKDOWN OF ESTROGEN-RECEPTOR ALPHA (ER\(\alpha\)) GENE ON ADIPOCYTE MORPHOLOGY AND FUNCTION IN ADULT FEMALE RHESUS MONKEYS
Annette Okafor, David Abbott (Mentor)
Polycystic ovary syndrome (PCOS) leads to a variety of metabolic morbidities including obesity in women. This project explored whether morphological changes may be associated with the development of PCOS-like metabolic traits in adult female rhesus monkeys. Six female monkeys underwent gene silencing (KD) of estrogen receptor alpha (ER\(\alpha\)) in the hypothalamus, and six additional monkeys underwent control procedures. We hypothesized that ER\(\alpha\) KD females will exhibit lower levels of noradrenaline (NA) in adipose tissue, resulting in diminished mitochondrial function, decreased thermogenesis and weight gain. Using digital microscope imaging, rt-qPCR and chromatographic methods, we analyzed changes in brown/beige adipocyte morphology, uncoupling protein expression, and NA levels.

COLLEGE ADJUSTMENT OF STUDENTS OF COLOR
Godwill Oke, Matthew Hirshberg (Mentor)
Adjusting to college life can present academic, psychological, and interpersonal stressors that adversely affect students. This period may be particularly stressful for students of color (SoC), but these students’ experiences are understudied. We will recruit a group of 100 incoming UW–Madison freshmen: 50 of whom will be SoC and 50 of whom will be White. At three different time points throughout the fall semester, we will administer an online survey to assess well-being, social engagement, and adjustment. This study will provide insight into how the college experience affects college freshmen in general, and SoC in particular, we will examine whether early engagement in extracurriculars and campus resources differentially mediate SoC healthy adjustment to college life.

ENGAGING YOUNG STUDENTS THROUGH GARDEN-BASED EDUCATION
Jackie Olson, Claudia Irene Calderón (Mentor)
This project will assist Nuestro Mundo (NM)’s Green Team to establish a vegetable garden and initiate a garden-based educational program to engage a diverse group of students, staff, and parents through planting, growing, and harvesting fresh produce. While there is a growing awareness of the benefits children gain from interacting with their outdoor environment, not all children have equal access to those spaces. The intersectionality of race, gender, socioeconomic class, etc., plays a strong role in determining access to the outdoors and fresh produce. My community partner, NM, is a dual language public charter school part of the Madison Metropolitan School District. With the support of Claudia Irene Calderón, the NM Green Team, and local school garden experts, we will (a) design a new vegetable garden, (b) revitalize the old rain garden, and (c) connect the garden to the classrooms through the initiation of a garden-based program. Key to the success of the garden is the definition of clear goals, formation of a garden committee, connection with key partners, and establishing measures of success. Throughout the project we will establish and tend to the garden, arrange proper supplies and educational materials, and engage with students in the garden during this time and for years to follow. I will serve as the contact for all garden inquiries. This garden will provide a unique opportunity for students and staff to engage in the outdoors, grow fresh fruits and vegetables, gain lifelong skills and introduce students to the importance of nutrition.
UTILIZING LOW-DOSAGE WHOLE BRAIN RADIATION AND IN SITU VACCINATION TO MODULATE BRAIN-RESIDENT MACROPHAGES TOWARDS AN ANTI-TUMOR IMMUNE STATE.

Alejandro Onate, Zachary Morris (Mentor)

Studies by the Morris Laboratory have identified an in situ vaccine (ISV) effect when combining Radiation (RT), intratumoral antibodies targeting the antigen GD2, and the checkpoint inhibitor anti-CTLA-4. This ISV effect can significantly prolong the survival of mice challenged with melanoma and establish a robust anti-tumor memory response. However, this treatment regimen has had limited success in clearing intracranial brain metastases (BrMets) compared to extracranial metastases. In this study, we investigated the ability of low-dosage (4 Gy) whole-brian radiation (WBRT) to potentiate an anti-tumor immune response in BrMets, paying close attention to its ability to engage brain-resident macrophages towards an anti-tumor state. Mice treated with ISV + WBRT exhibited significantly increased survival as well as increases in immune infiltrate, including T-cells and brain resident macrophages.

MITOCHONDRIAL LIPID SIGNALING AND ADAPTIVE THERMOGENESIS

Nanami Oshimura, Mae Hurtado-Thiele, Judith Simcox (Mentor)

Thermogenesis is a vital process for endotherms to maintain their body temperature in response to environmental temperature fluctuations. Two major mechanisms of heat production are shivering and nonshivering thermogenesis. During nonshivering thermogenesis, the cells of brown and beige adipocytes generate heat through uncoupling protein 1 (UCP1), which mediates the flow of protons into the inner mitochondrial membrane. Lipids such as ketones, acylcarntinines, cardiolipins, and fatty acids play important roles in regulating thermogenesis through signaling and as energy substrates. The review article will be composed of the analysis of studies and experiments on the effect of gene expression and lipid signaling on thermogenesis. We will delve into the mechanisms where these lipids signal for brown and beige adipocyte differentiation, influence substrate preference, and increase futile cycling.

OAT PANICLE ARCHITECTURE AND ITS RELATIONSHIP WITH SEED PRODUCTION

Tanner Oyen, Ines Berro Rovella, Lucia Gutierrez (Mentor)

Oat panicle architecture is believed to be a key factor when breeding for seed quality and quantity. We will map and analyze a diverse set of 30 genotypes to identify which architectural patterns contribute to favorable seed production. To do this we will use a software program to analyze and collect image analysis on the oat panicles and seeds. Such measurements include branch length, branch width, panicle biomass, seed weight, seed length, and seed width. We will then implement GWAS and run multiple statistical procedures to ensure there is a strong enough correlation to support our findings and organize them into optimal sample sizes to allow us to continue research on more genotypes. Herein, we connect architectural patterns to panicle traits and yield performance.

BAFF AND APRIL AS PREDICTORS OF TRANSPLANT GLOMERULOPATHY

Geet Pandya, Shannon Reese (Mentor)

End-stage renal disease results in a poor quality of life for patients, and has a high treatment cost with the only long term treatment being a transplant. However, our current ability to maintain a transplant is poor, and a large barrier to success in kidney transplantation is transplant glomerulopathy (TG). The disease mechanism of TG begins with activation of β cells, which then produce antibodies, and can eventually result in the loss of the allograft. Using a biorepository of patients with TG from 2014-2015, samples were stained for two β cell cytokines (BAFF and APRIL) using immunohistochemistry, then analyzed with quantitative densitometry. Cytokine levels determined were then used to predict allograft failure as well as decline in kidney function.
THE EFFECTS OF SIBLING COMPETITION ON ADOLESCENTS
Molly Paras, Jason Fletcher (Mentor)

Relationships with siblings are often the longest lasting bonds people have. Research has been done on the relationships between parents and children, but not as much is known about sibling bonds. The objective of the overarching research project, "Siblings: How They Shape Us," is to gain a better understanding of the relationships siblings have through smaller literature reviews. This project, "The Effects of Sibling Competition on Adolescents," provides insight into rivalry between siblings, covering topics like reactions to comparisons between siblings, the role of birth order in sibling competition, the use of de-identification to reduce rivalry, and more. Its goal is to understand how siblings act and react to one another, in terms of competition, and how that affects who they become.

EFFECT OF FARM-SIZE ON RURAL COMMUNITY WELL-BEING
Iris SooJin Park, Steven Deller (Mentor)

The current crisis in U.S. agriculture has seen a growing number of farm bankruptcies. The result has been a “hollowing out” of the middle in the distribution of farm size, with growth in the number of both very large farms and small farms. Using U.S. nonmetropolitan county-level data, we explore how the changing size of farms has affected community well-being as understood through five diverse measures. In general, we find conflicting evidence on the impact of farm size on community well-being. Our results suggest that the logical conclusion of what has become known as the Goldschmidt hypothesis line of thinking that the movement to fewer and larger farms will necessarily harm the well-being of the larger community is not supported by the data.

BEHAVIORAL EVALUATION OF RHESUS CARRIERS OF A FRONTOTEMPORAL DEMENTIA GENE
Matthew Patch, Karla Ausderau (Mentor)

Frontotemporal dementia (FTD) with Parkinson’s disease (PD) impairs the frontal and temporal lobe and can be traced to the R406W mutation of tau proteins. This study examined locomotor and anxious behaviors in rhesus macaques with the R406W mutation in response to a stressful situation for expanding upon current treatment for FTD with PD. This stressful situation was assessed through the human intruder paradigm (HIP) and the behaviors of freezing, crouching, and pacing were analyzed for four age-matched pairs with each containing one control and one tau macaque. This study found that pacing was more frequent in tau macaques, and freezing and crouching were majorly exhibited by the controls. This study indicates that future research should study motor-based behaviors which are more prevalent in human patients.

THE ASSOCIATION BETWEEN CHILDHOOD TRAUMA AND TRAITS OF PERSONALITY DISORDERS AMONG INCARCERATED INDIVIDUALS
Karina Patel, Shelby Weaver (Mentor)

Childhood trauma and traits of personality disorders, such as narcissistic (NPD) or antisocial personality disorder (ASPD) are more common among incarcerated individuals than community populations. However, the relationship between childhood trauma and personality disorders are not well understood among incarcerated individuals. In this study, linear regression will determine the relationship between childhood trauma and each personality disorder (NPD and ASPD). Childhood trauma and personality disorder information will be assessed using pre-existing data from self-reported questionnaires and interviews. This study aims to understand the relationship between specific types of childhood trauma and personality disorders. Results of these analyses will help to understand the long-term effects of childhood trauma and trauma types on specific personality disorders.
CONDENSED TANNIN RESPONSE OF P. TREMULOIDES TO METAL CONTAMINATION
Edward Paulsen, Richard Lindroth (Mentor)
Condensed tannins have been proposed to be upregulated as an antioxidant response in Populus tremuloides. We grew P. tremuloides in soil spiked with individual metals known to induce oxidative stress at multiple concentrations. The trees were grown for one growing season and the condensed tannin concentrations in leaf and root samples were determined spectrophotometrically. One-way ANOVA determined that the concentrations were not significantly different from each other. P. tremuloides is known to use other phytochemicals in response to metal stress which may negate the need to upregulate condensed tannins.

CORPORATE GOVERNANCE NO MAN'S LAND
Vincent Peng, Yaron Nili (Mentor)
The governance practices of large-cap companies, such as those in the S&P 500, have largely been well-analyzed and understood. The governance practices of smaller companies, such as those in the Russell 3000, have received much less attention. Smaller companies have significantly different practices than large companies. The boards of large public companies have evolved to be more diverse, accountable, and well-organized. In contrast, smaller companies are not put up to the same standards and have largely lagged behind. "Corporate Governance No Man's Land" refers to the world of under-analyzed governance practices of smaller corporations.

THE EFFECT OF PRENATAL EXPOSURE TO ZIKA VIRUS ON THE MOTOR DEVELOPMENT OF Rhesus Macaque Infants
Nicole Pereira, Karla Ausderau (Mentor)
Zika virus (ZIKV) is a mosquito-borne neurotropic flavivirus that has been found to cause a spectrum of birth defects and neurodevelopmental deficits in offspring exposed to the virus during gestation. The aim of his study is to evaluate the long-term effects that prenatal exposure to Zika virus has on the motor development of rhesus macaque infants. The experimental group (n=11) consists of infant macaques that were exposed to Zika virus during gestation, while the control group (n=7) had no exposure. It is hypothesized that the experimental group will have developmental delays in motor skills. This will be assessed by coding videos in Noldus Observer XT of the infants in their habitat focusing on behavioral codes: loss of balance, jump/swing, locomotion, and inactivity.

MACHINE LEARNING AND DEEP LEARNING ALGORITHMS FOR AUTOMATING SEGMENTATION OF DENSITOMETRIC PHANTOM COMPUTED TOMOGRAPHY DATA
Ashley Pernsteiner, Corinne Henak (Mentor)
Segmentation, the creation of digital geometries from image data is a barrier to implementing CT-based patient-specific finite element analysis (FEA) in the clinic. Automating segmentation may remove this barrier, increase repeatability, and decrease required operator time. Segmentation can be automated using machine learning (ML) or deep learning (DL) techniques. This study compared the results of ML and DL to manual segmentation (MS) in terms of contour mesh geometry, density calibration equation, and torsional surface strains. The ML algorithm was successfully trained and created more accurate calibration equation results than DL and MS for densitometric plugs, and required comparable operator time to MS. For current clinical implementation, this study showed ML algorithms are more accurate than DL algorithms when automating segmentation.
REWARD SHAPING ALGORITHMS FOR POLICY GRADIENT METHODS
Conor Perreault, Jerry Zhu (Mentor)
Policy gradient (PG) methods are some of the most effective reinforcement learning methods in practical problems involving large state and action spaces, but their theoretical convergence properties have only recently been explored. In addition, while machine teaching is a common area of research in other areas of machine learning, teaching agents are not commonly used with PG methods. In this work, we begin to explore the possibilities for reward-shaping algorithms to be used as a teaching agent to improve the convergence rates of PG learners. We leverage a teacher’s prior knowledge about the problem setting to transfer some information and reduce the problems raised by the non-convexity of the PG problems. We also explore the convergence rates of standard PG algorithms assisted by these teachers.

ADVERSE CHILDHOOD EXPERIENCES AND CHRONIC STRESSORS IN RACIAL MINORITY YOUTH
Samiya Pettaway, Anne Ersig (Mentor)
Studies have consistently demonstrated the harmful effects of adverse childhood experiences (ACEs) on health across the lifespan. However, these studies have primarily focused on the traditional ten categories of ACEs from the CDC-Kaiser ACEs study, rather than ACEs more unique to minority youth such as community violence, racial discrimination, and immigration. The purpose of this comprehensive literature review was to synthesize the literature on the compounding effects of ACEs and various chronic psychosocial stressors on health outcomes in racial minority youth. Preliminary results indicate that various health symptoms and health risk behaviors were higher in those who experienced chronic stressors more commonly experienced by racial minority youth. This review will inform the development of future studies that examine an expanded set of ACEs.

EXPLORING THE FUNGAL DIVERSITY AND ETHNOMYCOLOGY OF LAKESHORE NATURE PRESERVE
Naamon Peyton, Anne Pringle (Mentor)
Fungi are often overlooked when a person is enjoying the beauty of nature paths and hiking trails. Although there are guides to Midwestern fungi in the U.S., there are not any guides specific to the unique locations around the University of Wisconsin–Madison. The goal of this project is to highlight local fungal diversity within the Lakeshore Nature Preserve by creating an accessible field guide for patrons, emphasizing ecological niches across the preserve. To accomplish this goal, fungi will be collected during the fall and spring seasons at Picnic Point, Bill’s Woods, Caretaker’s Woods, Big Woods, and Eagle Heights Woods, and information regarding the identification, morphology, and ecology of each species will be synthesized from authoritative sources on identification and ethnomycology and documented for future publication.

WHAT MAKES A HOME? DEVELOPMENT OF HOME PERSONAS TO INFORM DESIGN OF MEDICAL DEVICES
Ellen Pflaster, Nicole Werner (Mentor)
Personas describe users in the design of medical devices, yet they often lack important contextual factors. For families caring for children with medical complexity (CMC), it is essential that the context (e.g., home) is considered in design. As such, we sought to develop 3–5 illustrative "home personas" to capture the home context. Data was collected through interviews with family caregivers of CMC (n=30). Caregivers walked through the home and demonstrated daily care, while interviewers asked questions. Using inductive thematic analysis, we identified seven aspects of homes to be included in personas. We aim to design personas that share a common thread but still uphold the complexities of individual homes. Personas can be used to design devices that better "fit" into the home.
The Role of Cancer/Testis Antigens in Cancer Development
Matthew Pham, Hasan Khatib (Mentor)

Second only to heart disease, cancers are a group of undoubtedly lethal and prevalent illnesses that we still fail to fully understand to this day. Recent discoveries, however, indicate that an underlying cause of many different types of cancers may be linked to the atypical expression of specific genes only normally found in the testis. These so-called cancer/testis antigens are a family of over 200 different genes that have been shown to be abnormally expressed in a variety of cancerous tissues and play a role in the growth and development of these tumors. By cataloguing and designing experiments with these genes using epigenome editing technology, this project seeks to better understand the mechanisms that lead to cancer development and eventually develop novel CTA-based therapeutical techniques.

Neurodevelopmental Effects of Congenital Zika Virus Infection on Macaque Brains
Tracy Pham, Emma Mohr (Mentor)

As of July 2018, Zika virus (ZIKV) has been reported in a total of 86 countries including the U.S. ZIKV is a flavivirus with no current cure or vaccine that is spread mainly by the bite of an infected Aedes species mosquito. While the majority of people who get bitten by an infected mosquito do not develop severe symptoms, the virus greatly impacts pregnant women and their infants. Pregnant women exposed to ZIKV can lead to numerous fetal abnormalities. To observe the symptoms and effects, MRI scans of nonhuman primate brains are analyzed. The purpose of our study is to identify early predictors of developmental deficits in ZIKV-exposed infant macaques which will help us identify which infants are at high risk for developing neurodevelopmental deficits.

Maternal and Child Health Updates during COVID-19
Felicia Phun, Pravleen Bajwa (Mentor)

COVID-19 has taken over the world. During this period, pregnant women and young children are especially vulnerable. With much ongoing research, it is important that the general public has access to reputable sources to stay informed. For example, the Centers for Disease Control and Prevention provides the Morbidity and Mortality Weekly Report regarding ground-breaking COVID-19 research from various sources. Our project by the UW Prevention Research Center (UWPRC) aims to raise awareness and provide reliable COVID-19 information regarding maternal and child health for the community. Through compiling both qualitative and quantitative resources backed by reputable organizations, the UWPRC intends to share them on its website and monthly newsletter. This will aid community organizations and members, especially parents, pregnant individuals, and young children, to stay well-informed.

Essential Amino Acids Have Additive Effects on mTORC1 in Bovine Mammary Epithelial Cells (MAC-T)
Kayleigh Pignato, Sebastian Arriola Apelo (Mentor)

Milk proteins are produced in mammary epithelial cells from amino acids (AA). Excess AA that are not used for protein synthesis are excreted by the cow as nitrogenous (N) waste products through urine. Excretion of N waste in large quantities poses threats to both natural ecosystems and human health through soil and water contamination. In addition to being a substrate for protein synthesis, some essential AA (EAA) are sensed by the mechanistic target of rapamycin complex one (mTORC1) to regulate metabolic processes, including protein synthesis. The purpose of the experiments is to determine if mTORC1 stimulating EAA have additive effects on mTORC1 signaling in MAC-T cells. Efficient stimulation of mTORC1 via additive EAA interactions could reduce the AA requirement for protein synthesis and nitrogen excretion.
EXPLORING THE DISCUSSION OF NEXPLANON (ETONOGESTREL BIRTH CONTROL IMPLANT) ON TWITTER

Lekha Pillarisetti, Bradley R. Kerr (Mentor)

The Federal Drug Administration (FDA) has approved fraudulent medical birth control implants associated with over 100,000 stillbirths. Few studies have examined tools such as social media to assess the risk of federally approved medical devices already on the market. This study examined Twitter content discussing the medical birth control implant, Nexplanon. In this content analysis study, Tweets were identified using #Nexplanon and evaluated to assess the reported experiences with having the device implanted. The Linguistic Inquiry and Word Count (LIWC) program was used to discern positive and negative emotions and tone shown in tweets, and descriptive statistics were calculated. Social media could be used to identify fraudulent medical devices and advocate for stricter FDA restrictions.

SPATIAL STRUCTURE IN AUTOCATALYTIC CHEMICAL ECOSYSTEMS AT THE ORIGIN OF LIFE

Alex Plum, David Baum (Mentor)

At the origin of life, autocatalytic cycles may have formed chemical ecosystems and evolved, providing the complex scaffolding required for later stages in the emergence of life. Mathematical models of the dynamics of chemical reaction networks situated in well-mixed reactors, continuously diluted, and driven out of equilibrium by a constant flux of food chemicals demonstrate that distinct autocatalytic processes within those chemical reaction networks can act analogous to distinct species in biological ecosystems. Past modeling has relied on mass-action kinetics so that concentrations are continuous, events are deterministic, and all spatial structure is abstracted away. Here, we introduce models that incorporate stochasticity and spatial structure to explore the role of chance events, compartmentalization, and local priority effects in chemical ecology.

RESHAPING A CULTURAL NARRATIVE

Kyla Pollard, Sami Schalk (Mentor)

With Chicago being a city recognized for its violent crime, many important and necessary narratives of black and brown people are overlooked. This Visual EP uses a unique lens to challenge narratives of blackness in Chicago. The hypervisible narratives of grief, bloodshed, poverty, and crime perpetuate one-dimensional conversations around blackness and participate in a larger cultural erasure. More specifically, this research will pose two questions: Who are the people of Chicago? and, what does it look like to live and love against the backdrop of White supremacy and racial violence? It is an exploration and unveiling of a people rendered invisible by their socioeconomic circumstances and an attempt at humanizing the residents of Chicago.

THE EFFECTS OF CIGARETTE SMOKE ON THE INFLAMMATORY RESPONSE IN EARLY AND LATE-STAGE CALCIFIC AORTIC VALVE DISEASE

Noah Pollard, Kristyn Masters (Mentor)

Smoking has been identified as contributing to many diseases, but little is known about its cellular-scale effects in driving calcific aortic valve disease (CAVD). CAVD is characterized by thickening valve leaflets and extracellular matrix (ECM) remodeling due to inflammatory responses. Two major risk factors include the male sex and smoking, however the relationship between the two has not been identified. To better understand the inflammatory response to cigarette smoke in male and female cells at the early and late stages of CAVD, cells were cultured on plates with various ECM components and treated with cigarette smoke extract. Through enzyme-linked immunosorbent assays, it was found that smoking influences inflammatory response preferentially with respect to sex, as well as causing opposite responses in early and late-stage environments.
EFFECTS OF SUGAR FEEDING ON PARASITOID DISPERAL
Journey Prack, Anthony Ives (Mentor)

*Aphidius ervi* is a parasitic wasp that infects the pea aphid, *Acyrthosiphon pisum*. Pea aphids can damage legume crops if they reach high densities, but natural predators like the parasitic wasp are able to keep aphid populations under control. Nectar sources are thought to positively affect parasitism rates, but some have postulated that fed parasitoids may leave host patches and be less effective in reducing pest populations. By running many experiments with fed and unfed wasps, temporal differences in dispersal and parasitism can be observed. Understanding these differences caused by feeding state can advance biological control programs and change how nectar sources can be used to foster predator retention in agricultural systems.

SEARCH FOR DARK MATTER IN EVENTS WITH MISSING TRANSVERSE MOMENTUM AND A HIGGS BOSON DECAYING TO TWO PHOTONS IN PP COLLISIONS WITH THE ATLAS DETECTOR
Yan Qian, Sau Lan Wu (Mentor)

A search for dark matter particles in events with large missing transverse momentum and a Higgs boson candidate decaying into two photons is reported. The search uses 139 inverse femtobarn of proton-proton collision data, collected at a center-of-mass energy of 13 TeV, with the ATLAS detector at the CERN LHC between 2015 and 2018. No significant excess of events over the standard model predictions is observed. The results are interpreted by extracting limits on three simplified models that include either vector or pseudoscalar mediators and predict a final state with a pair of dark-matter candidates and a Higgs boson decaying into two photons.

CHARACTERIZATION OF IMMUNOMODULATED HUMAN PLURIPOTENT STEM CELL LINES FOR THE PREVENTION OF ALLOIMMUNE REJECTION OF ISLET-LIKE CELLS.
Nicholas Quirini, Jon S. Odorico (Mentor)

Diabetes mellitus type I is an autoimmune disease that destroys insulin-producing beta cells and affects millions of people globally. While clinical methods of insulin delivery continue to advance, they are still limited by donor supply and immunogenicity concerns. We have knocked out gene regulators of MHC I/II and introduced a doxycycline responsive, immunosuppressive gene set into a human embryonic stem cell line to develop beta-like cells in vitro that are alloimmune tolerant. To analyze how these cells behave as they are differentiated, we have quantified protein production of these transgenes at various developmental stages with a custom-built ELISA kit, FACS, and immunofluorescent intensity measurements. Also, we have subjected these cells to killing assays to test their defense against an immune response in real time.

THE ROLE OF LYSINE MALONYLATION IN THE ACCELERATED AGING RETINAL PHENOTYPE DEVELOPMENT OBSERVED IN MUTANT TRANSMEMBRANE PROTEIN 135 MICE
Adrienne Race, Akihiro Ikeda (Mentor)

A number of age-related retinal diseases prompt vision loss for many elders. Our lab has established a transmembrane protein 135 mutation in mice causing an accelerated aged-retinal phenotype. I have discovered mutant Tmem135 (Tmem135FUN025/FUN025) mice display altered lysine malonylation that is similarly seen in leptin-deficient (Lepob/ob) mice. I hypothesize lysine malonylation is mechanistically linked with the pathologies in the Tmem135FUN025/FUN025 murine retina. By crossing Tmem135FUN025/FUN025 mice with Lepob/ob mice, I hypothesize further altering of lysine malonylation levels in vivo. I will investigate if lysine malonylation, photoreceptor degeneration, and neuroinflammation change in the Tmem135FUN025/FUN025,Lepob/ob mice compared to the Tmem135FUN025/FUN025 and Lepob/ob mice. I will continue our studies on unveiling the role of TMEM135 in preventing murine age-related retinal diseases aiding to human retinal diseases.
TERAHERTZ RADIATION MODE OF THE TRANSMON QUBIT
Owen Rafferty, Robert McDermott (Mentor)

Superconducting qubit structures are resonant absorbers of pair-breaking radiation. The metal pads that form the qubit capacitance support resonant standing wave modes with frequencies in the range from 10s of GHz to THz; these modes are strongly coupled to free space impedance through their electric dipole moment. For typical Josephson junction parameters, the junction provides a reasonable conjugate match to the radiation impedance of one or more spurious antenna modes. A clear understanding of the spurious antenna modes of qubits will allow designs that are immune to pair breaking radiation. This physics could be exploited to realize a new class of high-performance detectors for precision spectroscopy of the cosmic microwave background or of photons transduced from dark matter axions.

IMPLICATIONS OF THE GENERATION OF A GNRH NEURON CELL LINE IN STUDYING HYPOGONADOTROPIC HYPOGONADISM (IHH)
Srishti Rathore, Ei Terasawa (Mentor)

GnRH neurons have been shown to be involved in the pathology of hypogonadotropic hypogonadism (IHH), which is characterized by delayed or absent puberty due to the absence of GnRH neurons. Many genes have been shown to be involved in GnRH neuron development and function, including FGFR1, which codes for the receptor that binds FGF8. The absence of FGFR1 has been shown to stunt the growth of GnRH neurons, exemplified through gene knockdown experiments employing siRNAs. These experiments continue to help determine optimal conditions for GnRH growth, which aids in establishing a GnRH cell line. An established cell line for GnRH would increase the scope for testing and research on hypogonadotropic hypogonadism, and have implications for future IHH patients that would benefit from GnRH transplantation.

TEACHING SKILLS TO BUILD TRUST BY RESHAPING THE JOURNALISM SCHOOL’S CURRICULUM
Rachel Reingold, Susan Robinson (Mentor)

The purpose of this study is to improve the curriculum for journalism schools where students are taught engagement strategies to build trust with a specific audience. Our data was collected through student surveys and professor interviews. Our research highlights the most effective modules for changing students' attitudes about trust building. We explored the challenges faced by instructors while teaching these modules. Lastly, it shows the role J-schools play in preparing students to work in a newsroom where trust building is a foundational principle. The study emphasizes this overlooked topic in journalism curriculums so they can improve this training area for students. It also will help students outside the classroom to create trust when addressing specific community issues.

ADOLESCENTS’ DEFINITIONS OF AUTHENTICITY
Luam Rincon, Angela Calvin (Mentor)

Feeling authentic, defined by researchers as being “in alignment with one’s true or genuine self,” is associated with positive well-being during adolescence (Lenton, Bruder, Slabu, & Sedikides, 2013, p. 279). However, how do adolescents conceptualize being “one’s true self”? This study takes an emic approach to examine adolescents’ perspectives of what it means to be authentic. 135 adolescents were asked, “What does it mean to be your true or real self?” Preliminary coding of their statements found the following most common themes: (1) not being influenced by others, (2) feeling comfortable, confident or happy with the self, and (3) who a person is when no one is around. Findings from this study provide an understanding of how adolescents’ perceptions of authenticity compare with researchers’ definitions.
PERSPECTIVES OF LATINX STUDENTS ABOUT THEIR SENSE OF BELONGING IN RURAL WISCONSIN

Abigail Robinson, Diego Roman (Mentor)

Between 2000 and 2015, the Latinx population in Wisconsin increased by 95%, becoming the fastest growing racial/ethnic group in the state. Yet, little is known about the experiences of Latinx students in rural schools, especially as it relates to measures of sense of belonging. To address this gap in the literature, this study documents the voices of middle and high school Latinx students attending school in a rural, predominantly White district located in northeastern Wisconsin. Our data included surveys and semi-structured interviews with our student participants, their parents, and their science and ESL teachers. Preliminary findings suggest that Latinx students have a strong sense of belonging, not as a result of culturally and linguistically responsive pedagogy, but rather through affiliation with the dominant culture.

BARRIERS TO CULTIVATING AVIAN HABITAT IN URBAN AREAS OF MICHIGAN

Corina Robinson, David Drake (Mentor)

As environmental racism and justice become increasingly popular in today’s language, it is important to focus on the relationship underrepresented communities have with their environment. These relationships are usually damaged and must be mended in the grand scheme plan to heal our planet. Extensive literature finds that avian conservation in backyards provides a start. This project’s goal is to conduct a human dimensions survey of lower socio-economic status (SES) residents of Lansing, Michigan, to understand their opinions, knowledge, experiences, and barriers to creating avian habitat in their neighborhoods. The results of the survey will increase our understanding of avian habitat in urban areas lacking such habitat and increased connection to nature for underrepresented audiences, which may lead to increased mental, emotional, and physical human health.

WEST AFRICAN SPIRITUAL PRACTICES: BEFORE, DURING, AND AFTER THE TRANSATLANTIC SLAVE TRADE

Robin Robinson, Paul Grant (Mentor)

For over 400 years, African American people have resided within the United States without a recollection of their history prior to the transatlantic. Within this project, my goal is to uncover the history of African American people prior to the transatlantic slave trade. The focus of this project is to trace back the history of the people within the African diaspora amid the arrival geographically and culturally in the Americas and beyond. Within this, I hope to find the historical indication of identity of African American people and their cultural origin through the exploration into the transatlantic slave trade, the cultural link between African Americans and West African culture and West African spirituality.

ON THE USES AND ABUSES OF FLOOD: AUGUSTINE’S THEO-POLITICS OF DISASTER

Alicia Rolsma, Richard Avramenko (Mentor)

This paper seeks to establish the relation between natural disaster and political theory in the case of flood. Focusing particularly on the works of Augustine, who is essential to understanding the pre-modern political theory of flood and disaster more broadly. His theory of flood provides a guide for healthy politics by enforcing a linear conception of time, distinguishing between punishment and destruction, and expanding temporal horizons. This study suggests that perceptions of flood have consequences for the individual, the community, and the public. If Augustine is correct about the role of flood in the shaping of healthy politics, important questions are raised about the potential role of disaster in both communities of antiquity and modernity.
GENTRIFYING ACTIVISM: MADISON’S DOWNTOWN STREET ART AND MURAL PROJECT
Dawry Ruiz, Jill H. Casid (Mentor)

Employing the lens of gentrification, this research reframes our understanding of the Downtown Street Art and Mural Project (initiated May 31, 2020) with funding from Arts in Public Places Looking Forward. It interrogates why it took the deaths of multiple Black people for Madison, a city viewed as liberal, to bring art to the streets. Asking whether this is genuine support of Black life or protection of private property, this investigation compares Madison to New York and looks at the relation of mural projects to the regulation and criminalization of political graffiti. The research accomplished thus far includes interviews with lead players in the Madison Arts Commission of the Madison City Planning Commission which reveal performative activism on the part of business interests.

AVOCADOS AND VIOLENCE IN MEXICO
Bri Saenz, Itzel de Haro Lopez (Mentor)

Drug trafficking organizations, also known as cartels, compete for profits in illegal markets. Due to the recent drop in opium prices, Mexican cartels have switched to a different type of commodity: avocados. This research focuses on the increasing revenue of a legal commodity, like avocados, along with a decrease in the prices of drugs. The effect on the income in Mexico increases incentives for cartels to appropriate the resources, which may have led cartels to diversify. In my research, I will use a difference-in-difference approach to analyze how changes in heroin prices affect violence outcomes in avocado suitable municipalities in Mexico. I find that decreasing heroin prices significantly affect violent crime in avocado-growing municipalities.

INVESTIGATING THE ROLE OF 5HMC IN MEDIATING TRANSCRIPTION FACTOR BINDING TO REGULATE GENE EXPRESSION
Lara Sak, Reid Alisch (Mentor)

Alterations in DNA methylation have been reported in numerous neurodevelopmental disorders. We reported variations in the DNA methylation modification 5-hydroxymethylcytosine (5hmC) in a neurodevelopmental disorder mouse model and recently found that altered 5hmC in transcription factor binding sites is correlated with transcript levels. These findings led us to hypothesize that 5hmC influences transcription factor binding to regulate gene expression. To test this hypothesis we performed chromatin-immunoprecipitation coupled with next-generation sequencing and electromobility-shift-assays (EMSAs) to identify 5hmC-induced disruptions associated with the binding of the transcription factor CLOCK. We found three genes (Fry, Gigyf1, and Palld) with differential CLOCK binding associated with altered 5hmC and transcript levels. Moreover, EMSAs validated that 5hmC influences CLOCK binding. These data suggest 5hmC regulates gene expression via mediating transcription factor binding.

EXPLORING CAMPUS EXPERIENCES AMONG FIRST-GENERATION MEXICAN-AMERICAN COLLEGE STUDENTS AT THE UNIVERSITY OF WISCONSIN–MADISON
Elizandra Sandoval, Janean Dilworth-bart (Mentor)

With a growing number of Latinx students in higher education, this study examines how first-generation Mexican-American college students experience a sense of belonging at the University of Wisconsin–Madison. This study shares the cultural and social values practiced by Mexican-American traditions to assess students' educational experiences. Furthermore, given the lack of research on Latinx students in the Midwest region, this study intentionally highlights Mexican-American identity, generational status, and campus climate. The purpose of this study is to explore how social and academic families shape campus experiences among first-generation Mexican-American college students. In turn, this study will explore how students persist by examining their psychological, social, and cultural well-being. Altogether, this study centers the experiences of underrepresented students to ensure that campus resources are culturally responsive.
STRATEGIC AND ENVIRONMENTAL EFFECTS OF ELECTRICITY TRANSMISSION EXPANSION
Shreyans Saraogi, Gaurav Doshi (Mentor)

In Texas, electricity generated from wind farms is transmitted to distant demand centers through electricity transmission lines. Between 2010 and 2014, Texas invested $6.8 billion into transmission lines expansion. In this project, we analyze the development of wind farms near transmission line expansion sites. Descriptive evidence suggests that development of transmission lines led to development of new wind projects and thus higher proportion of electricity from wind. I use t-tests and other statistical methods to test whether this finding is statistically significant. Preliminary results show that sites with transmission line expansion were associated with statistically higher levels of wind investment than other sites. This provides us empirical evidence to suggest that investment in transmission lines has a feedback effect on the growth of wind energy as well.

PREDICTION OF ALCOHOL USE DISORDER FROM FACEBOOK PRIVATE MESSAGES
Sarah Scalzo, Sarah Sant'Ana (Mentor)

Alcohol use disorder (AUD) is a prominent issue among college students and all emerging adults. Many young adults with AUD do not seek treatment due to low insight into their drinking behaviors, and current AUD screening processes suffer from underreporting bias, low reach, and low scalability. This project aims to apply machine learning approaches to Facebook private messages for passive identification of AUD in emerging adults. 836 undergraduates provided full downloads of their Facebook messages and were assessed in session for AUD. The optimum combination of natural language-based feature sets (e.g. LIWC, Word2Vec), tuning parameters, and classification algorithm (e.g., elastic net logistic regression, random forest) was selected using repeated nested k-fold cross validation. Results demonstrated predictive utility within Facebook data for classifying emerging adult AUD.

ACCESS SPEAKING RESPONSES PROJECT
Sophia Scherwinski, Jason Kemp (Mentor)

Spoken language is critical for academic success, and verbal communication helps facilitate learning in classrooms. An important question in K–12 education is: How do second language learners acquire the language needed for success in different subjects? An initial analysis of students’ responses to speaking tasks on an English language proficiency test demonstrated that math and science questions require more academic vocabulary across all grades and proficiency levels. Online tools (i.e., Scoreboard) and Excel spreadsheets helped researchers transcribe and code students’ spoken responses. This process, in turn, allowed researchers to better understand how levels of academic English proficiency across grades develops in complexity. Findings uncovered how language complexity—vocabulary and syntactic—increases in particular academic areas, such as mathematics and science, and by grade level.

MORE THAN MEETS THE EYE: SIGHT WORDS IN EARLY READING INSTRUCTION
Lauren Schilling, Mark Seidenberg (Mentor)

To become skilled readers, children must fluently recognize the words they encounter in texts. In many reading curricula, teachers provide instruction about sight words, high frequency words containing irregular sound-spelling correspondences. However, little is known about which words should be taught and how they should be delivered. The present study investigates the sight word lists and teaching methods of several early reading instructional programs. Seven measures of word qualities were computed: word frequency, length, imageability, age of acquisition, orthographic-phonological regularity, number of syllables, and number of morphemes. Our results indicate that there is little agreement about the relevant characteristics of sight words and how to teach them. These findings point to a need for developing clearer criteria for the selection and delivery of sight words.
IS PARENT MENTAL HEALTH RELATED TO THEIR PARENT-CHILD RELATIONSHIP QUALITY IN FAMILIES OF CHILDREN WITH AUTISM?

Theresa Schinkowitch, Sigan Hartley (Mentor)

Little research has explored the parent-child relationship in families of children with autism spectrum disorder (ASD) and if this relationship is shaped by parent factors. The objectives were to: (1) to examine correlations between parent’s level of parenting stress and depressive symptoms and parent-child relationship quality; and, (2) determine if there are differences in the strength of these correlations depending on parent gender. Data was analyzed from 189 mother-father couples of children with ASD (aged 5–12 years). Findings indicated that mothers and fathers perceived a similar level of closeness with their son/daughter. Parenting stress and depressive symptoms were negatively related to parent-child relationship quality. The strength of the correlations did not differ between mothers and fathers. This study has intervention implications.

DELETION OF FXR1P IN POSTNATAL EXCITATORY NEURONS INDUCES BEHAVIOR ABNORMALITIES

Keegan Schoeller, Minjie Shen (Mentor)

Fragile X related protein 1 (FXR1P) is a member of the FXR family of RNA binding proteins also containing FMRP and FXR2P. This family has primarily been studied in the context of diseases such as fragile X syndrome and autism. Genome wide association studies (GWAS) have also linked FXR1P to schizophrenia and bipolar disorder. In the present study, we aimed to identify the function of FXR1P in excitatory neurons within the forebrain. Using the CaMKII promoter, we selectively knocked out Fxr1 in pyramidal neurons of neonatal mice and identified impairments in sociability and learning as well as increases in compulsiveness and anxiety. Understanding the role of FXR1P is critical for furthering treatment for those impacted by these conditions.

SYMPTOM EXPERIENCES OF CHILDREN NEWLY DIAGNOSED WITH CANCER

Stephanie Scholl, Kitty Montgomery (Mentor)

Background: Children newly diagnosed with cancer often experience varying degrees of pain, nausea, fatigue, and changes in appetite; however, there is limited data describing these experiences. Purpose: To describe symptom experiences of children newly diagnosed with cancer during the first two months after initial hospitalization. Methods: Patient or parent-proxy surveys were administered to collect information on symptoms for children newly diagnosed with cancer after initial hospitalization and monthly for two months. Results: Descriptive statistics will be used to describe the symptom experience of 25 children newly diagnosed with cancer. Conclusions: Understanding the symptom experience of these children will allow for parents, caregivers, nurses, and providers to deliver tailored symptom management interventions, leading to improved quality of life, decreased hospital utilization, and improved health outcomes.

EXCEPTIONAL POINT IN NON-HERMITIAN METASTRUCTURE

Kyle Seledic, Ramathasan Thevamaran (Mentor)

Many new age engineering structures and devices are highly dependent on the ability to accurately test and measure their dynamic response. These tests require sensor devices such as accelerometers with enhanced sensitivities, which may be provided by utilizing the unique properties offered by exceptional points in non-Hermitian systems. In this research, a non-Hermitian system yielding exceptional points was designed using finite element analysis techniques. Work has been conducted to understand how various system parameters affect exceptional point formation. The understanding gained from these studies will guide experimental design to realize an exceptional point in a non-Hermitian metastructure. This work will potentially serve as the basis for next generation sensor design.
THE RELATIONSHIP BETWEEN FAMILY ECONOMIC STRAIN AND ACTIVITIES OF DAILY LIVING SKILLS IN CHILDREN WITH AUTISM

Leesa Sesing, Tori Fleming (Mentor)

Previous research suggests that economic strain affects child development (Wachs et al., 2016). However, little is known about the effects of economic strain on the developmental outcomes of children with autism spectrum disorder (ASD). This study examines the relationship between household income of families of children with ASD and child activities of daily living skills. The sample is composed of 188 families with child age ranging from 5–12 years. Pearson correlations indicated that higher household income was associated with higher functional academics scores ($r = .211$, $p < .05$), improved communication skills ($r = .187$, $p < .05$), and health and safety awareness ($r = .195$, $p < .05$). These significant findings have large implications for future educational policy and funding for additional autism services, especially for low income families.

EVALUATING ADOLESCENTS’ RESPONSE TO CELEBRITY PHOTO ALTERATION ON INSTAGRAM

Manya Shah, Anna Jolliff (Mentor)

For young people, viewing edited or idealized images is associated with negative self-esteem. However, little is known about how people respond in social media comment sections to highly edited photos. The purpose of this study is to assess feedback and displays of self-esteem on edited and unedited Instagram posts. A content analysis will be performed in the comment sections of popular influencers’ Instagram posts. Descriptive statistics will be used to evaluate commenters’ negative or positive responses to posts as well as commenters’ displays of self-esteem. A t-test will then compare the number of likes and comments on edited versus unedited photos. This examination allows insight into what is perceived as “acceptable” or “unacceptable” to post on Instagram and whether posts are associated with self-esteem.

“HOUSING FIRST” AND HOMELESSNESS GOVERNANCE IN MADISON, WISCONSIN: WHAT IS TO BE DONE?

Benjamin Wiley Sharp, Jenna M. Loyd (Mentor)

The COVID-19 pandemic both exacerbated Madison’s homelessness crisis and brought a new level of visibility to the controversial issue. Homelessness has been a severe problem in Madison for decades, but has often been occluded by city government. Through interviews with community stakeholders and review of local discourse, I examine the shift in the city’s approach to homelessness governance with the inauguration of its “Housing First” strategy and its construction of two long-term supportive housing developments. While the shift in the city’s homelessness governance strategies has been significant, I argue that it is insufficient to address the sheer scope of the homelessness crisis. The city must take bold action in order to protect its most vulnerable residents.

NEWS MEDIA USE MODERATES ASSOCIATIONS BETWEEN CONSERVATISM AND CLIMATE CHANGE ATTITUDES

Kellen Sharp, Damien Short, Marie-Louise Mares (Mentor)

Political ideology is known to predict concern about climate change and support for related policies. The current project examined whether news media use moderates these relationships. We surveyed an MTurk sample ($N = 175$) asking about political ideology, climate change attitudes, and news media use. Political conservatism was negatively associated with climate change concern and policy support. However, these relationships varied by level of news media use. At low (-1 SD) and mean levels of news media use, there were significant negative relationships; at high (+1 SD) news use, the relationships were trivially small and nonsignificant. High news media use may foster climate change concern/support across the political spectrum.
OVARIAN MORPHOLOGY AND FOLLICLE QUANTIFICATION IN A NONHUMAN PRIMATE MODEL OF POLYCYSTIC OVARY SYNDROME

Sarah Shaw, David Abbott (Mentor)

We hypothesized that experimentally induced reduction (knockdown) of estrogen receptor alpha (ERα) protein expression in the ventromedial nucleus (VMN) of female rhesus monkey hypothalamus would produce an ovarian phenotype similar to that seen in polycystic ovary syndrome (PCOS). VMN ERα knockdown (n=6) and control (n=5) female rhesus monkeys were generated by means of RNAi technology. Previously, we found that the ERα knockdown females exhibited luteal phase insufficiency and mild ovarian hyperandrogenism consistent with PCOS. To provide further insight into accompanying ovarian abnormalities, we utilized ovarian histology to determine ovarian dimensions and follicle populations, and correlated histology-based measures with ovary-regulating hormones.

CHARCOAL AS A PROXY: INVESTIGATING INCREASING FIRE ACTIVITY AFTER MEGAHerbivore EXTINCTION IN FLORIDA

Miranda Siedelmann, Angelina Perrotti (Mentor)

In a time when many large species are vulnerable to extinction, it is important to predict the environmental impacts that may result from their absence. This research project investigates the effects of megaherbivore extinctions on vegetation and fire activity, which may be used as an analog for extinctions of modern large herbivores. Comparing charcoal at 10cm intervals from ~4m of lake sediment (from Lake Tulane, Florida) reveals changes in quantity and severity of fires throughout the late quaternary period, during which North American megaherbivores became extinct. Periods with more charcoal indicate larger fires and more vegetation “fuel,” which indicate fewer megaherbivores. It is hypothesized that the quantity of lake sediment charcoal increased after megafauna extinctions due to the large role megaherbivores played in consuming vegetation.

IN-SITU TUMOR VACCINATION USING COMBINATORIAL RADIATION THERAPY AND IRON OXIDE, POLY L'LYSINE, CPG CONJUGATED NANOPARTICLES

Noah Siegel, Zachary Morris (Mentor)

Neoantigens induced by random mutations and specific to an individual’s cancer are the most important tumor antigens recognized by T cells. Among immunologically “cold” tumors, limited recognition of tumor neoantigens results in the absence of a de novo antitumor immune response. Radiation therapy (RT) can enhance immune recognition of cold tumors, resulting in a more diversified antitumor T-cell response, yet RT alone rarely results in a systemic antitumor immune response. A multifunctional iron oxide nanoparticle (IOP) composed of Iron oxide (Fe3O4) conjugated with Poly L'LySine and CpG Oligodeoxynucleotide may increase neoantigen retrieval and result in significantly decreased tumor growth and prolonged survival in B78 melanoma mouse tumor model.

SIBLINGS-HOW THEY SHAPE US

Lexi Siegel, Jason Fletcher (Mentor)

This thesis attempts to uncover how socioeconomic status and birth order affect young children’s education in the U.S. in the 2000s. There are several factors that affect the socioeconomic status of parents, which play a role in the educational level of their children. The relative educational levels among siblings alone seems to already be a highly investigated topic. Through analyzing results from studies and comparing brain structures among children of different classes, the role that parental income plays in a child’s academic performance becomes clearer. The influence of parental socioeconomic status and birth order on a child’s development is important information to acquire before working to better those factors, in order to produce the best possible outcome for children’s education in the U.S.
AI’S LAUGHTER
Jacqueline Sii, Jacqueline Sii, Jan Miernowski (Mentor)

Recent research clearly indicates artificial intelligence (AI) possess the ability to imitate emotional intelligence that is indistinguishable compared to a human. However, there is limited information in regards to the extent of spontaneous and conscious emotional intelligence in AI. Thus, this study analyzes the degree of humanness present in AI by observing laughter through human-computer interaction. These results reveal how emotions impact AI’s decision-making and responses when exposed to diverse stimuli. If AI robots encompass emotional intelligence, they will demonstrate potential to aid in psychiatric care and may provide companionship in nursing homes and hospitals.

SIBLINGS—HOW THEY SHAPE US: THE FRATERNAL BIRTH ORDER AFFECT.
Logan T.C. Silva, Jason M. Fletcher (Mentor)

In my research opportunity, the team is researching siblings—how they shape us, which is to ask hard questions that we can try to answer and further research. We conduct our research reading through lab reports and research studies, focusing on a different topic such as birth order, financial status, and how siblings get shadowed by their siblings. As an aspiring psychologist I took the chance to further research the birth order effect on males. Data has shown that more older brothers increases the likelihood of homosexuality. The study I read covers over 7,000 homosexuals and 12,000 heterosexuals. Each team member conducts their own research which we can then help people apply to the real world, as people make better sense of everyone's situation.

ANALYSIS OF Pb ISOTOPES IN DRIED BLOOD SPOTS USING INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY
Manasi Simhan, Sean Scott (Mentor)

Lead (Pb) exposure, even at low levels, can lead to neurodegenerative effects in infant and prenatal populations. Pb isotopes in blood reflect the “fingerprint” of exposure sources; therefore, such isotopes can be used to identify and mitigate these sources. In this study, we develop a method to measure lead isotopes in dried blood spots by multi-collector mass spectrometry. The use of newborn blood spots as a primary media allows for the identification and isolation of hazardous lead compounds much earlier than typical childhood exposure programs. Results show that isotopes can be measured accurately at levels above 5 µg/dL. This work will provide a first-response ability to health departments involved in childhood blood lead mitigation efforts and further aid in the efficiency of Pb tracing.

EVALUATING AN ALTERNATIVE ANALYSIS PIPELINE OF COLLAGEN DETECTION TO EXAMINE THE ROLE OF OSTEOPONTIN AND ITS ROLE IN INFLAMMATION-INDUCED PROSTATIC FIBROSIS
Kegan Skalitzky, William Ricke (Mentor)

Osteopontin (OPN) is a pro-inflammatory protein that has been indicated in prostatic fibrosis and the development of male lower urinary tract symptoms. Because inflammation-induced fibrosis is associated with higher collagen abundance, we are investigating collagen levels in wild-type and OPN knockout mice after transurethral instillation of *E. coli* to understand the role of OPN in prostatic fibrogenesis. Our recent project using picrosirius red staining and polarized light did not identify a significant difference in collagen levels. In this study, we developed an alternative analysis pipeline utilizing immunohistochemistry (IHC) to assess Type 1 collagen subunit (COL1A1) expression. Our findings show a significant increase in collagen levels in *E. coli*-treated mice compared to control, suggesting that IHC results in more specific collagen staining.
A BRIEF HISTORY OF THE "REPRODUCIBILITY CRISIS"
Alexis Smiezek, Nicole C. Nelson (Mentor)
An awareness of a growing issue in the field of research is emerging: published results once thought to be stable are now being found unable to be replicated. This failure to replicate is known as the “reproducibility crisis”. Although failures to replicate may look obvious in retrospect, they are often difficult to interpret in the moment. The purpose of this research is to further investigate the emergence of the reproducibility crisis and its impact on those who experience it. Through a series of oral histories with both students who have experienced irreproducibility and experts active in the reproducibility discussion, we aim to better understand the crisis, specifically in the fields of psychology, computer science, and biomedicine.

STUDYING REACTIONS OF SOLVATED ELECTRONS AT THE SURFACE OF WATER
Dylan Snider, Gilbert Nathanson (Mentor)
Solvated electrons are electrons surrounded by water molecules and not bound to any atom. They are an interesting, high-energy species that will react with nearly any molecule that they come into contact with. In our experiments, we generate solvated electrons by bombarding a thin jet of water in vacuum with sodium atoms, which immediately dissociate into sodium cations and solvated electrons at the surface of the water jet. Short-lived electrons may react exclusively with molecules sitting at the surface (such as soap-like molecules), while longer-lived electrons may permeate into the bulk before they react. By observing the different products of the reacting electrons, we can determine where they react and how long they live before reacting.

USING TWITTER TO DISSEMINATE UP-TO-DATE INFORMATION ABOUT COVID-19 IN LATINX COMMUNITIES
Lizbeth Solórzano, Maria Mora Pinzon (Mentor)
COVID-19 has a disproportionate impact on Latinx people. The goal of this project is to create medically accurate content about COVID-19 to increase the spread of information in Latinx communities and identify best-practices. Due to the misinformation spread regarding the development and administration of the COVID-19 vaccine there has been more content produced specifically on this topic. The types of social media posts used are polls, images, videos, and text largely on Twitter but in addition to Facebook. Between October 2020 and January 2021, I have created 26 posts that have reached 15,000 people with 790 engagements and the number of followers has increased from 38 to 74. Social media for health promotion can reach large groups, additional in-person outreach is required for better engagement.

MEASUREMENTS OF THE HALL ELECTROMOTIVE FORCE IN MST TOKAMAK PLASMAS USING THE HALL DEEP INSERTION PROBE
Winston Solsrud, Noah Hurst (Mentor)
Previous experiments in reversed-field pinch plasmas in the Madison Symmetric Torus (MST) have studied the Hall dynamo, a mechanism which creates an electromotive force (EMF) in the plasma due to magnetic fluctuations. The Hall Dynamo can have significant effects, like modifying the equilibrium current during magnetic reconnection events. The goal of this experiment is to further understand plasma self-regulation by studying the Hall dynamo in MST tokamak plasmas during magnetic oscillations known as sawteeth. A generalized Ohm’s Law is used to derive an expression for the parallel Hall EMF in terms of fluctuating magnetic fields. The Hall EMF is evaluated with magnetic field measurements by a deep insertion probe. This work is expected to be relevant to nuclear fusion and astrophysics research.
DIRECT IDENTIFICATION OF KIR2.1 PHOSPHORYLATION SITES BY MASS SPECTROMETRY

Kunal Sondhi, Lee Eckhardt (Mentor)

KCNJ2 codes for the inwardly rectifying potassium channel Kir2.1: the Ik1 current in cardiomyocytes. The KCNJ2 mutations R67Q and V227F have been shown to associate with catecholaminergic polymorphic ventricular tachycardia (CPVT). We reported previously using electrophysiological techniques that these CPVT mutations cause a loss of phosphorylation at residue Ser425 in Kir2.1. Further, preliminary immunoblot-based (i.e. PhosTag) experiments and top-down proteomics show that there are three distinct phosphorylation sites. Using MS analysis, we confirmed the distal C-terminal Ser425 phosphorylation site as well as identifying sites at Tyr315 and Thr353 in the Kir2.1WT samples. Interestingly, we observed N-terminal phosphorylation at Ser13 or Ser14 as well as phosphorylation at Tyr326 in the Ser425Ala samples.

EARLY DEVELOPMENTAL ORIGINS OF ALTERED MORPHOGEN SIGNALING IN DOWN SYNDROME

Isabella Sorci, Anita Bhattacharyya (Mentor)

Down syndrome (DS) is a common genetic disorder characterized by a trisomy of chromosome 21 which leads to intellectual disabilities through unknown molecular mechanisms. While gene expression and pathway analyses of DS neurons have been done, they have yet to be applied to DS neurons in early development, during which we propose there are many dysregulated genes. To test this hypothesis, we will analyze gene expression differences in early DS neural development and validate our preliminary RNAseq data which suggest many genes are dysregulated in days 6 and 10 of in vitro DS iPSC-derived neuron development. Furthermore, we will use pathway analyses to identify dysregulated molecular pathways in this timeframe, which will allow for the generation of new hypotheses regarding DS brain development and dysfunction.

THE RACIAL/ETHNIC DIFFERENCES IN THE PREVALENCE OF CHOLESTEROL SCREENING DURING AN ECONOMIC CRISIS: A CROSS-SECTIONAL STUDY USING HEALTH & RETIREMENT STUDY

Serena Sorensen, Wan-Chin Kuo (Mentor)

Background: Although cholesterol screening rates in the U.S. improved in the past decade, the impact of economic instability and racial differences remain unclear. Purpose: This study aimed to examine the racial differences in the prevalence of cholesterol screening during economic instability. Methods: We analyzed data from the Health and Retirement Study, a nationally representative longitudinal survey of individuals over age 50 in the U.S. Chi-squared tests were used. Results: Black, Indigenous, and people of color (BIPOC) were less likely to have cholesterol screening, compared to Whites (p<0.001). The racial differences were stronger during the economic downturn (2008–10) compared to the racial differences before (2006–08) and after (2010–12) the Great Recession. Conclusion: Our results highlight the need to address racial disparities in cholesterol screening.

INVESTIGATING DYNAMIC HARDNESS OF SINGLE CRYSTAL METALLIC MATERIALS

Shreya Sreedhar, Savannah Ahnen, Ramathasan Thevamaran (Mentor)

This investigation aims to develop a fundamental understanding about the mechanical behavior of single crystal face-centered cubic metals under high-velocity projectile impact situations. Laser-induced projectile impact testing deforms single crystal metal substrates using spherical micro-projectiles at different impact velocities. A scanning electron microscope (SEM) and interferometer are used to examine the morphology and volume of the impact-induced craters. The evaluation of this data allows for the establishment of correlations between crystal symmetry directions of single crystal metals and their mechanical properties under high-velocity projectile impacts with a focus in dynamic hardness. This foundation could provide in-depth understanding of the structure-property relations in nano-structured metals under high-velocity projectile impact. It will enable the design of metals with superior performance in impact protection applications.
IMPROVED BOUNDS AND ANALYSIS OF THE NOISY POWER METHOD

Lucas Stanley, Laurent Lessard (Mentor)

The power iteration algorithm is a well-known algorithm within linear algebra used to compute the dominant eigenvalues of a matrix. We have performed an analysis of the “noisy power method,” or the power method applied to a linear system with additive noise. The algorithm's performance may be categorized into three distinct regions: transient behavior, linear convergence, and steady-state. Expanding upon the work of previous meta-analyses which focused more upon the convergent phase, we have been able to provide additional concentration bounds for the algorithm over larger regions of its performance, and provide numerical validation of these results.

SEARCH FOR MOLECULES IN THE HALO OF THE MILKY WAY USING THE ATACAMA LARGE MILLIMETER ARRAY

Lucy Steffes, Snezana Stanimirovic (Mentor)

Chemical species in the Interstellar Medium (ISM) emit radiation, frequently as radio waves. We analyze observations of different molecules in the diffuse ISM obtained with the Atacama Large Millimeter Array, in pursuit of understanding how molecules form and survive in the ISM. Molecular spectral lines detected indicate physical properties of the environment; low temperature and higher pressure are typically required for molecular formation. The most abundant molecule, H2, does not produce radio waves, thereby requiring the use of CO and other tracers to predict the relative abundance of H2. Observations of the Magellanic Stream, a gas cloud encircling part of the Milky Way, depict an extreme of typical clouds in the Interstellar Medium, as there have not yet been molecular detections nor observations of stars.

ICONOGRAPHY AND CREATION OF HOPEWELL EFFIGY PIPES: AN EXPERIMENTAL APPROACH

Sophie Stein, Jonathan Mark Kenoyer (Mentor)

Experimental replication of a soft stone effigy pipe was carried out in order to document specific aspects of technology and cultural style. These effigy pipes were originally made by Native American tribes of the Hopewell culture, Middle Woodland Period, 100 BCE—CE 500. A frog effigy pipe was created out of catlinite using traditional stone tools as well as some modern tools. Manufacturing stages and the time and effort associated with using different types of tools were documented and compared. The use of intermittent or continuous crafting time was also noted and compared with ethno-graphic examples to better understand the potential role of women in ancient stone effigy pipe production. The cultural importance and religious symbolism of amphibians on the pipes was also investigated.

ELECTRON BEAM CONTROL SYSTEM FOR NOVEL MULTI-SOURCE METAL 3D PRINTER

Leo Steiner, Kevin Eliceiri (Mentor)

A proof of concept system for a high-speed electron beam 3D metal printer is being designed in the Eliceiri group at the Morgridge Institute for Research. This novel system could fabricate specialized, precise, metal parts for a number of applications including patient specific medical implants. A novel beam extraction system needs to be designed and built that can simultaneously control the three pulsed electron beams in the metal printer. Changes needed to be made to the software and hardware of the beam extraction circuit design. Initial simulation shows the pulse shape of the beam extraction system to be valid. Successful completion of this printer could pioneer a field of its own in the 3D metal printing industry by changing the way metal is printed.
THE ROLE OF SOIL FERTILITY IN THE CONTROL OF GROWTH AND DISEASE IN NURSERY-GROWN RED PINE SEEDLINGS

Annalisa Stevenson, Nick Balster (Mentor)

Wilson State Forest Nursery, the only facility in Wisconsin, provides both hardwood and coniferous seedlings to afforest and reforestation efforts that are critical to environmental and economic interests of the state. Recently, nursery managers have observed spatially incongruent symptoms suggestive of various diseases in red pine (*Pinus resinosa*) seedlings that have resulted in stunted growth and premature death. The nursery has historically been managed to maintain certain soil fertility measures including a pH between 5–6, although this has been challenged with alkaline irrigation water. I will present an empirical study that elucidates the links between the prevalence and severity of disease relative to changes in soil fertility measures including pH. These data will be used to prescribe soil practices to reverse these trends.

REPRESENTATION: OAKLAND RAGE

Alpha Stokes, Pamela Oliver (Mentor)

This research project examines how mainstream (White) newswires and Black newspapers described the anti-police protests in Oakland in 2009–10 after the killing of Oscar Grant by transit police officer Johannes Mehserle. The research project involves describing this news coverage for a social science audience. The presentation will be a cohesive series of spoken word poetry and film based on this research. The presentation will include reenactments of historical events candid shots of the city of Oakland.

CONTENT AND LINGUISTIC ANALYSIS OF COVID-19 TWEETS ON UW–MADISON’S TWITTER PAGE

Zoe Stratman, Reese Hyzer (Mentor)

Social media can improve access to critical health information, especially at universities. The purpose of this study was to evaluate COVID-19 messaging on UW–Madison’s Twitter account to determine how tweet language, post frequency, and engagement, changed during the fall semester. We conducted content analysis of UW–Madison’s tweets from August 15–December 23, 2020. Tweets that mentioned COVID-19 were coded. Analysis utilized the LIWC software to assess linguistic elements of tweets. A t-test was used to determine significant differences in language during periods of high and low COVID-19 rates, and the relationship between post frequency and engagement and the number of COVID-19 cases was determined using correlations. Findings will help universities effectively disseminate public health information and regulations to their faculty, staff, and students via Twitter.

DEVELOPMENTAL DIFFERENCES IN RHESUS MACAQUES PRENATALLY EXPOSED TO ZIKA

Madison Stumpf, Karla Ausderau (Mentor)

Prenatal Zika virus (ZIKV) has contributed to a subset of children with late-onset developmental deficits, including language, regulation, motor, and cognition delays. Rhesus macaques are an ideal model system to examine these deficits because they share numerous characteristics with humans. The purpose of this research is to determine differences in the ZIKV exposed infants compared to the controls in their fine motor skills and sensory regulation. A PVC task was administered at 4 months of age to evaluate the animals’ ability to retrieve raisins and frosting, primarily focusing on finger dexterity, isolation, and tactile modulation. Preliminary findings suggest developmental differences among infants who were prenatally exposed to ZIKV as compared to controls in their fine motor development and behavioral regulation.
IN VITRO UPREGULATION OF Y-PROTOCADHERIN THROUGH A CRISPR/dCas9-GENE ACTIVATION SYSTEM

Moosa Syed, Xinyu Zhao (Mentor)

Methyl-CpG-binding domain protein1 (MBD1) is known to epigenetically regulate gene expression though a DNA-methylation-mediated mechanism. Deficiency in MBD1 has been linked to hallmark symptoms of autism-spectrum disorder (ASD), so it is critical that we understand MBD1's role in normal brain function. ChIP-seq and qPCR of cultured neurons revealed that MBD1 binds to the y-protocadherin (Pcdh-y) gene cluster and that MBD1 deficiency leads to the upregulation of Pcdh-y. To investigate whether upregulation of Pcdh-y leads to ASD phenotypes, we designed a CRISPR/dCas9 gene activation method to promote Pcdh-y expression. Transfection in culture and subsequent qPCR confirmed that Pcdh-y was indeed upregulated. This system may serve as a powerful tool to examine the effects of Pcdh-y upregulation in mice.

UNDERSTANDING THE BLUE STRAGGLER DISTRIBUTION OF NGC 188

David Szymulewski, Robert Mathieu (Mentor)

Outside the solar system there exist binary stars—stars that are found in pairs. The dynamical interactions between the stars in binaries influence the evolution of each star, often resulting in exotic products. One such product is known as the blue straggler. Unusually hotter and more luminous than they ought to be given our understanding of single-star evolutionary models, blue stragglers have challenged astrophysicists since the 1950s. While we do have an understanding of the mechanisms by which these stars are produced, what remains to be uncovered is their origin binaries. This study explores the parameter space governing the evolution of binary stars into blue stragglers (specifically those inhabiting the star cluster NGC 188) using the Modules for Experiments in Stellar Astrophysics software.

THE STRUCTURAL NEURAL CORRELATES OF PTSD AND THEIR EFFECTS ON ACADEMIC ACHIEVEMENT

Dana Tabaza, Josh Cisler (Mentor)

Post Traumatic Stress Disorder (PTSD) is a mental health condition characterized by re-experiencing, avoidance, and hyperarousal due to experiencing a traumatic event and affects 3.5% of the United States population. Studies show that 3–15% of adolescent girls who experience trauma develop PTSD. We will investigate the differences in academic achievement between trauma exposed and non-trauma exposed adolescent girls through examining the structural differences in grey matter volume and cortical thickness of the hippocampus (long-term memory and recall), and the orbitofrontal cortex (response control and decision making). MRI scans and assessments that measure behavior and trauma exposure will be used to address this question. This study enables us to understand the neurobiological correlates of PTSD in order to effectively treat the complexities caused by trauma.

EFFECT OF WILDFIRES ON SOIL CARBON AND PH IN CANADIAN BOREAL FORESTS: 1- AND 5-YEARS POST-FIRE

Judith Tafur, Teresita Cordova, Thea Whitman (Mentor)

Climate change is increasing the frequency and intensity of boreal forest wildfires in Western Canada. It is important to understand how they impact soil carbon and pH over time as these properties affect the structure of the vegetation and soil microbial communities. In 2015 (1-year post-fire) and 2019 (5-years post-fire), soils were sampled to a depth of 35 cm from burned (n =27) and unburned (n = 7) sites in Wood Buffalo National Park and Northwest Territories of Canada. Paired t-tests were used to assess how soil carbon and pH changed over time, while linear regression was used to determine if there was a relationship between fire severity with soil pH and carbon. This study would indicate if and when soils recover from wildfire.
EFFECTS OF β-CELL-SPECIFIC GLP-1R ON β-CELL PROLIFERATION AND INSULIN SECRETION

Jiayin Tang, Dawn Belt Davis (Mentor)

Glucagon-like peptide-1 (GLP-1) is critical for insulin secretion and β-cell proliferation. The actions of GLP-1 are mediated through binding to the GLP-1 receptor (GLP-1R), which is highly expressed in the β-cells. Prior studies showed one-week of high fat diet (HFD) feeding increases β-cell proliferation and insulin secretion. However, whether β-cell GLP-1R signaling is involved in this early adaptive β-cell proliferation remains unclear. To investigate the role of β-cell GLP-1R, we fed Glp-1r fl/fl (WT) and Glp-1r fl/fl –Ins1Cre (KO) mice with HFD for one week. β-cell proliferation and insulin secretion were measured. We found the expression of proliferation markers is higher in KO than WT. Understanding the role of β-cell GLP-1R is necessary for developing new strategies to augment β-cell mass in type 2 diabetes.

ANALYZING THE EFFECT OF PTPN11 IN ALVEOLOGENESIS

Maika Thao, David McCulley (Mentor)

Congenital diaphragmatic hernia (CDH) is a common and severe disease characterized by an opening in the diaphragm and herniation of abdominal organs into the thorax. Risk of mortality is due to abnormal development of lung and pulmonary vasculature. Our central hypothesis is that mutations in a core group of genes, such as protein tyrosine phosphatase non-receptor Type 11 (PTPN11), are responsible for defects in lung development associated with CDH. My research examined the role of Pttn11 during alveologenesis using an inducible and tissue-specific gene deletion approach in mice. My results demonstrate that Pttn11 is required in the lung mesenchyme for maintenance but not initiation of alveologenesis. These findings have helped improve our understanding of how changes in cell cycling are responsible for congenital lung defects.

EXPERIENCE OF HEARING LOSS AND CARE IN THE HMONG COMMUNITY: A QUALITATIVE STUDY

Sara Thao, Maichou Lor (Mentor)

Hearing loss is a prevalent chronic illness in the United States; yet no research has been done on the Hmong community. This study examined the experiences of Hmong patients with hearing loss and their caregivers. We interviewed 11 participants (n=9 patients, n=2 caregivers). Interviews were recorded and analyzed using conventional content analysis. Overall, patients and caregivers have different levels of acceptance. Some patients accepted their hearing loss and strive to adapt, whereas some were unable to accept and struggled to disclose their condition. Patients used technology (e.g., hearing aids), face-to-face communication, and/or altered their environment to improve their hearing. All caregivers sought a shaman to improve their family member’s hearing loss. Patients and caregivers desire social and emotional support and more education from healthcare providers.

A SYSTEMATIC REVIEW ON THE NEEDS OF DEMENTIA CAREGIVERS ACROSS CARE SETTINGS

Lesley Thao, Olivia Condon, Beth Fields (Mentor)

The purpose of this systematic review is to identify the specific needs of informal, unpaid caregivers of older adults with dementia, and how those needs differ across care settings in the United States. We identified a total of 12,651 articles through electronic literature searches of Medline, PubMed, PsychINFO, and CINAHL, plus manual reference checks of articles on caregiver needs published in English between 2006 and 2019. After screening the article abstracts and full text, 22 articles were included for data extraction and quality appraisal. Our next step is to synthesize the data by February 2021. Identifying the needs of caregivers will inform tailored interventions to equip them with the tools they need to fulfill care tasks for older adults with dementia across care settings.
THE IMPACT OF MINDFULNESS-BASED STRESS REDUCTION ON DEMENTIA SYMPTOMS
Gordon J. Thompson, Gudrun Buhnemann (Mentor)

As the elderly population grows in the United States, aging-associated diseases such as dementia will become more prevalent. With current treatments for dementia fairly limited, healthcare professionals may turn to more integrative techniques to ease dementia symptoms. Mindfulness-based stress reduction (MBSR) is a secularized meditation technique that was developed in order to decrease stress and chronic pain in a variety of patients. Recently, pilot studies have been conducted to analyze the impact of MBSR on the quality of life, cognitive functioning, and stress levels of dementia patients. While early research involving MBSR and dementia appears to have positive implications, current studies have been limited by their methodology. These methodological limitations need to be addressed to successfully determine the effectiveness of MBSR in treating dementia.

ASSOCIATIONS BETWEEN HOUSEHOLD CHARACTERISTICS, PARENT STRESS, AND CHILD MEDIA EXPOSURE
Sadona Thompson, Zoe Zanella, Andrew Bredland, Annalisa Chu, Heather Kirkorian (Mentor)

Parental stress may be a mechanism to explain the relationship between household factors and child media exposure. Previous research on children's media usage overlooks household factors. The purpose of the current study is to examine mechanisms (e.g., parent education, employment status) related to parental stress and how these factors are related to child media exposure. We will use correlational analysis with survey data from parents of young children, focusing on household characteristics, parent stress, and child media use. We expect that lower parental educational status and greater sources of stress will predict more child exposure to media. Findings will provide a better understanding of the context surrounding child media use and can help determine if certain populations are more susceptible to excessive media exposure.

RISK AND PROTECTIVE FACTORS OF A SENSE OF RESILIENCE IN WISCONSIN FAMILIES: SCHOOL SHUTDOWNS IN THE EARLY STAGES OF THE COVID-19 PANDEMIC
Milly Timm, Janean Dilworth-Bart (Mentor)

The beginning of the COVID-19 pandemic and the subsequent school shutdown were a disruptive event for families across the state of Wisconsin, leaving parents with the task of aiding their children’s education on top of other pandemic stressors. Previous research indicates that factors such as community bond bolster a sense of resiliency during stressful times. This study aims to explore further risk and protective factors of perceived resiliency in families who experienced a disruption in their child’s education. Using Wave I data from the Survey of Wisconsin Health, we will explore moderators of resiliency such as access to healthcare, job security, coping mechanisms, and access to childcare. This will provide a glimpse into what helps and hinders Wisconsin families’ sense of resiliency during COVID-19.

COLD ATMOSPHERIC PLASMA AS TREATMENT FOR PEDIATRIC RHABDOMYOSARCOMA CANCER
Ani Torres, Hau D. Le (Mentor)

Cold atmospheric plasma (CAP) has gained recent traction in treating solid cancers. There are two main types of this plasma application: outside of an organism (in vitro) or inside of it (in vivo). Regardless, there is more knowledge about CAP treatment for vitro applications. Moreover, the overall process entails initiating reactive species for the cancerous cells, targeting cell death for the malignant, a series of applications, and a host of other items. The use of CAP as treatment for rhabdomyosarcoma cancer in children has yet to be surveyed. Preliminarily, this research hopes to provide more context in applying cold atmospheric plasma to the pediatric form of rhabdomyosarcoma cancer.
INVESTIGATING THE EFFECTS OF NEUTROPHILS AND SKIN BACTERIA ON MELANOMA PROLIFERATION
Marielena Trujillo, Morgan Giese (Mentor)

There are more than 200,000 cases of melanoma in the U.S. per year, causing most skin cancer-related deaths. It is known that signals in the tumor environment affect tumor growth, including immune cells such as neutrophils, and even bacteria. High neutrophil numbers are correlated to poor patient prognosis in melanoma, but it is unknown what causes this. Since neutrophils are the first responders to infection, skin microbes on melanoma might affect cancer growth. This study seeks to investigate the effect of neutrophils and bacteria on melanoma proliferation. Utilizing ImageJ, we can evaluate neutrophil-tumor cell interactions with and without bacteria. Studying how melanoma proliferation is affected by neutrophils and bacteria can lead to improved melanoma patient prognosis by creating new anti-cancer therapies.

EFFECTIVENESS OF DIFFERENT FAN SPEEDS FOR REDUCING SIGNS OF HEAT STRESS IN DAIRY COWS
Kiara Twumasi, Jennifer Van Os (Mentor)

Heat stress negatively impacts the health of dairy cows and milk production. Our objective was to evaluate the cooling effectiveness of different airspeeds from fans over the cows’ resting area. From June to August 2020, 128 Holstein cows (n = 8 groups of 16 each) experienced each of 3 treatments: 100% fan power, 60% fan power, and control (natural airflow only). A trained observer blinded to the treatment measured respiration rates from video recordings 2x/week around 2 p.m. (peak heat of day). Skin temperatures were also taken at those times using an infrared camera. We predict that when cows experience the 100% fan power treatment, they will have lower respiration rates and lower skin temperatures compared to in the 60% fan power treatment and control.

UNDERSTANDING THE INFLUENCE OF SOCIAL SUPPORTS ON PARENT STRESS FOR PARENTS OF CHILDREN WITH AUTISM SPECTRUM DISORDER: DIFFERENTIATING BETWEEN POSITIVE AND NEGATIVE SOCIAL EXCHANGES
Emily Unmacht, Sigan Hartley (Mentor)

Social supports influence stress levels of parents of children with autism spectrum disorder (ASD) (Shepard et al., 2020). Less is known about the quality of exchanges these supports provide and their influence on parent stress. This study examines the association that positive and negative social interactions between parents of a child with ASD and their social supports have with parent stress. Parents (N=377) reported on their parenting stress and positive and negative social exchanges with their social supports. Pearson correlations indicated significant associations between unsympathetic social supports and parent stress (r=.373, p=.000) as well as between emotional supports and parent stress (r=-.102, p<.05). These results suggest that social supports alleviate parenting stress if the social exchanges are positive but may exacerbate stress if negative.

GENETICALLY ALTERING HISTONES IN S. CEREVISIAE TO IMPROVE INHIBITOR TOLERANCE AND INCREASE BIOFUEL YIELDS
Paul Urban, Trey Sato (Mentor)

The budding yeast Saccharomyces cerevisiae is a workhorse in the renewable bioenergy research sector due to its ability to produce biofuel at a high rate and titer, and tolerance to industrial fermentation conditions. Current genetic engineering approaches are looking to minimize sensitivity to inhibitors present in sustainable plant feedstocks while maximizing biofuel output. Based on recent chemical genomic data, genes related to the exchange of the histone H2A in the nucleosome for its variant, H2AZ were targeted. The presence of the histone variant H2AZ in the nucleosome has been predicted to increase yeast growth in inhibitors. Overexpression of genes related to H2AZ deposition in the nucleosome and deletion of genes related to H2A deposition are both hypothesized to result in improved yeast inhibitor tolerance.
EXAMINING SEASONAL VACCINE HESITANCY IN THE EMERGING ADULT POPULATION: A LITERATURE REVIEW

Kayla Van Boxtel, Anne Ersig (Mentor)

Vaccine hesitancy, including seasonal vaccine hesitancy, is a constantly evolving public health threat. Many studies have examined vaccine attitudes, but few focus on emerging adults, who range in age from 18 to 24. The purpose of this literature review was to examine findings from existing studies of seasonal vaccination attitudes among emerging adults and identify factors influencing their uptake of them. Preliminary results from 8 articles identified common trends such as familial opinions of vaccination and overall convenience influenced immunization attitudes and revealed concerningly low overall seasonal immunization uptake among this population. Findings from this literature review will guide a study examining emerging adults’ attitudes towards seasonal and COVID-19 vaccinations and inform future campaigns to increase uptake of these immunizations among this population.

EXPLORING MEANINGS OF “MOB” IN THE HMONG LANGUAGE WITHIN THE HEALTH CONTEXT

Lee Vang, Maichou Lor (Mentor)

Language plays an important role in pain assessments. Research has shown that cross-cultural misunderstandings can occur when patients and healthcare providers do not share the same language and culture. In the Hmong language, the word mob can refer to pain or an illness. Yet, no research has examined its meaning in the context of health. We conducted a secondary analysis of 67 interviews of Hmong patients who participated in a pain study. Using dimensional analysis, we found that the word mob has three dimensions of pain meanings—physical, psychological, and emotional. This study’s findings can increase Hmong medical interpreters’ and healthcare providers’ understanding and awareness of pain communication among Hmong patients.

EXPLORING WAYS TO IMPROVE DIABETES MANAGEMENT AND HEALTH LITERACY IN THE HMONG COMMUNITY USING AN INTERGENERATIONAL APPROACH AND TECHNOLOGY

Addison Vang, Brittany Yang, Linda Park (Mentor)

In Wisconsin, Type 2 diabetes mellitus (T2DM) prevalence rates for Hmong are more than double that of non-Hispanic Whites. Contributing factors are high rates of limited English proficiency and low literacy rates (health and education). Their strong adherence to cultural practices challenges Western medicine, creating difficulties in managing T2DM. A good intervention to address these difficulties for Hmong elders remains unknown. This study focused on using an intergenerational approach by understanding family caregivers’ support needs and identifying strategies to help their parents manage T2DM. Caregivers and case managers working with Hmong elders were interviewed. The study results will help modify an evidence-based health system developed at UW–Madison to increase the caregivers’ health literacy through education and support culturally sensitive strategies delivered via a smartphone app.

TARGETING SIRT1 TO RESTORE CIRCADIAN RHYTHMS AND SLEEP, REDUCE SEIZURES, AND DELAY MORTALITY IN A MOUSE MODEL OF SUDEP

Swati Vattem, Rama K. Maganti (Mentor)

Epilepsy is a spectrum disease characterized by recurrent hypersynchronous discharges of neurons. Sudden unexplained death in epilepsy (SUDEP), which has associations with sleep, is the leading cause of mortality. Disrupted circadian rhythms have been shown in the Kv1.1 knockout model. In this model of SUDEP, disrupted circadian oscillation of clock genes and an epigenetic regulator, Sirt1, was shown previously. Here, in the Kv1.1 mouse model, we investigated whether positive modulators of Sirt1 (SRT1720) can restore the disrupted circadian rhythm, diminish seizures, and delay mortality. We show that that SRT1720 decreased seizure frequency by 52%; however, it had no impact on seizure duration. Results on seizure severity were inconclusive. Currently, the effects of SRT1720 on sleep-wake patterns and mortality are being examined.
BIRTH ORDER AND THE NEED TO ACHIEVE
Anna Veenendall, Jason Fletcher (Mentor)

This study looks at the major research findings regarding the relationship between sibling characteristics and birth order for a potential book project. By exploring academic journals with both a psychological and sociological lens, our group of students has been exposed to several common themes regarding birth order. To narrow the research and explore the reasoning behind these findings, I will be focusing on why first borns do better than their siblings, in regard to academic achievement and annual earnings, and specifically whether first borns tend to exhibit more need achievement and achievement motivation than their siblings that allow them to succeed. By understanding the reasons for these differences there is a potential to adjust education and parenting models to help mitigate these effects.

ENVIRONMENTAL STRESS RESPONSES IN THE ALPINE GROUND BEETLE, NEBRIA VANDYKEI
Benton M. Veire, Sean D. Schoville (Mentor)

As climate change rapidly affects ambient temperatures and snowpack in alpine habitats, it is crucial that we understand the biological affects and conservation implications for rare alpine species. This study examines whether the alpine ground beetle, *Nebria vandykei*, has evolved heat, cold, and/or desiccation tolerances in the form of an induced gene regulatory response. By examining the gene expression patterns following these stressors, the genetic basis of a physiological response can be identified. Our results show a clear regulatory response to each stressor and expressed genes that are common among general stress responses. We suggest that these beetles have evolved some tolerance to these environmental stressors, but accelerated climate change warrants more research to understand the degree of tolerance and its fitness consequences.

DATA DRIVEN DESIGN OF NOVEL POLYMER-CERAMIC COMPOSITE SOLID ELECTROLYTE
Monniesh Velmurugan, Jiamian Hu (Mentor)

Solid-state batteries are the rising next generation batteries for powering sophisticated technology. The key advantage of a solid-state battery is the solid electrolyte that is safer and more stable than traditional liquid electrolyte. The conductivity of composite solid electrolyte—which consists of polymer matrix, ceramic fillers, and the interface in between—is highly related to its microstructure. However, the study of such microstructure-property linkage through experiments is usually expensive and tedious. Here, we are trying to use methods of computational materials science to reveal the linkage. Various microstructures will be generated, and the conductivity will be calculated through phase field simulation. The simulation data collected will be used to train a 3D-convolutional neural network, which will accurately predict the conductivity of solid electrolytes.

CHARACTERIZATION OF LEWIS RAT LIVER DENDRITIC CELLS GENERATED BY FLT3L ADMINISTRATION
Josh Verhagen, David Al-Adra (Mentor)

Conflicting reports have emerged demonstrating that the two major subsets of DCs, plasmacytoid DCs (pDCs), and classical DCs (cDCs) may play differing roles in episodes of allograft dysfunction and rejection. There is interest in characterizing the phenotype and functionality of tissue-specific subsets of DCs. However, tissue-specific DCs are hard to characterize as they compose a small cell population; therefore, DC yield can be increased by using FMS-like tyrosine kinase 3 ligand (FLT3L). The exact phenotype and function of dendritic cell subpopulations, specifically in the rat liver, has yet to be well characterized after FLT3L exposure. Our aim is to explore the effects of FLT3L on rat liver-resident cDC and pDC populations as well as further characterize the phenotype of these specific cell populations.
CHARACTERIZING THE IMPLICATIONS OF THE EPITHELIAL-TO-MESENCHYMAL TRANSITION IN PANCREATIC ADENOCARCINOMA ON THE TUMOR MICROENVIRONMENT

Nate Verhagen, Philip Emmerich (Mentor)

Pancreatic ductal adenocarcinoma (PDAC) has a dismal prognosis due to its treatment-resistant tumor microenvironment (TME) and its metastatic potential via epithelial-to-mesenchymal transition (EMT). Macrophages are the most abundant cell type in the TME and are conducive for tumor growth, metastasis, and therapeutic resistance. Specifically, M2 macrophages, which are polarized via MCSF-1 signaling, are associated with immunosuppression and worse overall survival. Western blot analysis of PDAC spheroids identified much greater MSCF-1 production in spheroids that underwent EMT. Additionally, qPCR exhibited three cytokines differentially expressed in EMT PDAC cells (TGF-β, IL-6 and IL-10; p < 0.01). These differences are thought to contribute to the observed decreased stromal organization in EMT tumors. Further characterization of EMT is necessary to explore the potential of exploiting these differences therapeutically.

GIS ANALYSIS OF EROSION AND PRESERVATION OF LOESS TABLELANDS, CENTRAL GREAT PLAINS

Tien Vo, Joseph Mason (Mentor)

The Central Great Plains is a premier site of potentially mobile loess (wind-blown dust deposit) and dune landscapes. The maintenance of these landscapes is potentially important for long-term storage of organic carbon and dust. As climate quickly changes, these landscapes are vulnerable to destabilization and movement. In order to predict their response to changing climate, it is crucial to understand the role of loess tablelands in preserving these landscapes. The objective of the study was to quantitatively determine how tablelands have affected preservation of loess over the last 14,000 years. We used GIS analysis to estimate total loess erosion over the time period. The results indicate there is a correlation between tablelands and loess preservation.

EFFECTS OF STEM CELL PASSAGE NUMBER ON THE EFFICIENCY OF GNRH NEUROGENERATION

Sara Wagers, Ei Terasawa (Mentor)

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

INSPIRED BY THE PAST: ARPILLERISTAS AND ACTIVISM IN TODAY’S CHILE

Madeline N. Walaszek, Ksenija Bilbija (Mentor)

The creation of arpilleras, patchwork quilts hand sewn by Chilean women, became a symbol of political resistance against the Pinochet dictatorship (1973–90) by telling stories of human rights abuses through colorful images. Since the protests over deep inequalities in Chilean society began in autumn of 2019, arpilleras have resurfaced as a tool of political and social expression and seem more relevant than ever in giving voice to the repressed and marginalized of Chilean society. This project focuses on the resurgence of arpilleras in recent Chilean history and the importance of these quilts as a form of political resistance and feminist expression.
CHARACTERIZING THE MECHANICAL PROPERTIES OF 3D PRINTED DUAL-CURE RESIN SYSTEMS DURING PROCESSING

Hannah Walker, Tim Osswald (Mentor)

Dual-cure resin systems are increasingly used in 3D printing applications due to their desirable thermal and mechanical properties. However, the combination of the two different cure processes results in two separate reactions during processing and a complex development of the mechanical properties. This study examines a dual-curing epoxy and urethane acrylate system that is first 3D printed using vat polymerization, resulting in a semi-rigid, partially UV cured part; the thermal cure stage follows, which heats the assembly, fully curing the material and achieving its peak modulus. The elastic modulus is measured at discrete levels of cure and processing temperatures, and results demonstrate modulus development during processing. Finally, a model is developed to describe the modulus as a function of processing temperature and cure.

PULSE OXIMETRY SCREENING FOR NEWBORNS: REVISING THE CURRENT CCHD SCREENING PROTOCOL

Julia Walters, John Hokanson (Mentor)

Since it was first implemented in 2011, pulse oximetry screening has significantly decreased the number of infant deaths from critical congenital heart disease (CCHD) by 33% in the United States. However, the current protocol is complex and easily misinterpreted. In 2020, the American Academy of Pediatrics (AAP) published recommendations for modifications of the existing screening protocol. While the AAP did publish these recommendations, they did not endorse the proposed changes which has left many clinicians unclear. In order to gather direction from clinicians, we surveyed over 330 clinicians from around the U.S and the world. Our findings suggest that clinicians support the new modifications of the screening protocol which would importantly simplify the protocol and potentially reduce the number of missed diagnoses of CCHD.

EVALUATING THE NUCLEUS-CYTOPLASMIC RATIO CERVICAL CANCER SCREENING

Kinzang Wangmo, Jacob Cedric Caceres, Kaitlin Sundling (Mentor)

Cervical cancer is among the most commonly occurring cancers in women. However, if diagnosed, cervical cancer is one of the most successfully treatable forms of cancer when detected early and managed effectively. Arguably the most prevalent characteristic of cancerous cells is an enlarged nucleus, indicated by high nuclear-to-cytoplasmic ratios (N/C ratio), obtained manually to determine cell malignancy. Cytotechnologists use this essential feature in identifying malignant cells. Our work initially involves digitally analyzing the N/C ratios using ImageJ from an archive of digital microscope slides. A survey will then be given to individuals with varying science backgrounds. By comparing their answers, we can gain insights into the accuracy of manually determining N/C ratios. Performing these procedures will hopefully better improve cervical cancer diagnosis.

LISTERIA MONOCYTOGENES OUTBREAKS RELATED TO COMMERCIALLY PRODUCED CARAMEL APPLES: DEVELOPMENTS IN SANITATION, PRODUCT FORMULATION, AND PACKAGING

Stevie Ward, Wendy Bedale (Mentor)

Prior to a deadly 2014 listeriosis outbreak, commercially produced, prepackaged caramel apples were not thought to be vehicles for the foodborne pathogen *Listeria monocytogenes*. The purpose of this review article is to provide a comprehensive summary of previous *L. monocytogenes* outbreaks related to prepackaged caramel apples, disparities in the sanitation and production process, and interventions being researched to prevent future outbreaks. A qualitative content analysis of literature located through the Web of Science database was used to compile this review. Previous sanitation, packaging, and storage procedures were insufficient to effectively deactivate *L. monocytogenes* in the case of product contamination. Novel sanitation, product formulation, and packaging methods have been developed and, in some cases, implemented in the production process to control *L. monocytogenes* on caramel apples.
Currently, semi-autonomous vehicles are quickly rising in the automotive industry. These vehicles are expected to bring positive impacts on roadway safety and operational efficiency. However, there is a lack of communication between the driver and the vehicle causing unsafe transportation. To better understand the field of human-machine interaction (HMI), two students explore multimodal cues, take-over requests, and secondary tasks through a literature review to further aid in the development and testing of future HMI designs. The results of the literature review will be a compiled summary of over 10 research articles in the area of trust and mental models in HMI in automated vehicles.

**Response to vaccination varies among the population. People with inflammatory bowel disease (IBD) elicit a poorer vaccination response and have lower gut microbial diversity than people without IBD. This study investigates whether the microbiome impacts vaccination response using a mouse model. Conventional laboratory mice are routinely exposed to non-pathogenic microbes while germ-free mice have no microbial exposure. We hypothesize the influenza vaccine will elicit a stronger humoral response in conventional mice compared to germ-free. Conventional and germ-free mice will receive the quadrivalent influenza vaccine, and antibody titer will be assessed three weeks post-immunization. If the data supports the hypothesis, this indicates the microbiome is implicated in vaccination response. Future studies can investigate whether gut microbiome diversity impacts vaccination response and translate these results to humans.**

Invasive species alter habitats, trophic interactions, and biodiversity. Feral hogs are a pervasive invasive ungulate in North America known to disrupt native ecosystems through rooting and herbivory, yet it is unknown how feral hogs impact native animal species through non-consumptive interactions. We examined the impact of feral hog activity on white-tailed deer activity and behavior via camera traps at the Savannah River Site (near Aiken, SC, U.S.A) using experimental hog removal across four sites with four control sites. Results show feral hog activity did not significantly affect deer behavior or activity, and significant site-level variance in deer vigilance was observed within the treatment and control sites. This research illuminates what biotic factors generate spatial variation in deer behavior and interactions between novel and native species.

The suppression of fire disturbance in the Midwest has continued to complicate efforts to preserve ecological integrity. The Kirtland’s warbler is a fire obligate species, meaning that the species depends on fire regime to regenerate ideal habitat conditions. Since the delisting of the species, there is an increase in reliance for private landowners to maintain the Kirtland’s warbler ecological success. This project explores (1) how and why are private landowners restoring habitat for Kirtland’s warbler and other disturbance dependent species in Wisconsin central sands? And (2) What policy changes would provide more landowner options for habitat for Kirtland’s warbler and other disturbance dependent rare species? In our findings, we illustrate the complex social and ecological and economic dynamics of pine barrens habitat restoration.
INVESTIGATING MICROTUBULE STRUCTURE AND DYNAMICS IN DEVELOPING HUMAN-DERIVED PHOTORECEPTORS

Madalynn Welch, Sarah Rempel (Mentor)

Photoreceptor (PR) loss through injury or disease leads to numerous forms of incurable blindness, and PR transplantation is a promising treatment solution. Restoring vision by cell transplantation requires a better understanding of how and why PRs migrate and project to their synaptic partner during development. Microtubules (MTs) are an important cytoskeletal component of migrating cells. Therefore, MT polymerization was investigated in different aged PRs and correlated with PR growth cone organization. To accomplish these goals, hESCs were differentiated into retinal organoids and infected with EB3-GFP lentivirus. Polymerization of MT plus ends was tracked in movies of EB3 positive PRs. These values were analyzed and used to test the hypothesis that as PRs age their terminals become less mobile due to reduced polymerization of MTs.

THE USE OF LEAD ISOTOPES TO EVALUATE LEAD EXPOSURE IN WILDLIFE

Kaitlin Westerbeke, Sean Scott (Mentor)

Today man-made products are a major source of wildlife lead exposure despite efforts to reduce the use of lead. In this study, we measured lead isotope ratios in a red tail hawk that was shot with lead pellets to determine the extent of exposure. Samples of organ tissue, blood, bone, and shot pellets were digested, purified, and analyzed by a multicollector mass spectrometer to determine the lead isotope ratios. The results showed that the pellets exposed the hawk’s blood and organs to lead prior to its death. This data supports the fact that lead use needs to be reduced to avoid wildlife exposure and premature death.

CORPORATE GOVERNANCE NO MAN’S LAND

Ben White, Yaron Nili (Mentor)

This project compares how corporate governance varies between large and small companies. I am collecting data on proxy access (a complex concept related to shareholder control) and the composition of the board of directors by looking at the companies’ filings with the SEC. Corporate governance and business practices vary in different-sized companies, and this research is studying how they differ. Large companies tend to have better governance practices, due to pressure from institutions and investors, which produces better results. Small companies without this pressure are less able to benefit their shareholders and society at large. This research could be used to help regulate different-sized companies and encourage smaller companies to adopt good governance. This project is in the data-gathering part of the research.

RACIAL DISCRIMINATION AND SEXUAL HARASSMENT IN WISCONSIN SCHOOLS

Samantha White, John B. Diamond (Mentor)

It is important that people feel safe wherever they are, but even more so in places that they are required to be. This is not the case as things exist now. The purpose of my research was to prepare information regarding racial discrimination and sexual harassment in Wisconsin schools. The research included gathering general and publicly available data on certain schools and school districts, as well as information for a literature review. Data was collected for the reasons of righting specific wrongs performed in Wisconsin schools, holding those in the community accountable for their actions and inactions, and ultimately ensuring that people are protected by the systems that they have no choice but to take part in.
QUANTIFYING ESTROGEN-RECEPTOR ALPHA EXPRESSION IN THE HYPOTHALAMUS PREDICTS FEMALE SEXUAL DYSFUNCTION IN A NONHUMAN PRIMATE

Samantha Williams, David Abbott (Mentor)

This study examines the effects of viral-vector induced gene knockdown of estrogen-receptor alpha (ERα) expression in the ventromedial nucleus of the hypothalamus (VMN) on the sexual behavior of adult female marmoset monkeys. We used an adeno-associated virus (AAV8) to deliver gene silencing RNA (shRNA) designed to target ERα mRNA and prevent translation of the ERα protein (ERαKD, n=4) or shRNA encoding a scrambled sequence with no known gene targets (control, n=4). After quantifying the expression of ERα in the VMN ~11 months after knockdown, we associated ERα expression with diminished expression of female sexual behavior during reunion tests with their male partner. Our findings suggest that estrogen action mediated by ERα in the VMN plays a vital role in regulating sexual behavior in female primates.

THERMOGRAPHIC PREDICTION OF DIABETIC FOOT ULCERS

Jan Wodnicki, Thor Larson, Justin Boutilier (Mentor)

Diabetes mellitus is a major epidemic in India—the diabetic capital of the world. One in five people with diabetes live in India, and 15–25% develop ulcers that lead to foot amputation. Currently, there are limited ways to identify those at risk of developing an ulcer. Previous research has demonstrated a temperature increase occurs on the bottom of the foot 30 days before ulcer formation. During an initial study of this novel warning sign, our group collected thermal images of 233 patients’ feet at the CMC Vellore Hospital in India. From this data we created a machine learning model that accurately predicts the presence of an ulcer. This prediction model may aid in prescribing treatment and triaging patients in future applications.

ISSUES OF EQUITY AND INCLUSION IN OUT-OF-SCHOOL-TIME PROGRAMS: CURRENT PRACTICES, PROBLEMS, AND PEDAGOGIES

Ayomi Wolff, Bianca Baldridge (Mentor)

Out-of-school-time (OST) programs have sought to foster learning outside the classroom while compensating for the deficiencies of the American education system. As such, youth work practitioners are often faced with the challenge of designing programs for underprivileged youth, who historically, have been shunned by said system. This project seeks to understand current pedagogies and problems in OST programs that service underrepresented youth. This research synthesizes literature with interviews of participants and professionals in the OST field to understand their practices and challenges. Although the project is in its infancy and only preliminary data has been collected, the study hopes to give a broader understanding of the disparities in OST programming. Current literature has displayed both practices and problems facing OST community-based leaders, past and present.

COSMIC RAY AND MAGNETICALLY DRIVEN BUBBLES IN GALAXIES

Sherry Wong, Ellen Zweibel (Mentor)

The Parker instability is a type of Rayleigh-Taylor instability which is important for understanding interactions between interstellar gas and galactic magnetic fields. The instability is relevant for explaining cosmic phenomena such as galaxy thickness and gas cloud formation. Previous simulations suggest cosmic rays are a major contributor to the development of the instability. Preliminary investigation has revealed gas bubbles moving towards and away from the galaxy disk at considerable speeds. This study aims to study these gas bubbles and their evolution in the larger system by designing and examining Athena++ simulations to find trends in their progression. These findings would help to explain observed gas above and below the galactic disc, as well as inform future studies about the Parker instability.
HEALTH IMPACT ON BLACK STUDENTS AT PREDOMINATELY WHITE INSTITUTIONS
Stephanie Woodson, Susan Andreae (Mentor)

Evidence-based strategies are needed to improve the health and wellness of Black students attending predominantly White institutions (PWI). In addition to academic demands, Black students at PWIs have increased mental health burdens due in part to daily experiences of discrimination, microaggressions, and vicarious racism. Moreover, current events such as the COVID-19 Pandemic and Black Lives Matter Movement have disproportionately impacted Black students. To better understand the experiences of Black students attending PWIs, semi-structured interviews were conducted and analyzed by using open-coding. Participants were asked to discuss their experiences attending a PWI as well as barriers and facilitators to health that exist within the current campus climate. The findings will inform the development of a culturally responsive wellness program for Black students attending PWIs.

IDENTIFICATION OF MICROBIAL ORGANISMS IN RESISTANT AND SUSCEPTIBLE COLORADO POTATO BEETLE WHOLE TRANSCRIPTOME RNA READ DATA FROM WISCONSIN
Evan Wooldridge, Zach Cohen (Mentor)

The Colorado potato beetle, *Leptinotarsa decemlineata*, is an agricultural pest that has proved to be challenging to manage due to exhibiting rapid adaptation in their changing environments. As a species with a broad diet breadth of various solanums, they rapidly evolved to form insecticide resistance, endure changing environments, and become a nuisance agricultural pest. Host plants play an essential role in shaping insects' gut bacterial community, and polyphagous microbial biomes can impact a range of biological associations between the beetle and host plant. Some insect symbionts enable herbivores to expand host plant range or facilitate host plant use by modifying plant physiology. However, little attention has been paid to identifying microbial organisms in resistant and susceptible Colorado potato beetle whole transcriptome RNA in Wisconsin.

OPTICAL METABOLIC IMAGING FOR FUNCTIONAL EVALUATION OF CHIMERIC ANTIGEN RECEPTOR (CAR) T-CELLS
May Wu, Melissa Skala (Mentor)

Quality control tests play an essential role in manufacturing chimeric antigen receptor (CAR) T-cells. In this study, we used a label free and non-destructive technique known as the Optical Metabolic Imaging (OMI) to evaluate CAR T-cell metabolism and functions through autofluorescence from the endogenous metabolic coenzymes NAD(P)H and FAD. We validated OMI’s sensitivity to activation of CAR T-cells in coculture with neuroblastoma cancer cells. Additionally, we identified the NAD(P)H mean-lifetime, the fraction of free NAD(P)H, and the optical redox ratio as the most representative OMI indices in characterizing functional changes in T-cells. Our results provide evidence for OMI’s potential as an alternative functional evaluation regime for adoptive T-cell therapy.

MAPPING THE UNIVERSE WITH HYDROGEN GAS
Yanlin Wu, Peter Timbie (Mentor)

I work with an array of radio telescopes that is mapping the universe in three dimensions by using the 21 cm emission line from hydrogen. Now we are making the first maps from the data we have collected. Map making is one of the most important parts of processing that data, not only because it is our final goal, but also because it can be very useful for data analysis. The raw data stream is the output (visibility) from each of the pairs of antennas in the array. What we want is the image of the real sky—the image a person would see if they had eyes sensitive to light in the radio range.
COMIX: MORE THAN JUST BOOKS
Shamyan Xiong, Adam L. Kern (Mentor)

Comix have begun to prosper in its most popular form, books. It is commonly believed that comix are, by definition, these graphic novels. That is false. Taking into consideration the definition of comix, the idea of comix is much more broad compared to its popularized form. Analyzing research papers that bring up these different forms of comix will open our eyes to realize that comix are not just books, but are everywhere. These different forms have a different function when compared to the generalized comic book, which leads to them not being acknowledged as a form of comix.

INVESTIGATING THE ABUNDANCE OF KEY STEM CELL REGULATOR, SYGL-1, AND ITS IMPACT ON THE FATE SWITCH FROM SELF-RENEWAL TO DIFFERENTIATION
Mingyu Xue, Judith Kimble (Mentor)

Proper balance between germline stem cell (GSC) self-renewal and gamete generation is crucial for survival of the species. In Caenorhabditis elegans, Notch signaling directly activates sygl-1 transcription to maintain GSC self-renewal. Importantly, SYGL-1 protein must be lost for cells to switch to differentiation (Shin and Haupt et al. 2017 PLoS Genetics). The sygl-1 promoter harbors three Notch-responsive LAG-1 binding sites (LBS). Mutating one LBS expresses enough SYGL-1 to maintain GSC self-renewal until adulthood, while mutating two LBS expresses virtually zero SYGL-1 and GSC self-renewal fails in larval development (Lynch, Xue et al. in preparation). To understand potential inter-chromosomal LBS influence on sygl-1 expression and animal fertility, we measured SYGL-1 protein and germline function in different trans-heterozygous LBS mutants. Our results suggest interallelic interactions between LBS.

CHANGES IN MITOCHONDRIA ASSOCIATED MEMBRANES (MAMS) IN PANCREATIC β-CELLS DURING OBESITY AND INFLAMMATION
Amanjot Yadev, Angela Olvera (Mentor)

In conditions of obesity and inflammation, often present in type II diabetes mellitus (DM), pancreatic β-cells undergo cellular stress leading to organelle dysfunction. The endoplasmic reticulum (ER) membrane forms connections to the outer mitochondrial membrane known as mitochondria associated membranes (MAMs). MAMs have been implicated in numerous human pathologies including DM. However, the role of MAMs in β-cell function and survival to maintain glucose homeostasis remains unknown. We hypothesize that MAMs are impaired during β-cell stress. Changes in MAMs related factors such as proteins present in MAMS junctions will be investigated in conditions of inflammation using a rat derived β-cell line. Extending this study, intra-islet studies of lean versus obese mice will be used to quantify MAMs using transmission electron microscopy and gene expression analysis.

GENDER AND RACE DIFFERENCES IN DEFINING AND PRIORITIZING KEY COMPONENTS OF PHYSICIAN WELL-BEING
Pachoua Yang, Jennifer Truong, Jessica Babal (Mentor)

This year, 42% of physicians reported they’re burned out. Physician depression, burnout, and suicide have prompted a project that’ll define physician well-being from the perspective of pediatricians and pediatric trainees. The medical community has a relatively good understanding of what facilitates burnout but there’s a gap in what’s known about sustaining well-being. This study aims to ask stakeholders in residency and physicians what well-being means. This research will provide society with intelligence on how to make physicians feel comfortable while considering diversity, equity, and intersectionality. Concept mapping, qualitative and quantitative approaches will be enforced to create a model of pediatrician well-being. Furthermore, a nationwide survey was sent to pediatricians and pediatric trainees to fill out, we’re in the process of synthesizing and analyzing the data.
FACE MASKS HINDER OUR ABILITY TO RECOGNIZE FACIAL EXPRESSIONS OF EMOTION

Dasha Yermol, Paula Niedenthal (Mentor)

With government-mandated social distancing, virtual meetings, and overall limited face-to-face contact, our everyday social interactions have drastically changed. As people continue wearing face coverings to help reduce the spread of COVID-19, a newly masked world presents itself with social challenges. For instance, will we still be able to communicate effectively with nonverbal facial cues when the lower half of our faces are covered? In other words, does the recognition of emotion from facial expressions depend on the entire face, or do the eyes alone carry enough information? The present study considers the influence of face masks on the interpretation of facial expressions and the importance of various portions of the face in emotion recognition.

UW JUSTICE LAB: PIBMI DOCUMENTARY

Victoria Ylizaliturri, Mabel Malhotra, John Eason (Mentor)

In recent history, there have been increasing numbers of deaths across ICE detention facilities and have rarely been held accountable for their actions. The project’s objective is to create a documentary regarding permanent injury beyond medical intervention (PIBMI), a term used in reports to lighten the severity of several U.S. immigrant detainee deaths, and reveal what immigrant facilities can tell us about how ICE reinforces its power legitimacy. The goal of the documentary is to portray an evaluative perspective showing how ICE-affiliated detention facilities disguise sickness, injury, and death to legitimize legal authority and strengthen punitive capacity. Collected data exposes how immigration detention is punitive and how exposing detainees to violence and inadequate medical treatment has increased incidents of death and attempted suicides.

TEACHING YOUNG CHILDREN HERITAGE LANGUAGE

Yvonne Yu, Heather Kirkorian (Mentor)

Heritage language is the family or ancestral language that is not the dominant language of the society. Due to the pluralistic nature of the U.S., research studying the concern of enhancing children’s heritage language in a second cultural context is not unusual. Building on previous studies, this project focuses on the practical approach to teaching heritage language. It has two parts: (1) an online survey finding out factors of teaching heritage language, (2) a closer observation and interview revealing how Chinese children in the U.S learn from the popular apps selected by parents in the online survey. Since a mixed-method approach has been used, this study can provide a broad overview of potential approaches that can be used to teach heritage language to preschoolers.

SIMULATIONS OF FLOW OVER DYNAMICALLY MORPHING CYLINDERS

Mikihisa Yuasa, Jennifer Franck (Mentor)

Undulated cylinders inspired by seal whiskers lower the drag force and vortex-induced vibration when compared to smooth cylinders and thus are applicable in underwater devices and engineering design requiring vibration and force suppression. Numerical flow simulations analyze the hydrodynamic response dependent on geometric parameters defining the undulatory features. Previous methodologies require each simulation to rerun after time-intensive manual mesh regeneration to make geometric changes to the undulations. The current research introduces an algorithm that directly updates the surface topographic features during the simulation by utilizing dynamic mesh morphing and parameterization of the complex whisker-inspired topography. Morphing the surface results in easy transitions from one geometry to another and a significant reduction of total simulation time, allowing for exploration of a wider range of parameters.
TRACING COURT AND JAIL HISTORIES OF PEOPLE ACCUSED OF CRIMES IN DANE COUNTY

Cathy Yuen, Pamela Oliver (Mentor)

My research with Professor Pam Oliver, "Tracing Court and Jail Histories of People Accused of Crimes in Dane County" is part of a community-university partnership focused on using data to advocate for more racial justice in our criminal-legal system in Dane County. We have used the Wisconsin Court records website (known informally as CCAP) to search for and download the public case records of people accused of crimes, focusing on those accused of battery and disorderly conduct. We are studying whether there are differences in bail, dismissals, guilty pleas, and sentences depending on their race or gender. My work has involved a combination of downloading cases, statistical analysis of cases, and writing qualitative descriptions. My presentation will summarize our methods and our preliminary results.

INVESTIGATING PLANT-BACTERIA INTERACTIONS IN RESPONSE TO PLANT DEFENSE SYSTEMS

Sonia Zaacks, Jeri Barak (Mentor)

Fresh produce can host a wide variety of bacteria, including *Salmonella enterica*. Plant pathogens, including *Xanthomonas gardneri*, have been found to enhance the survival of *S. enterica* in the phyllosphere. During the innate immune response of plants, known as pattern-triggered immunity (PTI), reactive oxygen species (ROS) accumulate at the site of infection which serve to inhibit bacterial populations. Later defense responses involve the activation of hormone-induced signaling pathways, stimulating plant hormones including salicylic acid (SA). The focus of this research is to examine how plant defense systems induced by bacterial stresses affect the survival of *S. enterica* in the presence of ROS and SA. Investigating the relationships between *S. enterica* and plant pathogens that modify the plant environment is critical for understanding bacterial invasion and for improving food safety.

MODULAR AQUAPONICS SYSTEM PROTOTYPE: COMMUNITY DEVELOPMENT, CAREER EXPLORATION, AND STEAM LITERACY ENHANCEMENT FOR UNDERSERVED YOUTH

Lily Zander, Lesley Sager (Mentor)

THINKponics (modular aquaponics) is a research effort seeking to provide interactive materials and tools in order to guide students at Gompers Elementary through the design and maintenance of an indoor, self-sustaining vertical aquaponics system. Using this prototype, we will examine how learning by doing promotes curiosity and improves STEAM literacy. It is anticipated that potential year-round interdisciplinary activities of this aquaponic system will generate active and engaged learning, which has been shown to increase understanding of engineering concepts among disadvantaged and ELL youth on final assessments. We will collaborate with Gompers Grows and the DOC Grow Academy in order to construct and test the prototype, with hopes of providing new opportunities for multi-sectoral career exploration while examining the project’s capacity for expansion.

STUDIES OF NIRAN NUCLEOTIDYLTRANSFERASE TO PERFORM CORONAVIRUS 5’ CAPPING

Zoe Zanella, Robert Kirchdoerfer (Mentor)

The twenty-first century has experienced the introduction of three highly pathogenic coronaviruses (CoV) into human circulation from animal host reservoirs: SARS-CoV, MERS-CoV, and SARS-CoV-2. Located in the N-terminal region of nsp12 (non-structural protein) is a nucleotidyltransferase domain termed NiRAN, which we propose plays a role in RNA capping. The 5’-cap structure of viral mRNA is essential for efficient translation and for the virus to evade host detection. Though it is known that coronaviruses cap their mRNAs, the identity of the viral capping enzyme remains to be elucidated. We propose that the nsp12 NiRAN domain plays an essential role in coronavirus mRNA capping. These studies will illuminate the coronavirus capping mechanism and aid in the design of novel antiviral drugs.
VERTICAL MOTION PROFILES OVER LAND COMPARED TO OCEAN

Warsa Zerome, Larissa Back (Mentor)

Convection and vertical motion in the atmosphere are important to understand weather and climate. The purpose of the research project is to study convection by examining vertical motion profiles over land in the Intertropical Convergence Zone (ITCZ). This is done using principal component analysis on reanalysis data from ERA-5 to create vertical motion profiles displaying empirical orthogonal functions (EOFs). The ratio of EOFs with the two largest variances can be translated to a map showing vertical motion top-heaviness in the tropics. Top-heaviness describes the location of where vertical motion peaks in the atmosphere. The future direction of the project is to compare profiles and maps over land to the ocean to determine the land-ocean relationship of vertical motion and why this relationship exists.

IS THERE A ROSTROCAUDAL GRADIENT FOR THE COGNITION ENHANCING EFFECTS OF PSYCHOSTIMULANTS WITHIN THE PREFRONTAL CORTEX?

Tianyi Zhang, Craig Berridge (Mentor)

The Berridge Laboratory has demonstrated that methylphenidate (Ritalin), a highly effective psychostimulant widely used in the treatment of attention-deficit/hyperactivity disorder (ADHD), acts within the dorsal portion but not the ventral of the rat medial prefrontal cortex (PFC) to improve cognition. This is consistent with a well-documented dorsoventral functional topography within the PFC. Limited evidence indicates there also exists a functional topography in the rostrocaudal (front to back) dimension of the PFC. However, the degree to which the procognitive actions of ADHD drugs involve a rostrocaudal topography is unknown. This study examined the degree to which the cognition enhancing effects of methylphenidate involve preferential action within the rostral vs. caudal dorsomedial PFC of rats.

TOWARDS A ROBUST NEURAL NETWORK MODEL FOR GENOMIC DATA

Zhaoyi Zhang, Claudia Solís-Lemus (Mentor)

The accurate prediction of biological features from genomic data is paramount for precision medicine, sustainable agriculture, and climate change research. For decades, neural network models have been widely popular in fields such as computer vision, astrophysics, and targeted marketing given their prediction accuracy and their robust performance under big data settings. Yet neural network models have not made a successful transition into the medical and biological world due to the unique characteristics of biological data. We investigate the robustness, generalization potential, and prediction accuracy of widely used convolutional neural network and natural language processing models with a variety of heterogeneous genomic datasets. While the perspective of a robust neural network model is out of reach, we identify certain model characteristics that translate well across datasets.

SCHOOL FOOD POLITICS IN CHINA AND THE U.S.

Skylar Zhao, Jennifer Gaddis (Mentor)

School lunch programs nourish billions of kids around the world. China has a state-sponsored program for students in underdeveloped areas, but struggles with food safety issues. The United States launched a national school program in 1946, but there are still many shortcomings with the program. We have found the preliminary results from a comparative analysis of primary sources and secondary sources related to both school lunch programs. The initial findings focus on three themes: gender divides in the labor structure, the role of the food industry in school food preparation, and food traceability management. In addition, more research is needed on how workers are treated on the farms, in the factories, and the cafeterias that provide lunches to schools in China and the U.S.A.
EFFECTS OF LANGUAGE EXPERIENCE AND CURRENT LANGUAGE CONTEXT ON OBJECT CATEGORIZATION IN MANDARIN-ENGLISH BILINGUALS

Zechun Zhao, Jiaxin Wang, Haley Vlach (Mentor)

Investigations have compared classifier languages with non-classifier languages to determine the role of language in noun categorization. Our current study examines how second language exposure and current language context influence object categorization in Mandarin-English bilingual adults. Bilingual participants (N=9) were randomly assigned to read instructions in either Mandarin or English while English monolinguals (N=56) were tested in their native language. All participants were shown 16 sets of black and white drawings and asked to choose the most similar object to the target object. Preliminary results showed that participants made more taxonomic/functional choices overall, but there was no significant interaction between choice type and bilingualism. We hope the current study and future data collection will provide more insight into the shape bias within the bilingual communities.

ESTIMATING GENETIC NURTURE WITH SUMMARY STATISTICS OF GENOME-WIDE ASSOCIATION STUDIES

Ethan Zhong, Qiongshi Lu (Mentor)

Recent findings suggest that genetic effects on a phenotype could be further separated into direct genetic effect and indirect genetic nurturing effect, often with distinct mechanisms. Although existing methods can effectively demonstrate the existence of these distinct effect pathways, they cannot provide estimates of each genetic variant’s direct and indirect effects. In this project, we propose a method to dissect direct and indirect effects using commonly accessible summary association statistics from genome-wide association studies (GWAS). We believe our new approach will resolve a fundamental and critical problem in sociogenomics research and will shed light on the complex genetic architecture, especially the within-family dynamics, of a variety of traits and diseases.

DUAL-LANGUAGE STORYBOOKS AS A PLATFORM FOR LANGUAGE LEARNING IN BILINGUAL CHILDREN

Stephanie Zumba, Katheryn Saavedra-Ballesteros, Melina Knabe (Mentor)

Dual-language storybooks have been used to support language learning in children. Prior studies have found that authors of Spanish-English dual-language books prioritize English, thus negatively affecting the reader's language learning and identity. Consequently, this study evaluates differences in textual formatting for Spanish-English dual-language storybooks, and how these differences impact dual-language learning. For this purpose, we conducted a content analysis of 75 dual-language storybooks. Each book was read by two coders who evaluated the storybook’s textual characteristics and page layout. Preliminary results have demonstrated that full-sentence translations are the most common format. Future studies will evaluate the efficacy of different formats for word learning. This research will inform the development of bilingual storybooks that can facilitate reader’s biliteracy learning, whether they be bilingual or monolingual readers.