

ABSTRACTS 2015



# Undergraduate Symposium

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service-learning



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*Cover photos courtesy Office of University Communications and the Undergraduate Symposium Committee*

## **INFLUENCE OF SALIVARY QUALITY ON SWALLOWING-RELATED OUTCOMES**

Bethelhem Abebe, Nicole Pulia (Mentor), Medicine

The purpose of this research is to determine the effects that alterations in the lubrication properties of saliva have on various aspects of swallowing function. The study includes Veterans diagnosed with dysphagia, or swallowing disorders, enrolled in a federally funded clinical demonstration program. Saliva samples will be collected from patients at the VA Hospital. All patients will complete a questionnaire with visual analog scales for perception of mouth dryness and swallowing effort as well as videofluoroscopic swallowing studies. The samples will be transferred to a food science laboratory for rheological and tribological analyses to determine viscosity and lubrication properties. These data will provide insight into the specific fluid flow and lubrication properties of saliva that are altered in patients with dysphagia.

## **WISCONSIN BIG CAT RESCUE PUBLIC SERVICE ANNOUNCEMENT**

Jennifer Abplanalp, Amanda Borkowski, Gina Lehner, Andrew Pieterick,  
Patricia Loew (Mentor), Life Sciences Communications

Wisconsin Big Cat Rescue is a non-profit rescue located in Rock Springs, Wisconsin. This PSA seeks to assist this small organization, which has minimal funds for advertising, in raising awareness and funds for their cause.

## **LUSK RAIDS: REPRESSION AND RESPONSE**

Ben Agatston, Alfred McCoy (Mentor), History

Midst the widespread repression after World War I against labor unions, socialists, and African-Americans, New York's Joint Legislative Committee to Investigate Seditious Activities enacted the 'Lusk Laws' that sparked a surge of police raids and prosecutions whose sum was a seminal moment in US political history. To explore the role of these highly publicized raids in US political history, this thesis will, first, map the Lusk Board's raids from 1919-20 in New York City on the Rand School of Social Science, the Industrial Workers of the World, Russian Soviet Bureau, among other left and radical organizations. Not only did the raids target marginalized religious and socioeconomic groups through prosecutions of dubious legality, they led, this thesis will argue, to xenophobia and nativism that spread beyond New York City to shape the national political climate. In retrospect, this seems one of the earliest instances of synergy between political elites, bureaucratic agencies, and public hysteria that has produced episodes of state excess that would mark US political history for the succeeding century, from the post World War I Palmer Raids through the post-9/11 Patriot Act.

## **EFFECTS OF P2X7 ON 5-LIPOXYGENASE: AN IN-DEPTH UNDERSTANDING OF ASTHMA**

Juan Aguirre, Elon Roti Roti (Mentor), Medicine

Currently our research is dedicated to learning how the enzyme 5-lipoxygenase (5-LO) is affected by a channel located on cell membranes, P2X7, during an asthma attack. Building off of previous research, we are developing an understanding of whether 5-LO becomes activated when the P2X7 channel is stimulated. We will stimulate P2X7 in mouse macrophage cells at different concentrations of the agonist to determine if 5-LO becomes activated after P2X7 stimulation. Then we will use fluorescence microscopy to assay for sub cellular localization of 5-LO within the cell. We expect to see active 5-LO presented in the nucleus of the cells while inactive 5-LO should be found in the cytosol. We hope that by understanding how P2X7 communicates with 5-lipoxygenase during an asthma attack, we will be able to ease or even prevent asthma attacks in human patients.

## **SESAME STREET STUDY**

Rachel Alter, Brianna Sewell, Julie Poehlmann-Tynan (Mentor), Human Development and Family Studies

Sesame Street has produced educational materials that focus on having a deployed parent, bullying, divorce, death of a parent, and other issues. In 2013, Sesame Street created materials for young children with incarcerated parents. There are more than 2.7 million children in the United States who have an incarcerated parent. The goal of Dr. Poehlmann-Tynan's Sesame Street Study is to examine the effects of providing educational resources to children (age 3 to 8) of incarcerated parents. Specifically, the study explores how children's behavior, health and visits with jailed parents are impacted by the intervention. The study has a randomized controlled design and uses a wait list control group.

## **INHIBITION OF HISTONE DEACETYLATION (HDAC) THROUGH BMPs ALTERS MOUSE PROSTATE DEVELOPMENT**

Helene Altmann, Chad Vezina (Mentor), Comparative Biosciences

Chromatin modifications are capable of regulating gene expression and contribute to prostate disease mechanisms. However, their role in prostate development is not known. Histone deacetylation, catalyzed by histone deacetylases (HDACs), typically results in transcriptional silencing. Histone acetylation/deacetylation has been shown to regulate bone morphogenetic protein (BMP) expression. BMPs are also known to contribute to prostate budding and branching morphogenesis. Therefore, the objective of this study was to test the hypothesis that inhibition of HDACs would alter prostate morphogenesis through a BMP-mediated mechanism.

## **WOMEN'S RIGHTS AND CONSTITUTIONAL REFORM IN MAGHREB**

Tasneem Amro, Aili Tripp (Mentor), Gender & Women's Studies

Women's rights in the Maghreb countries of Morocco, Tunisia and Algeria, have advanced further than other parts of the Middle East and North Africa (MENA), particularly in the area of constitutional reform, which serves as a basis for further legal reforms and litigation. In my paper I ask 1) What accounts for women's rights-related constitutional changes in the Maghreb in recent years, particularly at a time that has seen heightened Islamist influences in the region? 2) Why have we seen these developments particularly in the Maghreb and to a much lesser extent in other MENA countries? To tease out these differences, I compare Egypt, which has had limited reforms for women, with Tunisia, which has adopted the most extensive reforms for women in the region.

## **CELLULAR REPROGRAMMING BY INTRODUCTION OF ER, GATA3 AND FOXA1 TO RECOVER ESTROGEN RESPONSIVENESS**

Nina Anbouba, Elaine Alarid (Mentor), Oncology

Estrogen-dependence is the basis for therapies used to treat breast cancer, where 70% of tumors express estrogen receptor alpha (ER $\alpha$ ). However, when tumors transition from estrogen-dependent to estrogen-independent growth states, endocrine therapies no longer work. Right now the field depends on only a few models of ER+ breast cancer to study this transition, and these models are taken from very advanced stages of metastatic breast cancer. This study seeks to better understand the requirements for hormone dependence by creating a new model based on the concepts developed by IPS technology where reintroduction of certain factors can recover the phenotype. We will do this by reprogramming a HEK 293 cell via introduction of ER $\alpha$ , GATA3, and FOXA1, transcription factors hypothesized to be required for estrogen response, and test for known responses characteristic of estrogen treated ER+ cell types. Our goal is to create a reprogrammed HEK 293 cell that when treated with estrogen can demonstrate down regulation of its receptor, show correct post-translational modifications of ER $\alpha$ , increase transcription of estrogen-inducible endogenous and reporter genes, show an increase in growth. If successful, this knowledge may identify new targets in rationale design of therapeutics and concurrently, create a new model system for future assay development for therapy-resistant cancers.

## **ARE INDIVIDUAL DIFFERENCES IN PHYSIOLOGICAL RESPONSES TO EXERCISE TRAINING MAINTAINED INTO OLD AGE?**

Ellie Anderson, Gary Diffie (Mentor), Kinesiology

Aging is known to decrease many aspects of muscle function and exercise is thought to minimize some of these aging effects. Complicating this research is the fact that the ability of muscles to respond to exercise may vary among individuals in old age. Our research involves a rat model that exploits this difference in training response. Two groups of rats, previously determined to differ in their response to exercise training (High Response Trainers (HRT) versus Low Response trainers (LRT)) will be studied at advanced age. We will test the VO<sub>2</sub>max response to training to understand whether the HRT/ LRT difference persists in old age. We will thus determine if this line of rats are a preferred model for studying age and exercise-related changes in muscle.

## **PERVASIVE PESSIMISM: EXPLAINING DISCONTENT IN POSTCOMMUNIST BULGARIA**

Omer Arain, Boriana Nikolova (Mentor), Political Science

After decades of unthreatened communist rule, Bulgaria's transition to democracy persisted through a period of significant economic and political volatility. Political stabilization and EU accession fostered a protracted time of economic prosperity, as the state developed free democratic principles. Despite notable internal improvements, Bulgarian citizens maintain pessimistic attitudes about their government, state, and personal futures, even sometimes indicating a preference for socialism. Krastev et al. terms this peculiarity the "paradox of the Bulgarian transition." An examination of economic indicators, cultural features, and the institutionalization of political structures helps to explain this puzzle. The answer lies in the effectiveness of political structures attaining ideal democratic ends. Additionally, there exists some self-perpetuating cognitive biases among citizens that contribute to Bulgarian discontent.

## **NURSING SUPPORT OF SCHOOL-AGED CHILDREN WITH CHRONIC ILLNESSES AND THEIR PARENTS IN LEARNING SELF-CARE**

Alison Arensdorf, Karen Pridham (Mentor), Nursing

Aim: This poster is to examine the importance of self-care education for parents and school-aged children age 6-18 years with a chronic illness. Educational needs include understanding their illness and learn self-care methods to promote health. This poster integrates the literature to identify what is known and areas of needed research. Method: CINAHL identified English-language research articles published in the last 10 years focused on self-care education directed to both children and parents were tabled. Results: The results will focus on aims, methods, findings, and conclusions of 10 studies. Conclusions: The tabled findings showed self-care education of children with chronic illnesses made a difference for children and their parents. Several effective methods were identified.

## **TOWARDS OPTIMIZATION OF A GENERAL RNA LABELING DEOXYRIBOZYME**

Matthew Ashton, Aaron Hoskins (Mentor), Biochemistry

Using fluorescence microscopy as a tool to study biological systems has been proven to be useful in both experiments in cells and in vitro. However, current methods for preparing fluorescent RNAs for use in vitro fluorescence assays are challenging and inefficient. Recently, we have shown that deoxyribozymes can be used to site-specifically label RNA molecules with fluorescent GMP moieties. We believe that this method will prove generally useful for incorporation of fluorescent labels into different sites within an RNA molecule for use in biochemical studies. We propose that the annealing of two RNA molecules (the substrate RNA and a 'helper' RNA) to the deoxyribozyme results in formation of a ternary complex that brings key catalytic sites within close proximity in order to facilitate GMP transfer. Initial experiments suggested that this ternary complex is not stable during native PAGE analysis. I am currently studying a unimolecular RNA/DNA hybrid in which the substrate RNA, the helper RNA, and the DNA are all part of a single oligonucleotide. Our goal is to use this simplified construct to characterize the folding and reaction pathways for deoxyribozyme catalysis and RNA labeling. These experiments will lead to development of next generation deoxyribozymes with improved function.

## **NUMERICAL MODELING OF GROUND SOURCE HEAT PUMP EFFICIENCY AND COMPARISON TO FIELD DATA**

Ian Atkins, Christopher Choi (Mentor), Biological Systems Engineering

Ground source heat pumps (GSHP) are a rapidly growing heating and cooling solution that has been shown to reduce greenhouse gas emissions by 6% to 15% and yield rates of return as high as 17% in Wisconsin. As more and larger facilities opt for GSHP systems and additional design options emerge, it will become ever more important to be able to accurately model how a system will perform before it is implemented. The objective of this research is to develop a numerical heat transfer model to simulate the impacts of site-specific geologic conditions, design parameters, and operational practices on long-term GSHP efficiency. Representative heating and cooling loads are applied to the numerical model, and the resulting fluid temperatures are used to predict the mechanical efficiency of the heat pump. The modeled changes in fluid temperature and heat pump efficiency are compared to field data from a residential GSHP near Madison. Long-term simulations are then run with several sets of geologic conditions and design parameters to assess how these factors impact system performance and demonstrate how the model can be used to make design decisions.

## **RELATIONSHIP BETWEEN GEOGRAPHICAL LOCATION AND BEHAVIORAL AGGREGATION**

Amal Ayesh, Meghan Fitzgerald (Mentor), Zoology

Spiders from the *Nephila* genus are golden silk orb-weavers. The genus consists of numerous species, found in warm and humid regions around the world. The *Nephila* species are spread through Australia, Asia, Africa, and the Americas. The only species in the Americas, *Nephila clavipes* is found in the United States from the coastal southeast of North Carolina South to Texas and is widespread to the Northern regions of South America. This literature review explores the global trends in the genus. Specifically, the project looks at the interactions of the species with each other. We are looking for evolutionary behavior common throughout the species as a whole. As a research assistant, I do literature review for previous studies on the *Nephila* species to look for commonalities between studies, specifically looking to find a relationship between a particular geographic location and aggregation behavior. I hope to find that *Nephila* spiders that live in areas closer to the equator are also more likely to be found in aggregations and those found further from the equator are not found in aggregations, based on predictions of climate preferences for *Nephila* spiders.

## **DEVELOPMENT OF AN AUTONOMOUS PROSTATE BRACHYTHERAPY ROBOT**

Jennie Aylng, Lindsay Bodart, Bruce Thomadsen (Mentor), Medical Physics

Prostate cancer, the second deadliest cancer among men in the United States, is often treated with the implantation of small, radioactive sources, called brachytherapy. The insertion uses 25 to 30 needles. Due to its short procedure time and minimal invasiveness, brachytherapy is the method of choice for one-third of prostate cancer patients. However, the current procedure is performed by hand and, in one study, 37% of seed placements were deemed inadequate. The current methodology uses a template to guide parallel needle placement, but the template also restricts source locations, compromising tumor coverage and shielding tumor behind bones. The University of Wisconsin Medical Physics department is developing a robot to perform brachytherapy procedures autonomously, without the limitations of a template.

## **THE ROLE OF COMMUNITY ADVISORY BOARDS IN CONDUCTING RESEARCH IN AFRICAN AMERICAN COMMUNITIES**

Carly Babino, Kimberlee Gretebeck (Mentor), Nursing

Background: The role of community advisory boards (CAB) is important in the delivery of evidence-based programs for Community-based Participatory Research (CBPR). This is particularly important for programs being delivered in urban, African American communities. Purpose: To identify the role of CABs and program delivery components when conducting CBPR in two African American communities. Method: We will conduct focus groups at three CAB meetings in Milwaukee and Madison to elicit responses related to program delivery components (recruitment, retention, program location, logo, etc.) The CAB membership includes community leaders in these two African American communities. The results will be used to adapt an evidenced-based physical activity program for older African Americans in Milwaukee and Madison.

## **ESTABLISHING THE EFFECTS OF PHOSPHORYLATION ON SINGLE-STRANDED DNA-BINDING PROTEIN ACTIVITY**

Louis Baeseman, James Keck (Mentor), Biochemistry

Post-translational modifications are critical for regulation of protein function within the cell, with phosphorylation taking a key role in this process. Single-stranded DNA-binding protein (SSB) has been shown in our lab and others to be phosphorylated in bacteria however, the consequences of phosphorylation on SSB (a key protective and organization protein in DNA replication) remain poorly understood. My work has attempted to examine the effects of post-translational modifications on SSB in vitro. I will summarize results using SSB variants that mimic the phosphorylated and dephosphorylated states in DNA binding assays.

## **ENGAGING COMMUNITY MEMBERS IN MENTAL HEALTH AND PRIMARY CARE INTEGRATION RESEARCH**

Kelcie Baior, Natalie Decheck (Mentor), Family Medicine

Across the nation, approximately 1 in 4 individuals are affected by mental illness and many do not receive adequate treatment. Integrating mental health services into the primary care setting has become a notable effort to improve care for these individuals. Our project is the first known effort to add the voice of the community to inform further research on the outcomes of two prominent integrated models, Primary Care Behavioral Health (PCBH) and Collaborative Care. We will qualitatively analyze data from 381 open-ended video vignette surveys, distributed online and at various clinic and community locations. This feedback will help shape future research on how to best deliver mental health and primary care through learning what outcomes are important to a wide range of patients.

## **BRIDGING THE GAP**

Emily Baranek, Eric Bahr, Shannon Behling, Rebecca Breitlow, Jeri Jo Cassidy, Victoria Enriquez, Hannah Hayes, Sarah Hinde, Jordan Hollenbeck, Katja Kane-Foempe, Allyson Kowaleski, Lauren Lawson, Alejandra Lira, Bryanne Sekeres, Megan Van Boxtel, Leah Walker, Yvette Egan (Mentor), Nursing

Bridging The Gap is a community-based project where student nurses at University of Wisconsin-Madison were paired with an elder in Madison. This partnership facilitated a client-focused therapeutic relationship. Students developed communication and assessment skills while combating biases related to the elderly. Assessments were performed to evaluate mobility, nutrition, cognitive ability, and spirituality. The assessments provided the opportunity to discuss difficult subjects in a safe environment. A survey about attitudes towards the elderly was taken by the students before and after the project that revealed a change in beliefs about memory loss, pain related to aging, and confidence caring for older adults. Meaningful relationships were formed in which the elder and student learned from each other, bridging the age and societal divide between these diverse groups.

## **THE NEURAL MECHANISMS UNDERLYING VISUAL MOTION PERCEPTION**

Weeden Bauman, Bas Rokers (Mentor), Psychology

Amblyopia (“lazy eye”) is a neural disorder of the visual system, caused by mismatched visual input from the two eyes during development. As a result neural sensitivity to visual input through the lazy eye is reduced. Although amblyopia affects about 1 in 20 people (Flom & Neumaier, 1966), the neuro-developmental mechanisms that underlie the disorder are still poorly understood. Understanding these mechanisms will inform the treatment of neuro-developmental disorders such as amblyopia. Because our depth perception relies largely on combining information from the two eyes, people with amblyopia struggle with perceiving the position of objects in depth. However, some people with amblyopia seem nonetheless able to perceive motion through depth. The purpose of our study was to explore if people with unimpaired vision, would be similarly impaired in the perception of position in depth, but not motion through depth, if we simulated the effects of amblyopia. To mimic the condition of amblyopia we manipulated the blur, luminance, and contrast of visual input through one eye (while leaving input through the other eye unaffected). We demonstrated that all of these manipulations impair both position in depth, and motion through depth perception. We are currently exploring if motion through depth perception is more robust to the manipulations of blur, contrast and luminance, than position in depth perception. This research stands to provide insight into the nature of neural disorders of the visual system, and may help treat the perceptual deficits associated with amblyopia.

## **ROLES FOR THE ESCRT MACHINERY AND THE SEPTIN COMPLEX IN MEMBRANE ABSCISSION DURING CYTOKINESIS**

Emily Baumann, Anjon Audhya (Mentor), Biochemistry

Abscission occurs during the final phase of cytokinesis, effectively partitioning a mother cell into two separate daughter cells. The scission of the membranous intracellular bridge results in the release of a midbody structure. Proper membrane remodeling and removal of the midbody is a requirement for successful abscission, and thus the location and trafficking of the midbody can be utilized as a marker for the final steps of abscission. The septin and ESCRT machinery protein complexes have been linked to membrane scission and midbody removal, but their regulation and coordination during abscission are not fully characterized. The early *Caenorhabditis elegans* embryo was used as a model system to investigate the interdependent and cooperative roles of the septin and ESCRT machineries during abscission.

## **RECRUITMENT: A SHORT FILM**

Nathan Baumgarten, Aaron Granat (Mentor), Communication Arts

“Recruitment” is an exploration into what it may have been like for an individual who chose to enter into the intelligence community post-9/11. It explores his motivations, the process of applying to one of the agencies, and what it would be like once he was accepted. The film was produced for my Introduction to Media Production class, with the help of friends and family, using a Sony NX5U video camera. To achieve a sense of realism in the film I used authentic props in order to portray a more accurate atmosphere and world within it. By using archival footage, preserved newspapers, a period television, and other relevant props, the audience can hopefully be fooled into believing that they are re-experiencing events as they happened. The film then ties this past experience of one individual into events as recent as 2013 in order to provide a thought-provoking climax for the audience.

## **PROJECT BUILD**

Courtney Bergemann, Yanika Davis, Andrea Ruppert (Mentor), Rehabilitation Psychology & Special Education

Project BUILD is concentrated on examining the effects of a literacy-based general education curriculum on students in a cross-categorical classroom. This study has both qualitative and quantitative components; however, our participation in the research is mainly contributed to the qualitative study. Our research team of doctoral, graduate, and undergraduate students will observe and analyze how the change from segregated classroom setting to an inclusive environment effects a student with a significant intellectual disability. Due to the fact that this is technically human research, all of the researchers participating in this project were required to complete IRB training as well as subjected to background check. As undergraduate research scholars, our tasks have included: preparing adapted text materials for the literacy intervention and transcribing interviews from cross-categorical teachers as well as their assistants, and analyzing interview transcripts for themes related to three research categories: definitions about literacy, expectations of literacy outcomes, and self-efficacy in literacy instruction.

## **IDENTIFYING THE GENETIC BASES AND MECHANISMS OF PLANT SUSCEPTIBILITY**

Madeline Berkvam, Hilary Bultman (Mentor), Zoology

The genetics of plant susceptibility seeks to identify the genes that influence a plant's resistance and susceptibility to damage (pathogen, insect, and environmental damage). I hypothesize that leaf damage in aspen (*Populus tremuloides*) will have an identifiable genetic basis, and that particular plant traits will influence plant susceptibility and resistance. To test this hypothesis, I am conducting a genome-wide association study to identify the genetic regions in aspen that influence foliar pathogen damage as it relates to several leaf traits (e.g., area). This work will improve our understanding of the genetic bases of plant-pathogen, plant-insect, and plant-environment interactions. These findings can then be used for advancing *Populus* as a biofuel crop. Lastly, this work will highlight candidate genes for future functional analysis and genetic modification.

## **ARABIDOPSIS THALIANA MUTANT RESPONSE TO ENVIRONMENTAL STIMULI THAT MIMIC COMPONENTS OF SPACE FLIGHT**

Natasha Bilkey, Richard Barker (Mentor), Botany

Plants are sessile organisms and have thus become exquisitely sensitive to mechanical stimulation in order to adapt to the constantly changing mechanical environment around them. The purpose of this research is to analyze the genetic, morphological, and physiological responses to environmental stimuli as a result of touch-signaling in *Arabidopsis* mutants. We generated mutants that are part of a network that is altered in the calcium signaling pathway, *tch-2*. We then assessed their response to thigmotropic, gravitropic, hypoxic, drought, and flooding stimuli, in comparison to wild-type plants. Results from these experiments may provide insight to plants' response to space-flight and the role of touch-signaling in the regulation of plant development. This work is funded by NASA.

## **THE EFFECT OF RHO GTPASES ON BREAST CANCER CELL PROTRUSIONS IN COLLAGEN MATRICES**

Reed Bjork, Suzanne Ponik (Mentor), Cell & Regenerative Biology

In 2014, over 230,000 people in the United States were diagnosed with breast cancer. While many factors influence the risk of contracting cancer, individuals with dense breast tissue are four to six times more likely to develop carcinoma. Dense breast tissue has been characterized and attributed in large part to an increased amount of stromal collagen. The organization of stromal collagen within and surrounding a mammary tumor is important for cell migration. In the context of migration regulation, Rho GTPases are some of the most vastly studied signaling proteins and are known to play a major role in cell contractility. We aim to observe and characterize the effect of Rho pathway inhibitors and ECM spatial regulation on breast cancer cell protrusions using 3D aligned and random collagen matrices.

## **WHAT DOES METROPOLIS HAVE TO DO WITH JERUSALEM? SUPERMAN IN THE STUDY OF RELIGION**

Daniel Bliss, Corrie Norman (Mentor), Religious Studies

In the history of the superhero genre, one particular hero has stood out from the rest. Faster than a speeding bullet, more powerful than a locomotive, champion of the oppressed, fighter for “truth, justice and the American Way,” Superman has entertained and inspired followers and fans since 1938. My project is an ethnographic and literary study on the functional aspects of Superman through comics, film, and fan culture. Put simply, my project seeks to understand how fans use Superman religiously through rituals, symbols, and worldviews. It is my hope that understanding Superman and comics can inform the ways that scholars of religion and media understand religion and from there, the ways we approach popular culture in religious studies.

## **CASE STUDY OF WISCONSIN GROUND SOURCE HEAT PUMP TO CALCULATE AND ANALYZE COEFFICIENT OF PERFORMANCE**

Eleanor Bloom, James Tinjum (Mentor), Geological Engineering

Ground source heat pumps (GSHPs) offer a potentially low-fuel, low-carbon solution to the impending global energy crisis. In a study comparing GSHP’s potential for reduced greenhouse gas (GHG) emissions in Wisconsin using a life cycle analysis, it was found that the coefficient of performance (COP) is a significant factor of the GSHP’s environmental impact. A comprehensive assessment of the COP for a conventional vertical GSHP configuration with three boreholes is studied based on real, operational GSHP data in Grand Marsh, Wisconsin. Over four months of heating season data collection and processing, the COP was determined to be 3.22. Further analysis has allowed multiple conclusions to be drawn regarding the controls over the GSHP’s performance, such as its dependence on heat pump operation and entering water temperature.

## **LIFE CYCLE ASSESSMENT OF INTERSTATE 94 RECONSTRUCTION IN KENOSHA COUNTY, WISCONSIN**

Eleanor Bloom, Angela Pakes Ahlman (Mentor), Geological Engineering

The Recycled Materials Resource Center (RMRC) analyzed the environmental benefits of incorporating recycled material in the reconstruction of Interstate 94 (I-94) in Kenosha County, WI, using BE2ST-in-Highways, a life cycle assessment tool. Recycled materials used in the project include fly ash, bottom ash, foundry sand, recycled concrete aggregate, and recycled asphalt pavement. For the I-94 construction, the use of recycled materials led to a 43% decrease in energy usage, a 35% decrease in greenhouse gas emissions, a 35% decrease in social carbon cost, a 33% decrease in hazardous waste generation, and a 22% decrease in water consumption as compared to a design that used no recycled materials. This study further demonstrates the environmental value of using recycled materials in road construction.

## **EFFECTS OF ADDING TANNIN EXTRACT TO DAIRY COW DIETS ON AMMONIA EMISSION FROM MANURE AFTER APPLICATION**

Amanda Borkowski, Michel Wattiaux (Mentor), Dairy Science

Studies have shown that feeding tannins to dairy cattle can reduce urinary nitrogen (N) excretion resulting in lower ammonia (NH<sub>3</sub>) emission from manure. Our objective was to assess the impact of adding tannins to a dairy cow diet on NH<sub>3</sub> emissions from manure after simulated land application. Manure from dairy cows fed different levels of tannin (0 (control), 0.45, and 1.8% of dietary dry matter) was applied at two N application rates (240 kg/ha and 360 kg/ha) to a silt loam soil. Emissions were recorded using lab-scale ventilated chambers. Although not statistically different, added tannin in diets decreased NH<sub>3</sub> emissions from 7.4-9.7% compared to emissions from the control. NH<sub>3</sub> emissions at the high N application were 56.4% greater (P<0.10) than at the low N rate.

## **THE BINAURAL INTERACTION COMPONENT: STIMULUS VARIATION IN AUDITORY MIDDLE AND LATE LATENCY RESPONSES**

Sam Boroumand, Cynthia Fowler (Mentor), Communication Sciences & Disorders

Everyday people utilize binaural processing (hearing with both ears) to understand and pinpoint speech sounds from other noises in the environment. This study compares how binaural processing is affected in the presence of different auditory stimuli (500Hz tone, 2000Hz tone, “Ba” speech sound). Study participants are presented with each stimulus, monaurally and binaurally, while electrophysiological responses from their brainstem and cortex are recorded via scalp electrodes. Analysis of the monaural vs binaural responses yields a Binaural Interaction Component (BIC) which provides a strong correspondence to the neural resources allotted to binaural processing. Current results reveal lower frequency tones generate larger BIC responses, particularly in the cortical regions of the brain. Results of this study will help to improve communication for people who have binaural shortcomings.

## **EFFECTS OF CROSS-LINGUISTIC SIMILARITIES ON READING ABILITIES IN BILINGUAL CHILDREN**

Natalie Bowman, Margarita Kaushanskaya (Mentor), Communication Sciences & Disorders

Existing research on language processing has established that knowledge of cognates, words that share form and meaning in two languages, significantly influences understanding and production of language in bilingual participants. Specifically, presence of cognates increases language comprehension but decreases fluency of speech production. Most existing research examines cognate effects exclusively in the single-word or sentence contexts. This study examines the effect of cognate knowledge in the context of a more ecologically valid text-reading task. Matched bilingual and monolingual children read two stories aloud. One story includes 20 cognates, while the other includes 20 matched non-cognates. It is hypothesized that bilingual children will be less fluent but demonstrate better comprehension when reading a text that is rich in cognates vs. a text with no cognates, with the monolingual group showing no difference in performance on cognate-rich vs. non-cognate reading tasks.

## **THE MENOMINEE TRANSCRIPTION PROJECT**

Faith Bowman, Monica Macaulay (Mentor), Linguistics

The Menominee Transcription Project utilizes a decade worth of recordings of the endangered Menominee language gathered by Monica Macaulay and transcribes them so that they may be employed in an online dictionary. The recordings are then used to reexamine the work of a 1920s linguist named Leonard Bloomfield who studied Menominee and published a lexicon in 1975. Using Bloomfield’s lexicon, Elan (a transcription program), and the audio files, the researchers on the Menominee Transcription Project analyze and transcribe the meanings and sounds of Menominee words. The work being done with the audio will contribute to the authentication of the words available in the online dictionary accessible by educators of the tribe. In addition, the research will be influential in the revitalization of the Menominee language.

## **BONE ANALOG FOR VALIDATION OF MEDICAL IMAGE-BASED ANALYSIS AND MECHANICAL TESTING OF LONG BONES**

Matthew Boyer, Heidi-Lynn Ploeg (Mentor), Mechanical Engineering

With the growing medical, economic and social implications of degenerative bone disease and trauma, there is a need for research in bone health with accurate and repeatable methods to assess bone strength. Current medical image-based strength analysis of whole bones provides clinicians with valuable information in the assessment of bone fracture risk. Such imaging analysis tools are based on data gathered through the mechanical testing of whole bone samples. Inherent variance of biological materials requires experiments with large sample sizes of bone, which is time consuming and expensive. Some of this variance in mechanical test data can be reduced by validating and standardizing the test and analysis methods. A bone analogue, or physical model possessing similar bone geometry and structural properties to long bones, can be used to reduce the errors and variability in testing the testing and analysis methods. An analogue can provide a consistent and reproducible testing calibration, ultimately validating analytical and mechanical testing methods and reducing required sample sizes. A two-material bone surrogate was designed, fabricated and tested to provide a bending stiffness, cross-sectional geometry and densities mimicking porcine femur without the variance of biological tissue. By utilizing inexpensive and CT-readable material components, such a long bone analog allows for the validation of image-based analysis and testing methods while reducing the costs of experimental bone testing.

## **EFFECTS OF LEVODOPA AND VOCAL THERAPY IN A 6-OHDA RAT NEUROTOXIN MODEL OF PARKINSON DISEASE**

Alexander Brauer, Michelle Ciucci (Mentor), Communication Sciences & Disorders

Voice and swallowing deficits occur in 90% of patients with Parkinson disease (PD). Combined, these cranial sensorimotor deficits are the leading cause of morbidity and mortality in PD. Vocal therapy (e.g. LSVT/LOUD) can significantly reduce these deficits. At the same time, most PD patients receive levodopa as dopamine replacement therapy. However, the effect of levodopa on vocal therapy is unclear. We used a rat 6-OHDA model to evaluate the interactions between these two treatments. Ultrasonic vocalizations (USVs) were used to assess the progression of cranial sensorimotor deficits. These data will be the first to demonstrate the therapeutic effects of exercise and medication in a rat model.

## **THE EFFECT OF ANTIBODIES ON THE IMMUNE SYSTEM'S RESPONSE TO INFECTION**

Caroline Brown, Daniel Butz (Mentor), Animal Science

Severe bacterial infections can overwhelm the body's immune defenses. We hypothesize that the intestinal tract's immune system plays a critical role in the progression of severe infections. Oral administration of antibodies may be a treatment for infections, as it enhances immune response. Using mice as a model for human infection, symptoms of E. Coli, given by injection of lipopolysaccharides (LPS), were treated with three different antibodies: BP2, FCA, and a #6 formula. A control group of PBS was also observed. Following injection of LPS, mice were monitored for 72 hours, taking a weight and body condition score (BCS) every six hours. Results revealed that mice treated with formula #6 had the greatest survival rates and BCSs, with 36.4% surviving with an average BCS of 9.

## **QUANTIFYING GROWTH OF C2-C7 VERTEBRAE IN PRE-PUBESCENT CHILDREN**

Anna Buchholz, Meghan Cotter (Mentor), Waisman Center

The purpose of this research was to quantify the vertical growth of the cervical spine. It focused on males and females ages zero through ten. The C-spine measurements were taken for anterior and posterior mid-sagittal points for both superior and inferior faces. The measurements were used to find vertical distances of each vertebrae, the intervertebral spaces, and the overall length of the C-spine, which was measured from a fixed point within the head. They were then compared to both age and height of the subjects. We found that the vertical height measurements had a better correlation to subjects' height than when compared to age. Males and female growth does not necessarily happen during the same age, therefore, subject height should be used to make accurate comparisons between genders and cervical spinal growth.

## **CROSS-INFORMANT AGREEMENT ON BEHAVIOR OF CHILDREN WITH AN INCARCERATED PARENT**

Kathryn Bursinger, Julie Poehlmann-Tynan (Mentor), Human Development and Family Studies

Parental incarceration has been found to have numerous effects on children, which can be seen with both internalizing and externalizing behavior. To gauge some of these effects, this study collected data from incarcerated parents, current caregivers and teachers of young children experiencing parental incarceration. Participants filled out various forms pertaining to the child's behavior, including the Child Behavior Checklist and the Caregiver-Teacher Report Form (Achenbach, 2000). Despite reporting on the same child, differences in the responses provided by participants were observed. This project will look at the cross-informant agreement between the child's incarcerated parent, current caregiver and teacher. Additional variables include: length of time the child has been separated from the incarcerated parent; child's relationship to their current caregiver; and child's relationship to their teacher.

## **FIGURINES FROM PRE-COLONIAL INDIA**

Katelyn Callies, Jonathan Kenoyer (Mentor), Anthropology

This project looks at a collection of terracotta figurines, originating from Colonial India, to better understand their production and use. The figurines were documented quantitatively and qualitatively and recorded through narrative descriptions. Most of the figurines were made from molds and depict people from pre-colonial and colonial times in India. Clay replicas of the figurines were produced to better understand crafting techniques and determine the differences between molded and hand-sculpted figurines. Comparable figurines from the Colonial Period in South Asia were studied to determine stylistic and technological aspects of this ceramic tradition. This study has made it possible to record and document a unique collection of figurines that represent aspects of daily life in India and their crafting methods during this time period.

## **IN-VIVO VALIDATION OF 4D-FLOW MRI FOR THE ASSESSMENT OF PORTAL HYPERTENSION**

Camilo Campo, Alejandro Roldan (Mentor), Radiology

Emerging 4D-Flow-MRI techniques have shown great promise in quantifying blood flow changes associated with portal hypertension, a life-threatening complication resulting from chronic liver disease. Despite recent advancement in these techniques, in-vivo validation studies of 4D-Flow-MRI have been limited. Therefore, the purpose of this study is to validate 4D-Flow-MRI in-vivo by comparing its performance to ultrasound measurements. Studies were performed by inducing portal hypertension in 7 pigs via the partial ligation of the portal vein. Additionally, 4D-Flow-MRI and ultrasound blood flow measurements were obtained pre- and post-operation. Both techniques detected a reduction in portal venous flow post-operation, and differences in mean blood flow did not reach statistical significance. Thus, our results provide reassuring evidence for the future use of 4D-Flow-MRI for the assessment of portal hypertension.

## **THE ROLE OF CHONDROITIN SULFATE PROTEOGLYCANS IN RECOVERY AFTER FOCAL CEREBRAL INFARCTION**

Claire-Marie Canda, Lindsey Jager (Mentor), Neurology

In a focal cerebral infarction, the loss of blood flow destroys brain tissues, causing some areas to lose function. The tissue's response to this injury is an upregulation of molecules that promote repair and regeneration of the lost neurons and structure. But, there is a prevalent amount of molecules, chondroitin sulfate proteoglycans (CSPGs), which inhibit this needed growth and, consequently, recovery. It is still unknown if the functions of these molecules apply to both the spinal cord and brain. A systematic review of scientific literature was done in order to examine the extent of CSPGs after stroke. The general conclusion is that these are inhibitory molecules expressed after central nervous system (CNS) damage. Furthermore, studies have shown that this type of molecule exists in relative forms, resulting in different localizations in the CNS. Future research is needed on these molecules' specific functions in the brain.

## **DISSECTING THE SUMO PATHWAY IN MAIZE AND ITS ROLES IN STRESS PROTECTION**

Nahin Cano, Robert Augustine (Mentor), Genetics

As environmental conditions continue to fluctuate in response to global climate change, understanding how plants respond to stress is becoming increasingly important, especially in crop species. Small ubiquitin-related modifier (SUMO) is an essential post-translational modifier that regulates plant responses to abiotic stress, such as changes in temperature, exposure to salinity, and drought. Mutator (Mu) transposable element lines will be used to identify knockouts that disrupt the SUMO pathway. These lines will provide insight into how these genes affect the ability of maize to SUMOylate. Identifying the specific role that SUMO plays in stress protection will enable the development of future strategies for crop improvement.

## **LONG-TERM EFFECTS OF CONCUSSION ON FEMALE ATHLETES**

Kristen Cassarini, Kristen Pickett (Mentor), Kinesiology

Female athletes are at increased risk of concussion but are studied less frequently. Long-term effects of concussion are generally not well understood and are particularly neglected in women. This study will examine the effects of sport-related concussion on balance, gait and activities of daily living. This pilot study will include 5 females with a history of 3 or more documented sport-related concussions and 5 healthy age and activity-matched controls. Individuals will complete a standardized balance test, an activities of daily living assessment and 5 trials of 5 gait conditions: preferred speed forward; fast forward; dual-task forward; tandem; and backward. The findings from this study will offer rehabilitative intervention to individuals experiencing functional challenges due to repeated mTBIs.

## **FURTHER INVESTIGATION OF INTERACTIONS BETWEEN AROMATASE-EXPRESSING CELLS AND GnRH FIBERS.**

Taylor Cesarz, Ei Terasawa-Grilley (Mentor), Pediatrics

Gonadotropin releasing hormone controls reproductive function. We investigated interactions between aromatase-expressing cells and GnRH neurons. Aromatase is the rate-limiting enzyme for estradiol synthesis. Immunostaining data indicate that there was no colocalization of aromatase in GnRH neurons, whereas there were some interactions of GnRH fibers with aromatase-expressing cells. Because of the unreliable nature of the aromatase antibody, in the present study we conducted whether immunopositive GnRH fibers contact aromatase mRNA expressing cells using double fluorescent in situ hybridization and immunohistochemistry. The results will show whether GnRH fibers play a role in estradiol synthesis or estrogen-synthesizing neurons interact with GnRH fibers in the stalk-median eminence.

## **STRUCTURAL DETERMINATION OF THE WbKc ENZYME FROM BRUCELLA ABORTUS**

Daniel Chantigian, Hazel Holden (Mentor), Biochemistry

The goal of my research is to structurally and enzymatically characterize an N-formyltransferase referred to as WbKc. It is involved in the production of N-formylperosamine, an unusual sugar that has been found on the O-antigen of Gram negative bacteria belonging to the Brucella genus. Members in this family cause brucellosis, which mainly affects cattle, pigs, goats, sheep, and dogs. It can be transmitted to humans through the consumption of raw milk or fresh cheese, however. Current research suggests that the O-antigens of some Gram negative bacteria may play a role in virulence. As such, my research may ultimately provide a three-dimensional scaffold for structure-based drug design.

## **PATTERN LEARNING AND RECOGNITION IN CHILDREN**

Ann Chapman, Molly Yunker (Mentor), Wisconsin Center for Education Research

In this project, we explore whether children change from general to specific learners as they develop and how types of learning context may influence this change. We play an educational game that draws children's attention to the similarities and differences of felt monsters' facial features. To do this, we ask them to tell us a story using the monsters. Then, the children are told to reconstruct monsters' faces based on what they already learned. Afterward, the children are asked to correctly identify the monsters' noses. Preliminary results show older kids learn patterns faster while younger do not learn the patterns. We want to highlight older children's abilities to notice two patterns while younger kids do not learn any to better understand children's learning.

## **THE IMPACT OF IMMUNOGLOBULIN LEVELS ON DAIRY CALF WEIGHT AT NINE DAYS OF AGE**

Edwin Chen, Melissa Cornett (Mentor), Dairy Science

Passive transfer immunity (PT) is crucial for growth and survival in calves as suppressed immunity increases infection risk. This study used BRIX total solids as indirect measurements for Immunglobulins (IgG) for dam colostrum (BRIXC) and calf blood serum (BRIXB) to determine if BRIX predicts 9d dairy calf wt (WT). Data derived from Jersey (n=6) and Holstein calves (n=112) enrolled on a 2X2 factorial direct-fed microbial efficacy study. PROC MIXED in SAS analyzed data. Final Weight was (Mean±SD) 46.13±4.36 kg (bulls), 43.10 ±5.13 kg (heifers), and 31.82±6.38 kg (heifers) for Holstein and Jersey, respectively. For every additional percentage point on BRIXC, calves were (MEAN±SE) 4.56±2.56 kg significantly heavier at WT. BRIXB was not significant. Results suggest BRIXC is a better predictor for WT in dairy calves.

## **EXPERIMENTAL AND NUMERICAL INVESTIGATION OF SMALL SOLUTE CHEMICAL INTERACTIONS**

Lixue Cheng, M. Thomas Record (Mentor), Chemistry

The goals of this research are to quantify the interactions both experimentally and computationally between alcohols, polyols and related biochemical solutes with nucleic acid bases and base analogs. The data will be interpreted in terms of interactions of individual functional groups on the solutes (e.g. aliphatic C, hydroxyl O) and the nucleobases (carbonyl O, amino N, aliphatic C, and ring C, N). The analysis is based on additivity of these interactions, and involves the solution of an overdetermined set of equations dissecting each solute-base interaction free energy into additive contributions from all possible pairwise interactions of functional groups. This analysis can be performed in several ways, yielding interaction free energies per group or per unit of accessible surface area of each group. For this research project, we will determine additional polyol-nucleobase interactions and test the various methods of analysis and the underlying hypothesis of additivity, which our laboratory has demonstrated to be valid for other data sets. We will compare the results with those obtained from atomistic simulations of the radial distributions of solute in the vicinity of nucleobase, in order to test additivity and, if necessary, to refine the force field parameters used in the simulation.

## **IMPROVING THE DRINKING WATER QUALITY IN DELHI, INDIA**

Brandon Chic, Laura Grossenbacher (Mentor), Technical Communication Program

Delhi, India is one of the most populated cities in the world, and its large population requires a substantial amount of clean drinking water. While the city's water source, the Yamuna River, is vast, Delhi's water supply is far from clean. This research project evaluates the two major weaknesses of Delhi's current water management practices: the waste outflow from the city into the Yamuna River and the lack of efficiency of the city's sewage treatment plants. Based on the results of the research, recommendations are made for an improved sewage network and increased public awareness; implementation of the recommended projects will likely cause a substantial improvement in the quality of drinking water in Delhi within only a few years.

## **DETECTING DECEPTION THROUGH MONEY ALLOCATION**

Lillian Childress, Lyn Van Swol (Mentor), Communication Arts

This study is on detecting deception, how people decide to lie, and linguistic differences between lies and truths. Participants were randomly assigned to their role: as the allocator or recipient. Allocators self-classified themselves as good or bad liars. The allocators divided seven dollars between themselves and their recipient. The recipient was unaware of how much money the allocator was given. Allocators could lie to the recipient if they chose and could decide how to interact with the recipient. The interaction and transfer of money between the two participants served as the data for this study, which is in analysis stage. We hypothesize that people who perceive themselves as good liars may lie more often and make the decision to lie to someone's face rather than through text chat; whereas people who perceive themselves as bad liars may lie more often through anonymous text chat.

## **KINEMATIC AND KINETIC ASYMMETRIES DURING A VERTICAL JUMP FOLLOWING ACL RECONSTRUCTION**

Joshua Choe, Bryan Heiderscheit (Mentor), Orthopedics & Rehabilitation

Anterior cruciate ligament injuries are among the most common knee injuries. Following an anterior cruciate ligament reconstruction (ACLR), athletes have up to a 25% chance of tearing the ACL of the involved or contralateral limb, and have a higher risk of developing early onset osteoarthritis. With such a high risk of re-injury, it is clear that current rehabilitation practices may not be appropriately targeting important biomechanical asymmetries in ACLR patients. For example during the first half of the jump stance, in ACLR subjects, peak knee flexion angle was appreciably lower for the involved limb compared with the uninvolved limb. In order to better understand how an athlete's biomechanics change through the rehabilitation process the proposed study will monitor athletes who have undergone an ACLR at 2-month intervals until returning to competition, in order to assess the development and rehabilitation of asymmetries over time. The focus of this study will be on assessing asymmetries of lower extremity joint angles and kinetic measures during a vertical jump. The results of this study may help to demonstrate specific biomechanical asymmetries that are currently unaccounted for in typical ACLR rehabilitation programs in an attempt to reduce subsequent ACL injury risks.

## **ANALYZING THE REPRESSION FUNCTIONS OF THE BICAUDAL-C PROTEIN: A REGULATOR OF VERTEBRATE DEVELOPMENT**

Andy Chung, Nithin Charly, Michael Sheets (Mentor), Biochemistry

Organisms are composed of millions of cells that depend on the proper regulation of mRNAs. Bicaudal-C (Bic-C) is a regulatory protein that controls how specific mRNAs in cells are used to make proteins. Although our lab has recently identified some mRNAs controlled by Bic-C, the mechanism by which Bic-C represses the translation of these mRNAs is unknown. My studies have implicated protein-protein interactions between Bic-C and the CNOT7 repressor protein. The goal of my experiment is to define Bic-C's role in mediating translational repression via its interaction with CNOT7. Investigating the biological roles of Bic-C may lead to a broader understanding of how embryonic and adult tissues such as the kidney and heart form and potentially provides new insights on how to treat human medical conditions such as polycystic kidney disease.

## **DARK ENERGY MEASUREMENTS USING A CYLINDRICAL RADIO TELESCOPE**

Aleks Cianciara, Ying Lu, Catherine Steffel, Peter Timbie (Mentor), Physics

Perhaps the most important question in physics today concerns dark energy. Dark energy is the phenomenon that physicists believe is causing the expansion rate of the universe to accelerate. In order to understand dark energy, new radio telescopes tuned to the 21cm line of neutral hydrogen are being constructed to survey the universe and accurately measure the expansion rate. We carried out electromagnetic computer simulations on a novel 21cm cylindrical radio telescope and compared the results to the actual antenna response.

## **THE CHARACTERIZATION OF AFRICAN AMERICAN MOTHERS AND MOTHERHOOD**

Adetola Coker, Brigitte Fielder (Mentor), Comparative Literature

The objective of the project is to collect a variety of sources that personify African American mothers and motherhood in 19th century American literature. The Christian Recorder, the official newspaper of the African Methodist Episcopal Church, was a newspaper intended for African American readers. The project is carried out by manually searching through Christian Recorder records and analyzing articles that describe African American mothers and motherhood. The intended product for the project is to create a collection of sources that show the importance of grooming young women into good wives and in turn, good mothers. By analyzing the perception of motherhood from the Christian Recorder, it shows how preparation for marriage and motherhood was framed for African American girls in the context of this important African American publication.

## **EXERCISE AND GAIT IN PARKINSON DISEASE**

Vaughan Collins, Kristen Pickett (Mentor), Kinesiology

This research proposes to examine the use of exercise to improve gait function and thereby ease the symptoms of Parkinson disease (PD). PD is a neurodegenerative disease, in which patients often suffer from impaired gait, rigidity, and overall decreased flexibility throughout their extremities. In this study, a stationary bicycle will be used in the home of individuals with PD living in rural settings or who are unable to travel. The goal of the study is to observe the relationship between exercise and gait and lifestyle changes in those who suffer from PD. By investigating the possible association between improved gait and daily function and exercise we hope to improve gait, decrease falls and improve the quality of life for individuals living with PD.

## **ISOLATING AND IDENTIFYING MICROBIAL COMMUNITIES IN THE COPEPOD EURYTEMORA AFFINIS**

Joseph Connolly, Martin Bontrager (Mentor), Genetics

Recent studies of animal microbes suggest that these bacterial communities play crucial roles in host fitness. In order to fully understand their interactions with the host, these communities must be isolated, identified and manipulated. The copepod *Eurytemora Affinis* represents the ideal host organism to study these microbial communities due to its history of parallel freshwater to saltwater invasions. Isolating and identifying member of the *E. Affinis* microbiome will help us understand the dynamics of host associated microbial communities during rapid environmental change. Using multiple bacteriological techniques, we were able to isolate and identify several of these bacteria species.

## **MAPPING FEMINIST-RELIGIOUS DISCOURSE: IDENTITY, COMMUNITY, AND COALITION BUILDING ONLINE**

Chelsea Cornelius, Corrie Norman (Mentor), Religious Studies

Scholars previously investigated the intersections of religion and feminism, feminism and online discursive space, and online discursive space and religion, but none take up the particular convergence of all three discursive features. In this Religious Studies honors thesis I examine the written reflections and responses of feminist-religious identity, community, and coalition building in the discursive area of online blogging. The discursive space of online blog writing not only offers a public space for individuals to both articulate their own identities, experiences, and beliefs regarding their religion and their feminism, but also facilitates development of networks and online community. Rooted in the integration of religious and feminist theory with an investigative case study, I argue that this particular online forum facilitation and participation exhibits a unique feminist, religious, and discursive phenomenon.

## **MAXIMAL HEART RATE DIFFERS BETWEEN LABORATORY AND FIELD CONDITIONS AMONG FEMALE ATHLETES**

Carol Coutinho, Andrew Watson (Mentor), Orthopedics & Rehabilitation

Accurate maximal heart rate (MHR) determination is essential for prescribing exercise intensity among athletes and the general public. Although MHR can be determined by a number of testing and estimation methods, minimal conflicting research exists regarding differences between these methods. Therefore, the purpose of our study was to identify if MHR varies between laboratory testing, field testing, training, competitive matches and an age-predicted MHR equation among female collegiate soccer players. Twenty-one female NCAA Division 1 soccer players had MHR determined by each of these methods and results indicated that MHR from laboratory testing was significantly lower than field testing, training, and competition. The differences in these methods should be taken into account when using MHR to prescribe exercise intensity to prevent over- and undertraining.

## **COMMUNITY-BASED WATER-BORNE DISEASE PREVENTION IN RURAL ECUADOR**

Erin Crain, Catherine Woodward (Mentor), Institute for Biology Education

The goal of this project is to assess the incidence of and identify the most common water-borne disease pathogens in Jama County, Ecuador. Diarrheal disease has major human health implications in the area, causing severe illness and even death from dehydration. I communicated with the laboratory director at the Jama hospital, and I collected water-borne disease incidence data from patient fecal and blood examination records. After data analysis and disease identification, I created an educational campaign to teach community members about the causes and prevention of major water-borne pathogens, which will be taught by educated community members and future interns. Soap made by locals will be distributed at the educational meetings, encouraging sanitary practices and decreased disease transmission in the future.

## **DEVELOPING MICROENTERPRISE OPPORTUNITIES IN RURAL ECUADOR FOR BETTER HEALTH AND WELL-BEING**

Alexandria Cull, Lily Grant, Jennifer Knoepfel, Janet Niewold (Mentor), Design Studies

After participating in a microenterprise and global health field course in Ecuador last year, Alexandria, Lily and Jenny received a Wisconsin Idea Fellowship to return and further their microenterprise work with the indigenous women's group, Sumak Muyo. The project has allowed the women to develop business strategies that increases profits to support their families and invest in their community. The women sell their products locally as well as through the UW student organization Wisconsin Without Borders Marketplace and a new campus retail location. Focusing on microenterprise-linked health outcomes, this project contributes to bettering the health status of Sumak Muyo while setting up the frameworks for similar projects in Mexico and Kenya.

## **IMPACTS OF BEST MANAGEMENT PRACTICES ON STREAM QUALITY WITHIN CHEQUAMEGON-NICOLET NATIONAL FOREST**

Margot Cumming, Barbara Peckarsky (Mentor), Zoology and Entomology

The aim of this project is to test whether new best management practices (BMPs) implemented in 2004 improved trout stream health in the Chequamegon-Nicolet National Forest. We analyzed available fish and invertebrate data provided by the Wisconsin DNR by comparing indices of biotic integrity (IBIs) before and after 2004, and between managed and unmanaged forests. Only one site had sufficient invertebrate data, but nine sites had useful fish data. Invertebrate data at the one managed site showed declining IBI's after implementation of the new BMPs, consistent with stream degradation. However, analysis of the fish IBIs shows no significant impact of the revised BMPs, or between fish communities in streams in managed and unmanaged forests. Further invertebrate data are needed to better test our objectives.

## **EFFECT OF MBOA ON PLANT-GROWTH PROMOTING BACTERIUM RHIZOBIUM PUSENSE IRBG74**

Audrey Dalgarno, Matthew Crook (Mentor), Agronomy

Rhizobium pusense IRBG74 is a bacterium that has a symbiotic, growth-promoting relationship with legumes and rice. However, the bacterium is unable to establish this beneficial relationship with maize B73. Our research aims to diversify the plants that IRBG74 colonizes to allow more efficient agriculture. MBOA (6-methoxy-2-benzoxazolinone) is an antimicrobial compound found in maize B73, but not legumes or rice. We hypothesized that Rhizobium pusense would be susceptible to MBOA. Our experiments that tested IRBG74 against varying MBOA concentrations found no evidence of susceptibility and did not support our hypothesis. Further experiments will be performed using the ‘Buckler maize diversity collection’ of 25 maize varieties to find genetic differences that affect colonization by Rhizobium pusense IRBG74.

## **CRESTED GUAN CONSERVATION IN MEXICO AND LATIN AMERICA**

Antonio Del Valle, Samantha Buechner, Mary Schneider, James Berkelman (Mentor), Wildlife Ecology

The Crested Guan (*Penelope purpurascens*) is a member of the Cracidae family of birds. Crested Guans are social and feed primarily on fruit in the canopy of trees. They are a popular game species found in Mexico, through Central America to northern South America. Overhunting, combined with habitat loss, has led to the decline of Crested Guans across their natural range. However, many conservation organizations have not prioritized their protection due to their wide range. We investigated the threats to Crested Guans, and in order to conserve this species, we recommend identifying and protecting critical habitat areas for population recovery. We also recommend educating locals on the importance of conserving this species, as well as educating on sustainable hunting practices outside of protected areas.

## **TODDLERS’ LEARNING FROM TOUCHSCREENS**

Hailey DeLuca, Mary Matoba, Michelle Riesenfeld, Marissa Savitch,  
Heather Kirkorian (Mentor), Human Development and Family Studies

Our previous research indicated that toddlers learn better from an interactive touchscreen than from non-interactive video. The purpose of the current study was to extend this finding by determining whether learning is greater for children with well-developed working-memory skills. Toddlers (26-35 mos) played a hide-and-seek game transferring from video to real-life objects. Some children actively interacted with the screen, while others passively viewed. We replicated our previous research that found toddlers learn better from an interactive touchscreen than from non-interactive video. Furthermore, we observed that toddlers with higher working-memory skills performed better in both conditions, even after controlling for age and vocabulary scores. Our research findings provide a better understanding about how young children learn from screen media.

## **ENVIRONMENTALLY FRIENDLY ROBOT: PROTECTING NATURAL RESERVES AGAINST RANDOM LITTERING**

Xiang Deng, William Sethares (Mentor), Computer Engineering

With large increases in tourism and tourist sites in many developing countries, the act of littering and polluting in natural reserves is done in a fashion that is difficult and inefficient for cleaners to complete their tasks due to the random nature of littering. The purpose of this research project is developing an automated robot that is capable of maneuvering in dynamic, unstructured wild environment and collecting data about litters’ distributions and forming patterns. The robot is aimed to give critical information about the commonly polluted areas and facilitate tourist sites to develop a significantly more efficient method of collecting trash or prevent littering in advance. The distribution patterns will allow for cleaning crews to quickly find trash in areas that is most common, thus saving a lot of time.

## **FABRY-PEROT OBSERVATIONS OF LUNAR EXOSPHERIC POTASSIUM EMISSION**

Nicholas Derr, Susan Nossal (Mentor), Physics

The lunar atmosphere, a thin, loosely bound exosphere, must be continually replenished in order to offset its constant loss of constituent vapors to space and surface re-capture. Influenced by interactions between the lunar surface, solar wind and solar radiation, it exists in a variable equilibrium. While sodium and potassium are trace elements of the lunar surface, they are major components of the lunar exosphere due to their high rates of liberation. As such, they are valuable tools for the study of space weather. High signal-to-noise temperature and velocity measurements of the lunar potassium exosphere at specific latitudes and altitudes around the moon are presented here. They are derived from ground-based Fabry-Perot observations taken throughout 2014 and demonstrate possible monthly and yearly trends.

## **PASSIVE SURVEILLANCE PROGRAM FOR VECTOR-BORNE PATHOGENS IN TICKS FROM WISCONSIN**

Carlie Deziel, Susan Paskewitz (Mentor), Entomology

The deer tick, *Ixodes scapularis*, is a vector of several pathogens which can induce illness in humans (*Borrelia*, *Anaplasma*, and *Ehrlichia*). Incidence of diseases caused by these pathogens has steadily increased since their emergence in the United States. A passive surveillance program was initiated to establish the distribution of pathogens in Wisconsin in order to assess the risk of human infection. *I. scapularis* ticks were collected off of a variety of animals at veterinary clinics and wildlife refuges throughout Wisconsin in 2014 and analyzed for the presence of these pathogens.

## **THE ROLE OF NITRATE IN IRON'S BIOGEOCHEMICAL CYCLE**

Manish Dhungana, Jacqueline Mejia (Mentor), Civil & Environmental Engineering

Iron (Fe) is the most abundant transition metal on Earth and plays a major role in biogeochemical cycles. The transformation of iron oxides under abiotic Fe(II)-oxidizing conditions is understood well. However, Fe(II) oxidation coupled with nitrate reduction in anaerobic environments remains poorly understood. This research investigated the geochemical role of nitrite in Fe(II) oxidation by studying the formation of Fe(III) minerals. Reactors containing aqueous Fe(II) or Fe(II)-rich minerals were subjected to complete redox cycles by addition of nitrate to induce Fe(II) oxidation. X-ray absorption spectroscopy was used to investigate the Fe(III) formed. Ion Chromatography was used to determine nitrate concentrations of the aqueous solutions. Observing this redox process can help us understand how biogeochemical cycles of iron are effected by the presence of nitrate.

## **INVESTIGATING THE ROLE OF KDM3B, A HISTONE DEMETHYLASE, IN THE ACQUISITION OF PLURIPOTENCY**

Michael Diny, Khoa Tran (Mentor), Biochemistry

Induced Pluripotent Stem Cells (iPSCs) are somatic cells that have been reprogrammed to acquire the properties of embryonic stem cells by the overexpression of a small set of proteins. iPSCs have the unique ability to self-renew and maintain pluripotency, allowing them to differentiate into any of the three primary germ layers. This makes them suitable tools for regenerative therapy and disease modeling. Since somatic cells and their corresponding iPSCs share the same genome, iPSCs have acquired pluripotency by modifying their epigenome, the chemical marks on their DNA and histone tails. These epigenetic modifications are performed by various epigenetic enzymes. These enzymes have shown to be highly specific in their activity, but the mechanism by which they operate is not well understood. In order for safe, controllable and efficient iPSC therapy to be achieved, the molecular mechanism underlying the transition to the pluripotent state must be better understood. The goal of this proposal is to help delineate the molecular mechanism of an important epigenetic enzyme, Kdm3b, during the reprogramming process.

## **A SPATIAL ANALYSIS OF A SUMMER CYANOBACTERIAL BLOOM IN LAKE MENDOTA**

Patrick Dowd, Robin Rohwer (Mentor), Bacteriology

Anthropogenic eutrophication causes harmful cyanobacterial blooms in freshwater bodies around the world. We collected 24 spatially distributed water samples during a cyanobacterial bloom in eutrophic Lake Mendota on July 4, 2015. Simultaneously we collected physical and chemical data using the Fast Limnology Automated Measurement platform (FLAMe), a boat-mounted water intake and sensor system. Automated Ribosomal Intergenic Spacer Analysis (ARISA) determined the bacterial community composition in the 24 samples. We analyzed the communities to understand how the environmental variables at each location influenced differences in community composition. We correlated the bacterial community compositions and environmental variables with cyanobacterial bloom intensity to understand how these variables affect water quality. We put this single-day spatial study into temporal context with our long-term sampling of Lake Mendota.

## **COMMUNICATING SCIENCE CONCEPTS TO ADULTS AND CHILDREN**

Elizabeth Duchow, Emily Bero, Haley Vlach (Mentor), Educational Psychology

Research has shown that, to foster children's development, adults use language differently when explaining concepts to them. The communicative techniques used by adults in explaining a prominent domain of education, science, have not been exclusively researched. To address this gap, a study was conducted to investigate if and how adults changed their word choice and explanatory approach when explaining science topics to children and how that varied from explanations to adults. Eighty-one participants were given various science topics and were asked to explain each topic to both adults and children. Immediately afterwards, participants were asked to grade themselves on the strength of their responses. Video recordings of these explanations were reviewed and assessed based on the accuracy and content. Results from the follow-up evaluation showed that participants did change their explanation to children and were confident that they provided strong and accurate explanations. Contrastingly, results from the video analysis confirmed that adults decreased the quality of their explanations to children, providing weaker and less accurate explanations than those provided to adults on the same topics and that their language did change with children. These findings suggest that adults do not possess the knowledge of how to adequately explain science topics to children nor are they aware that their explanatory strength decreases. This study suggests that adults may not be linguistically prepared to explain science domains to children.

## **BACTERIAL IMPACT ON LEAF-CUTTER ANT FUNGAL GARDENS**

Zach Dumar, Cameron Currie (Mentor), Bacteriology

Leaf-cutter ants have a mutualism with a fungal cultivar that provides them with food. Bacteria also associate with this cultivar, but the relationship of the bacteria with the cultivar remains uncertain. To test this relationship, we treated subcolonies of fungus garden with leaf discs infused with antibiotics, and compared leaf incorporation rates to a control whose infusion only included water. Ants gradually incorporated less antibiotic infused leaf disks into fungal gardens over the course of the experiment, but no visible changes in the cultivar occurred. We concluded that the bacteria associated with leaf-cutter ant fungal gardens have little impact on the fungus's ability to maintain its structure. Possible involvement of the bacteria with promoting fungal garden growth will be examined in the future in vitro.

## **TRACKING CANDIDATUS ACCUMLIBACTER CLADE ABUNDANCE OVER SEVERAL STEPWISE OXYGEN REDUCTIONS**

Matthew Dysthe, Natalie Keene (Mentor), Civil & Environmental Engineering

Conventional wastewater treatment plants (WWTP) performing enhanced biological phosphorus removal (EBPR) operate with extensive aeration to ensure sufficient dissolved oxygen (DO) for microorganisms. The aeration system is generally the greatest energy consumer of a WWTP; therefore, the industry is interested in minimizing this demand while maintaining quality effluent. EBPR selects for polyphosphate accumulating organisms, where *Candidatus Accumulibacter phosphatis* (CAP) is dominant. The purpose of this study was to track the different clades of CAP in a pilot plant as DO was reduced. Samples collected over 5 months were analyzed using quantitative Polymerase Chain Reaction (qPCR) to determine relative clade abundance by targeting the polyphosphate kinase (ppk1) gene. The results obtained will help clarify to what extent DO can be reduced while sustaining EBPR.

## **NANOG AND E-CADHERIN EXPRESSION IN ASTROCYTES DURING REPROGRAMMING TO INDUCED PLURIPOTENT STEM CELLS**

Paul Ehrlich, Rupa Sridharan (Mentor), Cell and Regenerative Biology

Induced pluripotent stem cells are derived from reprogrammed somatic cells and have the ability to replicate indefinitely and differentiating into any cell type. Reprogramming is the transformation a cell undergoes to become an iPSC. In MEFs, E-cadherin precedes Nanog, while in Astrocytes, Nanog proved E-cadherin independent. However, DPPA3 appeared only with Nanog and E-cadherin, suggesting reprogramming of ectodermal and mesenchymal cells is different with similar endpoints. We are interested in post-translational modifications that influence heterochromatin. The Heterochromatin Protein 1 (HP1) family (alpha, beta, and gamma), play a role in heterochromatin formation. Their binding specificity to K9 trimethylation is known, but the influence of surrounding amino acid and post-translational modifications is undetermined. We will purify recombinant HP1 family members and determine binding specificities using a histone-peptide array.

## **EFFECTS OF ESTROGEN METABOLITES ON NITRIC OXIDE PRODUCTION BY UTERINE ARTERY ENDOTHELIAL CELLS (UAEC)**

Chariesse Ellis, Rosalina Villalon Landeros (Mentor), Obstetrics and Gynecology

Our research focuses on the hormone estradiol and its derived metabolites, the hydroxyestradiols (2-OHE2, 4-OHE2), and the methoxyestradiols (2-ME2, 4ME2). These metabolites are of great importance for regulation of the uterine vasculature during pregnancy. Our current hypothesis is that estrogen-metabolites induce the production of the potent vasodilator nitric oxide, which is important for dilating vessels and increasing blood flow during fetal development. To test this hypothesis we will use high performance liquid chromatography (HPLC) to determine the production of NO by uterine artery endothelial cells (UAECs) upon stimulation with estrogen metabolites. After the completion of this study, the results will provide further information towards understanding the influence of estrogen metabolites on the vasodilation processes during pregnancy.

## **CHARACTERISTICS OF RADIATION-INDUCED CHANGES IN CULTURED HUMAN VOCAL FOLD FIBROBLASTS**

Gabrielle Enos, Susan Thibeault (Mentor), Otolaryngology

Radiation therapy for the treatment of head and neck cancer has been shown to have antagonistic effects on the vocal folds such as tissue damage, reduction in vocal fold function, and overall diminished voice quality. Our understanding of the biological mechanisms underlying these changes is limited. The purpose of this study is to investigate the effects of radiation on gene expression, cell morphology, cell viability, and cell growth of vocal fold fibroblasts. Fibroblasts are an important cell type in the vocal folds as they are responsible for the structure and regulation of the extracellular matrix (ECM), which is vital for tissue viscoelasticity and healthy vocal fold function. Fibroblasts also play an important role in tissue injury and the healing process. This study specifically examines the gene expression of multiple inflammatory cytokine genes and ECM genes, and involves analysis of cell stains to investigate cell viability, documenting microscopic images to evaluate cell morphology, and performing a clonogenic assay to assess cell growth. Knowledge gained from this study will further our understanding of the biological mechanisms underlying radiation-induced vocal fold damage as well as lead to the development of future treatment options.

## **REPORTER LINES FOR DIRECTED DIFFERENTIATION OF RETINAL CELL TYPES FROM HUMAN PLURIPOTENT STEM CELLS**

Zachary Erlichman, Elizabeth Capowski (Mentor), Waisman Center

Cell based therapy using retinal cell types derived from human pluripotent stem cells (IPS) has emerged as a new method for combatting both acquired and inherited retinal degeneration, such as macular degeneration. In the Gamm Lab, the focus is on developing strategies for generating retinal cell types for transplantation and disease modeling. This goal requires an understanding of the mechanisms involved in eye development. We have constructed a model using IPS cells that recapitulates early cell fate decisions required for retinal specification. The current experiment is to use CRISPER/Cas9 gene editing to develop fluorescent reporter iPSC lines targeting key proteins involved in these cell fate decisions. The reporter lines will be important tools for developing protocols to generate pure populations of retinal cell types for therapy.

## **DERIVATION OF REGION-SPECIFIC ASTROCYTES FROM HUMAN PLURIPOTENT STEM CELLS**

Maria Estevez, Randolph Ashton (Mentor), Biomedical Engineering

Astrocytes play important roles in maintaining brain homeostasis and proper functioning of the central nervous system. Several neurodegenerative diseases are related to astrocyte abnormalities. In order to effectively model and study these diseases, it is necessary to generate all affected cell types *in vitro*. Current methods for deriving astrocytes from human pluripotent stem cells (hPSCs) are long and lack the ability to pattern the astroglial progenitors to specific spinal cord domains. This lack of control represents a significant challenge to the field given the extensive astrocyte heterogeneity observed in the body. Here, I present a novel method for differentiating hPSCs to astrocytes from cervical, thoracic, and lumbar regions of the spinal cord using a chemically defined method that yields astrocytes in a significantly shorter timeframe.

## **LIFE COURSE PREDICTORS OF ASTHMA RISKS IN A LARGE CLINICAL POPULATION: AGE, SEX, AND BMI**

Jarjeh Fang, Lawrence Hanrahan (Mentor), Family Medicine

Current literature indicates the existence of a significant association between asthma prevalence and body mass index (BMI), with a dose-dependency between BMI and asthma control. These associations are modified by sex, possibly due to interactions between sex hormones and immune factors or underlying inflammation linked to both asthma and obesity. Studies indicate a stronger association in pediatric males and adult females. We examined cross-sectional data in the University of Wisconsin Electronic Health Record Public Health Information Exchange (UW eHealth-PHINEX). These data suggest an effect of age and sex on the association between asthma and obesity in a large, clinical data set, supporting previous data implicating an effect of female sex hormones and obesity on asthma prevalence.

## **IDENTIFYING PROTEINS THAT ASSOCIATE WITH BICAUDAL-C DURING TRANSLATIONAL REPRESSION**

Thomas Feustel, Michael Sheets (Mentor), Biomolecular Chemistry

Bicaudal-C (Bic-C) is an RNA binding protein relevant to the study of embryology and human polycystic-kidney disease. Bic-C regulates gene expression by repressing translation of specific mRNAs during oogenesis and embryogenesis. Evidence suggests that repression is facilitated by binding of proteins to Bic-C, but the exact mechanism is unknown. Bic-C is being engineered to contain an Avitag amino acid sequence. The Avitag is a specific sequence of amino acids that is biotinylated by the BIR-A enzyme. Biotinylation allows isolation of Bic-C and associated proteins using a biotin-streptavidin pull-down assay. Identifying proteins that associate with Bic-C during translational repression will allow further study about mechanisms of repression. Ultimately, such information could provide new insights into Bic-C and its potential use as a target for disease therapies.

## **DOES EXPOSURE TO SPANISH MAKE BILINGUALS THINK IN SPANISH, EVEN WHEN USING ENGLISH?**

Kathryn Ficho, Margarita Kaushanskaya (Mentor), Communicative Sciences and Disorders

Several studies have examined whether grammatical gender information in one of a bilingual's two languages affects processing in the other. Evidence shows that a language that uses gender may influence processing in a language that does not. For example, speakers of Spanish find it easier to remember pairs of English words when these share grammatical gender in Spanish than when they do not. In this study, I examined whether priming bilinguals with their gender-marking L2 (Spanish) before they engaged in a word-association task in English would increase the degree to which grammatical gender information in Spanish would become available during English processing. Participants, English monolinguals and English-Spanish bilinguals, are exposed to videos in English or Spanish before performing word-association tasks in English. It is hypothesized that exposure to the gender-marking Spanish will serve to increase activation of Spanish, yielding stronger effects of Spanish gender on English language processing than exposure to English.

## **CENTER FOR CHILD AND FAMILY WELL-BEING**

Kristen Field, Kristen Krueger, Julie Poehlmann-Tynan (Mentor), Human Development & Family Studies

The Center for Child and Family Well-being (CCFW) is focused on developing the well-being of children and families through family research and evidence-based programming and policy-making. We seek to respond to critical issues faced by family members and those who serve them by organizing statewide events aimed at empowering youth and maintaining healthy lifestyles. As of 2014 the center has gained numerous affiliated research and outreach projects promoting and optimizing individual and family well-being. The Center for Child and Family Well-being hosts community-based events such as the 2014 YouthON! Film Festival, RePLAY children's fashion show and a series of Families and Well-Being seminars all designed to engage the community in child and family well-being outreach.

## **CHILDREN'S REPRESENTATIONS OF ATTACHMENT RELATIONSHIPS IN FAMILY DRAWINGS**

Kristen Field, Amy Yang, Julie Poehlmann-Tynan (Mentor), Human Development & Family Studies

This data comes from Dr. Julie Poehlmann-Tynan's research, "Infant-Parent Interaction." The specific study, "Young Children with Incarcerated Parents" measures a wide range of parent-child relationship qualities. One measure chosen to present is the family drawings, which is a drawing created from the child to represent how he or she perceives the family. The drawing is then coded for eight varying qualities on a seven-point scale indicating the child's level of attachment. We are interested in analyzing the variance across these children's attachment style based on the length of separation from their incarcerated parent and how many people live with them.

## **TO TILL OR NOT TO TILL: NO-TILL BETTER FOR SUPPRESSING CLONAL WEEDS IN THE BIOCORE PRAIRIE**

Cristina Fischer, Janet Batzli (Mentor), Biocore

We studied how soil tilling influences the abundance and coverage of weeds in the Biocore Prairie in preparation for planting prairie seeds. Tillage generally decreases weeds overtime by increasing seed germination and depleting the seed bank. We hypothesized an increase in the abundance and percent coverage of weeds in a tilled versus no-tilled area of the Biocore Prairie. We measured species abundance and percent coverage of weeds in twelve 0.5m<sup>2</sup> quadrats in tilled and no-tilled areas eight weeks after tilling. No-till had 60% weed coverage with 32% comprising weedy forbs. Tilled had 19% coverage with 65% comprising weedy forbs, including an increased prominence of clonally reproducing Canada thistle. The data indicates that tilling decreases weed coverage, but no-till provides better control of aggressive clonal weeds.

## **QUANTIFYING INTESTINAL LEAKAGE IN DROSOPHILA MELANOGASTER FOLLOWING TRAUMATIC BRAIN INJURY**

Julie Fischer, David Wassarman (Mentor), Cell and Regenerative Biology

TBI is the leading cause of death and disability in the USA in people from ages 1-44. It results from impacts to the head, causing injuries to the brain. One of the known outcomes of TBI is intestinal permeability, allowing unnatural molecular flow of glucose and bacteria to occur between the intestines and the circulatory fluid. Excess glucose in the blood can potentially damage blood vessels that supply the vital organs, resulting in organ failure and nerve damage. Our lab hopes to develop a sensitive and quantitative method for measuring the leakage of molecules from the intestines following TBI. This will allow us to determine when leakage begins relative to injury and also to calculate the rate of leakage at times after TBI.

## **COVER CROPS FOR SMALL SCALE VEGETABLE PRODUCTION**

Madeline Fischer, Elizabeth Bosak (Mentor), Agronomy

Cover crops are widely used in small-scale vegetable production to provide weed suppression, prevent soil erosion, and add organic matter and nutrients to soil. Sorghum-sudan grass is a summer annual grass that is fast growing and therefore very efficient in weed control. Red clover adds nitrogen to the soil, suppresses weeds, and breaks up heavy soil. Berseem clover provides many of the same services as red clover, except it is used to prevent erosion rather than to break up soil. During the 2014 growing season, the previously described cover crops - sorghum-sudangrass, red clover with oats, and berseem clover with oats - were evaluated for their ability to suppress weeds (predominantly velvetleaf) and add nitrogen to the soil. The cover crops were broadcast seeded in strips after winter rye. Results from weed observations and biomass collections will be reported. Through Cooperative Extension's Agriculture and Natural Resources internship program, in addition to assisting with on-farm research projects, I participated in the 2014 Farm Technology Days Extension exhibits. I created the posters for the cover crop plots as well as explaining functions of different cover crops to farmers.

## **TREATMENT OF PIK3CA AND APC MUTANT COLORECTAL CANCERS WITH DUAL PI3K/MTOR INHIBITION**

Tyler Foley, Dustin Deming (Mentor), Medicine

Colorectal cancers (CRC's) with mutations in the PIK3CA gene, which produces a constitutively active phosphoinositide-3-kinase protein (PI3K), along with aberrations of the adenomatous polyposis coli (APC) gene comprise a significant portion of the CRC patient population. In this study, we engineered mice expressing both mutations along with spheroid cultures derived from mouse tumor tissue. Spheroids and tumors were treated with a dual PI3K/mTOR inhibitor BEZ235. BEZ treatment resulted in a reduction in size of PIK3CA and APC mutant spheroids. Additionally, BEZ elicited a dramatic treatment response in these cancers on endoscopy, with a 45% decrease in median lumen occlusion compared to a 70% increase in controls over the 14-day treatment period. These results warrant further investigation in clinical studies.

## **CALCULATING THE GALACTIC ROTATION CURVE OF THE MILKY WAY**

Leah Fulmer, Clayton Bennett, David Carr, Jennifer Heup,  
Julia Mayeshiba, Snezana Stanimirovic (Mentor), Astronomy

Using the University of Wisconsin's Small Radio Telescope (SRT), we have mapped the Milky Way's rotation by examining 21 cm hydrogen emission. We observed every 3 degrees of galactic longitude from  $20 < l < 75$  degrees and from these observations—and using our knowledge of the Doppler Effect—we have calculated the radial velocity ( $V_r$ ) of galactic hydrogen clouds. We then plotted the  $l - V_r$  diagram, correcting for noise and random motion. Using this rotation curve we can calculate the total mass of the Milky Way via classical mechanics. Finally, using the calculated mass we can calculate the dark matter component of the Milky Way galaxy by comparing it with the predicted mass of visible matter in our galaxy.

## **INSECT IDENTIFICATION OF LAKES OF NORTHERN WISCONSIN**

Vilas Gaddameedi, Paul Schilke (Mentor), Forest Ecology

The types and quantities of birds in northern Wisconsin rely heavily on the insects present. Our hypothesis looks at how the vegetation around the water's edge is related to the populations and densities of the insects in the same regions. Our research is to identify samples of insects collected around the lakes on wax paper in the summer months of 2013 and 2014. It is done mainly by examining the insects through a microscope and recording the data in an electronic spreadsheet. Research is still undergoing and currently it seems that midges are the most abundant insects present and we hypothesize that they will be the ones most directly affecting the vegetation in these lentic ecosystems.

## **BLASTOMYCES DERMATITIDIS**

Connor Gallaher, Kurt Reed (Mentor), Pathology & Laboratory Medicine

Heavily concentrated in parts of Wisconsin, *Blastomyces dermatitidis* is an infectious agent found in the environment that can lead to a fungal infection called Blastomycosis in both humans and animals. Blastomycosis is notoriously marked by pneumonia-like symptoms and if left untreated, can lead to serious health concerns. With limited existing research about the topic, this study aims to uncover many of the key factors involving *Blastomyces dermatitidis*, including but not limited to the population genetic structure and the landscape ecology of the fungus. This study will allow better identification of *Blastomyces dermatitidis*, prevention and treatment techniques, and more background information, providing key information for future research, medicine, and overall knowledge.

## **FCGR3A AND FCGR2C VARIABILITY: COPY NUMBER AND SINGLE NUCLEOTIDE POLYMORPHISMS**

Mikayla Gallenberger, Jacquelyn Hank (Mentor), Human Oncology

Despite cancer immunotherapy being named Science Magazine's 'Innovation of the Year' in 2013, there is still room for advancement in the optimization of immunotherapeutic techniques to improve the prognosis of the millions of individuals living with cancer. One factor that can affect the clinical outcome in cancer patients is genetic variability of specific loci. In particular, the Fc gamma receptor genes (FCGR) are subject to genetic variation; some of the FCGRs are copy number variable (CNV) and some of them have single nucleotide polymorphisms (SNP). Such variations affect how the FCGRs interact with IgG antibodies used in immunotherapies. We propose that genetic variation of the genes FCGR3A and FCGR2C, which have both genetic variations (SNPs and are CNV), will affect the phenotype of FCGR3A and FCGR2C on Natural Killer cells (NK cells). We will use a new method, Reference Query Pyrosequencing (RQPS), to simultaneously genotype SNP and CN variability in healthy donor samples, and then utilize flow cytometry to look at the external expression of FCGR3A and FCGR2C proteins with respect to CNV and SNP. These ideas will be translated to clinical trial data for future use in predicting which trial patients will benefit the most from immunotherapeutic treatments.

## **PREVENTION OF BLOODSTREAM INFECTIONS FROM CENTRAL LINE VENOUS CATHETERS**

Carlos Galvan, Nasia Safdar (Mentor), Medicine

The purpose of this research is to lower the risk of bloodstream infections from central line venous catheters at the UW-Hospital. The probability that a patient gets a bloodstream infection is very low, but if someone gets an infection, his or her chances of dying are very high. My research mentor Dr. Nasia Safdar has partnered me up with Rosa Mak, an Infection Preventionist, to work on this project together. In order to lower the risk of infection, Dr. Safdar assigned me to create a questionnaire to ask patients their perceptions of line-related infection. Our findings so far are that patients have no specific concerns related to their line and have a good understanding of the risks of infection.

## **STAR EMPLOYEE EFFECTS ON COWORKER PERFORMANCE, ATTRACTION, AND RETENTION**

Tianna Garcia, Paul Davis (Mentor), Management & Human Resources

Star Employees include individuals with extremely high levels of performance (relative to peers), substantial visibility, and mobility within the labor market. Given the prominence of stars, their compensation may be bid up such that costs of keeping the star offset the value of their direct performance contributions. However, if stars additionally contribute positive direct influences that encourage organizational goals, these individuals may still allow for competitive advantage. This project investigates the path of these indirect effects: the individual-level performance consequences of star employees on their coworkers. Theory suggests that the effects of stars differ depending on contextual factors in the areas of employee performance, attraction, and retention. We observe these factors in the context of professional sports leagues by collecting data and analyzing the impact of a star athlete on not only teammates, but also the organization as a whole.

## **NONACCLIMATED ROOT FROST TOLERANCE IN GOLDENROD SPECIES IN THE BIOCORE RESTORATION PRAIRIE**

Emma Geiduschek, Ellen Damschen (Mentor), Zoology

Increasing winter temperatures is increasing the number of freeze-thaw cycles in the soil, exposing plant root systems to more frost extreme events. Plants with relatively higher root frost tolerances will have higher survival rates than plants with lower root frost tolerances. This has been linked to nutrient stress survival, with weedy species found to have higher nutrient uptake efficiencies than their native congeners. I predicted that the weedy *Solidago canadensis* would have a higher nonacclimated root frost tolerance than the native *Solidago speciosa* in the Biocore Restoration Prairie. Nonacclimated root frost tolerance was measured after exposure to 14-hour freezing treatments. No significant difference of nonacclimated root frost tolerance was found, potentially due to similar resource utilizations in the *Solidago* genus or protocol errors.

## **FOLIC ACID INDUCED CNS REGENERATION IS MEDIATED DIRECTLY THROUGH NEURONS**

Wil Gibb, Joslyn Strebe, Bermans Iskandar (Mentor), Neurological Surgery

Injuries to the central nervous system (CNS) are often debilitating partially due to an inability of the injured neurons to regenerate axons. Our lab has shown that folic acid (FA), a common dietary supplement, significantly enhances CNS regeneration following injury in vivo in a biphasic fashion, with optimal recovery occurring at 80 $\mu$ g/kg FA. To better understand this mechanism, we are examining the effect of folic acid on axon growth in cultured DRG neurons following spinal cord injury. Preliminary results show an identical biphasic dose response curve, which indicates that this complex response of the injured CNS to folic acid is mediated directly through the neurons, rather than the glial environment. These data will help guide future studies to optimize therapies for CNS injury.

## **ANALYSIS OF PHOSPHO-S6 IN RENAL CELL CARCINOMA CIRCULATING TUMOR CELLS**

Benjamin Gibbs, Joshua Lang (Mentor), Medicine

Everolimus, an mTOR inhibitor, has improved survival in patients with advanced renal cell carcinoma. However, prediction of therapeutic response has been limited by lack of biomarkers. Circulating tumor cells (CTCs), tumor cells disseminated from tumor deposits into the blood, are one potential source of tumor samples for serial analysis of putative biomarkers. CTCs were identified in patients using flow cytometry by gating CD45+, CD34+, and CD14+ cells in peripheral blood. The remaining were analyzed for phospho-S6, S6, CaIX, and EpCAM expression. Analysis of CaIX and EpCAM expression in patient samples have shown heterogeneous populations of CTCs within and across patients. Phospho-S6 and S6 expression are being analyzed in CTCs as a potential predictive biomarker of therapeutic response.

## **THE EFFECT OF ATTORNEY ATTRACTIVENESS ON SUCCESS BEFORE THE UNITED STATES SUPREME COURT**

Brock Gilsdorf, Ryan Owens (Mentor), Political Science

There is little research on how attorney attractiveness influences the outcome of court cases. Common wisdom suggests that attorney success is a function of the quality of their arguments. Nevertheless, a host of scholarship shows that appearance matters in nearly every facet of daily life. From obtaining jobs and raises, to electing leaders, looks influence people's decisions. Does this same dynamic influence judges? Our research investigates whether attorney attractiveness positively influences the outcome of High Court cases.

## **RETROVIRAL INFECTION ACTIVATES CELL CONTRACTILE FORCES IN A MODEL 3-D EXTRACELLULAR MATRIX**

Elijah Gomez, Jaye Gardiner (Mentor), Oncology

Retroviruses such as murine leukemia virus (MLV) infect lymphocytes that, in vivo, must serve as vehicles for viral dissemination within a dense tissue microenvironment. Here we compared the behaviors of MLV infected cells and uninfected cells in a 3D culture system with low (<2 mg/mL) and high (>3 mg/mL) densities of collagen as a model for the dense extracellular matrix (ECM). Unexpectedly, we found that cells infected with MLV exhibit increased cell-dependent collagen contraction in both lower and higher density matrices relative to uninfected cells. This result suggests that viral infection activates actin-linked signaling pathways, leading to increased contraction. Activation of these signaling pathways by infected cells may allow for interactions with the ECM in vivo, facilitating the spread of infection.

## **THE IMPACT OF DDR2 ON CELL MIGRATION AND PROLIFERATION IN BREAST CANCER**

Madeline Gore, Esteban Carrillo (Mentor), Cell and Molecular Biology

Collagen density in breast tissue is the greatest independent risk factor for cancer. As the tumor grows, the surrounding collagen aligns perpendicularly outward. The cells migrate along them using Discoidin Domain Receptor 2 (DDR2). We found that DDR2 is highly expressed in cancer cells embedded in a collagen-dense matrix. Using pharmacological inhibitors, we found DDR2 expression is controlled partially by FAK, p38-MAPK, cyclic AMP and Src, and that only dormant (4T07) cells are sensitive to Celecoxib - a Cox2 inhibitor- while there was little effect on DDR2 in the proliferative (4T1) cells. Additionally, amplification of DDR2 aids in the metastatic potential of cells. We are dissecting the way cells respond to their environment causing them to proliferate or senesce in breast cancer progression by DDR2.

## **IMPACT OF A MINDFULNESS INTERVENTION ON THE DEFICITS SEEN IN HEAVY MEDIA MULTITASKERS**

Thomas Gorman, Christopher Green (Mentor), Psychology

Recent research suggests that constantly switching between various forms of media (i.e. “media multitasking”) has a detrimental effect on basic attentional abilities, a disconcerting result given the prevalence of media multitasking in today’s youth. The present study sought to obtain more data on the potential harmful effects of heavy media multitasking, as well as to investigate the extent to which the deficits can be ameliorated via a short-term intervention previously shown to have beneficial effects on attentional abilities (“breath-counting”). Consistent with previous work, we found that heavy media multitaskers showed generally poorer attentional and cognitive abilities than light media multitaskers. For the intervention, while the results are promising, more data is necessary to confirm its efficacy.

## **PRE-COLUMBIAN RAISED FIELDS ON THE MENOMINEE RESERVATION**

Tyler Gorski, William Gartner (Mentor), Geography

Many view historic Menominee peoples as hunter-gatherers, in part because the sandy, acidic, and nutrient-poor soils of the south-central Wolf River basin are not conducive to traditional agriculture. The recent discovery and analysis of relict raised fields on the Menominee reservation suggest that ancestral Menominee peoples developed a sustainable form of organic agriculture before the Columbian landfall. Raised fields are planting surfaces that have been elevated above the natural level of the ground. We conducted soil analyses on raised field deposits to better understand ancestral Menominee agriculture. Particle size analyses indicate that raised field planting surfaces often have significantly more silt than pre-agricultural deposits from the same profile and the surface horizons of nearby control profiles. In addition, raised field planting surfaces and ditches have significantly more organic carbon than these non-agricultural deposits, as determined by loss-on-ignition methods. Soil pH trends were similar between agricultural and non-agricultural deposits. Soil pH is a rapidly adjusting feature and therefore reflects soil development since site abandonment. When combined with field investigations and other laboratory analyses, our results strongly suggest that ancestral Menominee peoples amended their soils with silt from nearby river bottoms, charcoal and ash, and organic materials. In addition to hunting, gathering and fishing, ancestral Menominee peoples developed a sustainable form of organic agriculture.

## **DETERMINING PATTERNS OF POLLEN COLLECTION BY HONEY BEES**

Nicholas Gretzon, Daniel Minahan (Mentor), Zoology

The majority of flowering plants rely on animals to maintain genetic diversity in plant populations through the transfer of pollen between individuals. Bees often facilitate this movement of pollen. In agriculture, for example, this can lead to the contamination of conventional crops by transgenic varieties via bee pollination. We aim to determine the pollen sources collected by bees, and from where these collected resources originated. The contents of the pollen pellet will be quantified by determining the number and identity of unique pollen types. From these data we will be able to understand how bees use resources within their landscape, and later apply this knowledge to infer relevant ecological processes such as gene flow between plant populations.

## **INDIRECT EFFECTS OF LANDSCAPE CONNECTIVITY ON POLLINATOR DIVERSITY IN 30 OZARK GLADES**

Shannon Grover, Jesse Miller (Mentor), Zoology

Native pollinators have experienced unprecedented declines in the United States in recent decades. Although there are many factors contributing to these declines, habitat loss and fragmentation are considered predominate causes. Despite being a well-documented phenomenon, the mechanisms by which habitat fragmentation leads to declines in pollinator diversity have yet to be thoroughly understood in most ecosystems. Because plants and pollinators are obligate mutualists, understanding the relationship between plant and pollinator diversity appears to be central to this issue. However, there has been little research on whether it is the diversity of plants or pollinators that limits the other in fragmented landscapes. To address this question, we surveyed the diversity of flying invertebrate pollinators in 30 Dolomite glades across the Missouri Ozarks, and quantified plant species richness and landscape connectivity at study sites. We found that glade isolation indirectly decreased pollinator diversity via its negative effects on plant diversity. These results indicate that plant diversity limits pollinator diversity in response to isolation, instead of the other way around. These findings underscore the importance of maintaining plant diversity for sustaining diverse pollinator communities in fragmented landscapes.

## **COMMUNICATING THE ACHIEVEMENT GAP**

Alexa Grunwaldt, Tyriek Mack, Susan Robinson (Mentor), Journalism & Mass Communication

This research sought to determine the obstacles within the network of communication about the achievement gap. While the achievement gap has gained recognition, there is no united effort among parents, school districts, and the media due to the lack of effective discourse on this issue. Interviews with these groups uncovered underlying distrust in families affected by the achievement gap, and the prioritization of efficiency by school districts and the media. Families and activists highlighted systemic obstacles, which tend to leave minorities under- or falsely represented. The schools and the media indicate a lack of resources make it difficult to address the achievement gap. The specific research findings will be compiled to aid districts and the media in reforming their structures to more effectively communicate about the achievement gap.

## **THE NEUROPSYCHOLOGY OF SELF-REFLECTION IN PSYCHIATRIC ILLNESS**

Conrad Gudmundson, Michael Koenigs (Mentor), Psychiatry

A responsibility of health professionals is to make accurate diagnoses; the primary diagnostic shortcoming of mental health compared to other medical fields is the lack of performance-based assessments of behaviors and physiological indicators of illness. Self-reflection (i.e., the tendency to reflect on one's own thoughts, feelings, and actions) may be an important aspect in the development of a more quantitative and biologically-based system of diagnosis. Previous research suggests low levels could be associated with externalizing disorders (Antisocial Personality Disorder or Psychopathy). Further, self-reflection has been linked to neural connectivity levels in a specific brain circuit known as the default-mode-network (DMN). Therefore, we hypothesize that low levels of self-reflection and diminished DMN connectivity will be characteristic of externalizing disorders in a sample of incarcerated criminal offenders.

## **TRACHEAL REGENERATION IN THE ADULT DROSOPHILA NERVOUS SYSTEM**

Cayla Guerra, Grace Boekhoff-Falk (Mentor), Cell & Regenerative Biology

My lab is working on the regenerative properties of the adult *Drosophila* brain after a penetrating brain injury. Trachea are important structures in the brain because they carry oxygen and remove carbon dioxide, much like blood vessels in our own brains. Data from my lab indicates that neurons and glial cells in the brain regenerate. My project is to determine whether or not the trachea regenerate as well. I am using flies carrying a breathless-Green Fluorescent Protein (btl-GFP genotype) reporter. At different time points after injuring the brain with a small needle, I am examining GFP expression. We expect that tracheal tissue will regenerate. If this is true, we will gain information about the variety of cell types able to regenerate after brain injury.

## **THE POSSIBLE RELATIONSHIP BETWEEN GnRH AND MKRN3 WITH PUBERTY**

Wanjia Guo, Ei Terasawa-Grilley (Mentor), Pediatrics

Activation of hypothalamic gonadotropin-releasing hormone (GnRH) neurons as a result of GABA disinhibition triggers puberty onset. A recent report indicates that patients with inactivating mutations of the MKRN3 gene exhibit precocious puberty and MKRN3 expression in the hypothalamus decreases before puberty. However, the relationship between GnRH and MKRN3 remains unclear. We hypothesize that MKRN3 expression will decrease with a developmental increase of GnRH neurons. In this project, we compared expressions of GnRH and MKRN3 mRNA levels using an immature GnRH cell line (GN11) and a mature GnRH cell line (GT1-7). Preliminary results suggest that while GnRH mRNA levels in GT1-7 were higher than in GN11 cells, MKRN3 mRNA levels in GT1-7 were not lower than in GN11 cells. Thus, our hypothesis appears to be null.

## **DOES HIVE PLACEMENT AFFECT APIS MELLIFERA (HYMENOPTERA: APIDAE) FIDELITY TO CRANBERRY?**

Aidee Guzman, Christelle Guedot (Mentor), Entomology

Honeybees provide essential pollination services to Wisconsin cranberry growers. We sampled pollen foraging bees at three hive locations (near wild habitat, near a water reservoir, and the center of a marsh) to determine the impact of hive placement on honeybee fidelity. Floral assessments were also done to identify floral resource diversity surrounding hives. Given proximity to additional resources, hives near wild habitat were expected to have lower fidelity to cranberry. However, there was no correlation between hive placement and honeybee fidelity. Cranberry pollen contribution varies between hive location and marsh, with a range of 0-99%. Analyses of floral diversity assessments are ongoing. The variability is likely to be driven by local farm practices and distance to additional floral resources.

## **VIDEO GAME MOTOR LEARNING IN AUTISM**

Larissa Hacker, Andres Gomez, Brittany Travers (Mentor), Kinesiology

We are conducting tests related to the motor capabilities and learning of people with Autism Spectrum Disorder (ASD) in order to understand how motor skills relate to core ASD symptoms in the brain. Past research shows that people with ASD have more difficulties with their critical motor skills than people with typical development. The purpose of our research is to determine whether Wii Fit Games and our Ninja Balance Games are an effective manner for improving the balance and motor skills of people diagnosed with ASD. We will determine if there is any improvement based on their points earned in the games, through diffusion tensor imaging and postural stability and kinematic analyses. In the lab we are running participants through games over the course of 6 weeks with 3 sessions per week. Learning more about the motor skills of people with ASD will help them learn how to achieve efficiency with everyday motor skills like getting dressed or brushing their teeth, and it will help us learn how motor skills development may be linked to brain development.

## **REGULATION OF TSC-MTOR-MEDIATED AXON GUIDANCE BY BDNF AND SLIT2 IN HUMAN NEURONS**

Kate Hagen, Timothy Gomez (Mentor), Neurobiology

Tuberous Sclerosis Complex (TSC) is a disease caused by a mutation in either TSC1 or TSC2 genes, which encode proteins that form a complex that inhibits mTOR-dependent protein synthesis by inactivating Rheb GTPase. Uninhibited activation of mTOR is believed to cause benign tumors in various organs as well as the central nervous system. Recent evidence suggests that in addition to tumors, intellectual deficits may also be the result of defects in neurite growth and synaptogenesis. Functional neural network formation is reliant on proper guidance of axons through a dense, complex extracellular environment, and is controlled by attractive and repellent guidance cues. Interestingly, mTOR is an important regulator of axon guidance and may be involved in the pathophysiology of cognitive defects seen in TSC. In animal models, brain derived neurotrophic factor (BDNF) and Slit2 have been characterized as attractive and repellent cues, respectively. Our lab is interested in understanding the basic mechanisms of protein synthesis dependent axon guidance, and how these mechanisms are dysregulated in TSC. The aim of this specific study is to test the effects of BDNF and Slit2 in human neurons using induced pluripotent stem cells (iPSCs). We hypothesize that guidance cues that modulate mTOR-dependent protein synthesis function in part by regulating TSC2 activity. In particular, we hypothesize that Slit2 activates TSC2 to inhibit mTOR-dependent protein synthesis, while BDNF inhibits TSC2 to stimulate mTOR-dependent protein synthesis.

## **A SYSTEMATIC REVIEW TO FIND THE BEST HISTOLOGICAL METHOD TO QUANTIFY CEREBRAL INFARCTION VOLUME**

Crystal Hall, Matthew Jensen (Mentor), Wildlife Ecology

Measuring cerebral infarction volume is heavily used when conducting research on strokes. The way of measuring the infarct is still behind in advancement. Currently, the procedure calls for someone to manually trace each hemisphere and use calculations to determine the volume. This method includes human error but it was effective enough to conclude the area. We have performed a systematic review to find the best histological method to quantify the cerebral infarct volume. The results were a variety of different staining (CV, TTC, HE) uses and semi-automatic technology to calculate the volume. Most studies compared the experimental technique to the current manual tracing. No experiment clearly redefined the process. More research is needed in order to conclude the best method.

## **CHALLENGES OF INTERNATIONAL SCIENCE: AN INTERDISCIPLINARY ANALYSIS OF STEM CELL RESEARCH**

Tianxiao Han, Linda Hogle (Mentor), Medical History & Bioethics

Stem cell therapies promise to advance human health. However, translating the science to clinics is challenging due to policy and ethical issues that differ across locales. Governments struggle to negotiate local needs and priorities while competing in the global stem cell economy, and must determine their regulatory environments accordingly. Compared to Asia, North American regulations are seen by researchers as cautious and cumbersome, while the environments in China, South Korea and Singapore are often viewed as lenient. This attracts researchers to pursue trials there, yet there is concern about increased risk to patients and the continued lack of interoperability across regulatory regimes. I analyze the ethical, social, political and scientific issues that arise in regulatory environments in the US and Asia and propose policy solutions.

## **CASE STUDY OF SUCCESSFUL SPINAL CORD STIMULATOR IN PATIENT WITH BILATERAL CRPS I**

Rewais Hanna, Alaa Abd-Elsayed (Mentor), Anesthesiology

We present a case of a 34 year-old woman with bilateral CRPS I (Complex Regional Pain Syndrome I). Patient presented with severe pain in both hands (7-8/10 in severity) with severe allodynia. Patient was unable to perform most tasks with her hands including shaking hands, buttoning her jeans and preparing dinner. She failed conservative management after trying several medications and narcotics. Patient was then offered a cervical spinal cord stimulator as a final alternative to help alleviate her pain. She exhibited a significant increase in activity tolerance and significant decrease in her pain level, which demonstrated a successful spinal cord stimulator trial. Following the trial and implant, the patient reported total recovery of activity in her hands with complete ability of the previously mentioned activities. Patient also stopped all of her pain medications, which included high dose opioids.

## **PHYSIOLOGICAL IMPORTANCE OF THE REGULATION OF (P)PPGPP ON XPRT IN BACILLUS SUBTILIS DURING STRESS**

Aili Hao, Jue Wang (Mentor), Bacteriology

Bacterial cells adjust their metabolism constantly in response to signals and stress from the environment. One way in which almost all bacteria respond to stress is through the small nucleotide (p)ppGpp. In Gram-positive bacteria, such as *Bacillus subtilis*, (p)ppGpp acts as a key post-transcriptional regulatory molecule in cells' GTP homeostasis during starvation, through direct inhibition of GTP synthesis enzymes. One such enzyme, XPRT, is not well understood apart from knowing that it is able to bind to (p)ppGpp. This study aims to demonstrate the regulation of (p)ppGpp on XPRT, and show its role in cell viability during stress. These findings will be applicable to other pathogenic bacteria, such as MRSA and *Listeria*, which also rely on proper GTP levels for survival and transmission.

## **RESPONSE OF GEOSYNTHETIC CLAY LINERS PERMEATED WITH LOW-LEVEL RADIOACTIVE LEACHATE**

Bennett Hasseldeck, Kuo Tian (Mentor), Geological Engineering

Experiments were performed to determine how the hydraulic conductivity of geosynthetic clay liners (GCLs) can be affected by low-level radioactive leachate. Six GCLs were measured with two GCLs containing conventional sodium bentonite and four containing modified bentonite-polymer blends. The GCLs were direct permeated with two synthetic LLW leachates that are chemically identical, except one leachate is prepared without radionuclides (non-radioactive synthetic leachate, or NSL) and the other with radionuclides (radioactive synthetic leachate, or RSL). Control tests were conducted with deionized (DI) water. The GCLs were tested with various effective stresses to simulate in situ condition. Effluent samples were collected from the hydraulic conductivity experiment and analyzed using an inductively coupled plasma mass spectrometer (ICP-MS). The change in the effluent's chemical composition compared to the cumulative outflow was measured to see the chemical effects the permeating fluid has on the sample. In particular, the major cations of sodium, potassium, calcium, magnesium, and uranium were recorded with various trace metals also monitored. Overall, the hydraulic conductivity of GCLs ranges from  $1.1 \times 10^{-12}$  to  $7.6 \times 10^{-10}$  m/s. Increasing the confining stress from 20 to 450 kPa reduced the hydraulic conductivity approximately two orders of magnitude for both leachates.

## **REPORTED OUTCOMES OF PSYCHOEDUCATIONAL PROGRAM FOR FAMILY CAREGIVERS: BENEFITS BY GENDER OR RELATION**

Kari Hayat, Clifton Barber (Mentor), Human Development and Family Studies

Powerful Tools for Caregivers (PTC) is a psychoeducational intervention designed to enhance the self-efficacy, self-care, and emotional well-being individuals providing care for persons with chronic conditions. This study is a secondary analysis of a PTC dataset collected by UW Extension Family Living Programs over a 10-year period of time, and focused on a sub-set of 561 participant cases. The study addressed the question: Is there evidence that benefits derived from PTC varied by selected caregiver gender, and caregiver relationship to the care recipient? Comparison of pre- and post-course means revealed significant increases for both male and female caregivers, and for both filial and spousal caregivers in all three targeted outcome areas. However, only modest gains were reported by male caregivers in the area of self-care.

## **SUBSTANCE ABUSE DISORDER AS A DISTINCTION BETWEEN PRIMARY AND SECONDARY SUBTYPES OF PSYCHOPATHY**

Brandi Hefty, Michael Koenigs (Mentor), Psychiatry

Drug and alcohol abuse has a devastating effect on society and there is an especially high rate of substance abuse among psychopathic criminals. Psychopathy is a personality disorder associated with recidivistic criminal and antisocial behavior. This project will examine whether putative subtypes of psychopathy (low-anxious “primary” and high-anxious “secondary”) differ on the prevalence of a diagnosis of substance use disorder. Based on the premise that high-anxious psychopaths tend to have more traits that coincide with poor behavioral controls and need for stimulation, we hypothesize that high-anxious psychopaths will have a higher prevalence of substance abuse disorder than low-anxious psychopaths. The results of this study will reveal the degree to which SUD may be relevant to psychopathy and its diagnostic criteria.

## **HISTOLOGICAL METHODS FOR EX VIVO AXON TRACING**

Cassandra Heilingoetter, Matthew Jensen (Mentor), Neurology

Axon tracing methods allow for the visualization of neural pathways through the application of a substance called a tracer. By administering a tracer, insight into development, function, and connectivity of neural tissue can be achieved. Previously, these techniques were performed exclusively with in vivo studies; however, axon tracing methods currently have the capacity to be incorporated into ex vivo studies. We conducted a systematic review to determine the best histological method for ex vivo axon tracing and found a lipophilic dye called DiI was the most prominent choice. Although many aspects were compared directly, other likely important aspects of tracing have not been compared directly. Furthermore, we conclude that additional research is needed in order to affirm the optimal method for ex vivo axon tracing.

## **NOVEL MHC CLASS I ALLELE DISCOVERY IN SOOTY MANGABEYS**

Katelyn Heimbruch, Julie Karl (Mentor), Pathology

Sooty mangabeys (*Cercocebus atys*) are natural SIV hosts and the presumed source of HIV-2 and SIVmac, which makes them a valuable model for HIV/SIV research. However, little is known about their major histocompatibility complex (MHC) genetics. In this study, we deep sequencing in order to determine the MHC class I sequences in a cohort of 165 sooty mangabeys). We have characterized 121 functionally full-length classical (Ceat-A and Ceat-B,) and non-classical (Ceat-F and Ceat-I) alleles and have also identified 22 Ceat-A/Ceat-B haplotype chromosomal combinations. These newly identified alleles and haplotypes provide the basis for studying cellular immunity in sooty mangabeys and provide a framework for rapidly cataloging MHC class I sequences in an understudied, yet important, nonhuman primate species.

## **DCAP: A BROAD-SPECTRUM ANTIBIOTIC THAT TARGETS THE CYTOPLASMIC MEMBRANE OF BACTERIA**

Victoria Heinrich, Katherine Hurley (Mentor), Pharmaceutical Sciences

Slow- and non-growing persistent bacteria infections are not susceptible to most currently available antibiotics that target rapid-growth cell mechanisms. The synthetic antibiotic 2-((3-(3,6-dichloro-9H-carbazol-9-yl)-2-hydroxypropyl)amino)-2-(hydroxymethyl) propane-1,3-diol (DCAP) and its analog 1-(3,6-dichloro-9H-carbazol-9-yl)-3-[(3-methylbutyl)amino] propan-2-ol (i-DCAP) inhibit growth of bacteria by disrupting membrane potential and permeability. Treating *E. coli* cells with DCAP and i-DCAP and imaging with epifluorescence microscopy in the presence of impermeable Sytox green DNA stain reveals an increase in the membrane permeability. Co-dosing studies with i-DCAP and ampicillin indicate that targeting the cell wall in two ways displays antibiotic synergy. The presence of divalent-cations, Mg<sup>2+</sup> and Ca<sup>2+</sup>, represses the antibacterial activity of i-DCAP. Dye release assays of in vitro calcein-encapsulated liposomes suggest that the phospholipid composition of liposomes containing DOPE has a greater susceptibility to disruption by i-DCAP.

## **THE EFFECTS OF TRANSFORMING GROWTH FACTOR BETA ON GROWTH OF A FOLLICULAR THYROID CARCINOMA CELL LINE**

Holly Helein, Ricardo Lloyd (Mentor), Pathology and Laboratory Medicine

Thyroid carcinoma is the most common endocrine malignancy and is readily treatable through surgery or radiation therapy. However, thyroid carcinomas that escape therapy can invade locally or metastasize. Cancer stem-like cells (CSC) and epithelial mesenchymal transition (EMT) are major components of therapy evasion, disease progression and metastasis. Transforming growth factor beta (TGF $\beta$ ) is a growth factor that has been observed to induce CSCs, EMT and exert both inhibitory and stimulatory effects on tumor growth. Here, we are studying the effects of TGF $\beta$  on the growth of a follicular thyroid carcinoma (FTC) cell line that had previously undergone EMT. We conclude that TGF $\beta$  has a stimulatory effect on growth of FTC, as well as, continues to induce CSC and EMT features.

## **ATTAINING PHYSICAL ACTIVITY GUIDELINES IN UNIVERSITY UNDERGRADUATE AND GRADUATE STUDENTS**

Blake Helton, Elizabeth Larson (Mentor), Kinesiology

This project examines the characteristics of UW Madison undergraduate and graduate students who meet U.S. Department of Health and Human Services 2008 physical activity guidelines (150 minutes of mild/vigorous activity per week) and their experience and perceived meaning of physical activity. Students enrolled in two courses at the University of Wisconsin-Madison were invited to participate in the study. 76% of 193 students consented to have their data used for analysis. Participants were asked to complete a time diary spanning 6-7 days where they recorded all daily activities and ranked the degree they experienced pleasure, productivity, rejuvenation, and time pressure during these activities. Students also completed a brief survey of their age, year in school, gender, height, and weight. The students' height and weight data were used to calculate BMIs (Body Mass Index, a measure of percentage of body fat). Participant data was de-identified by the research team before analysis. Each entry that suggested 'physically activity' in the time diary was coded as either unplanned or planned physical activity. Difference in total time in planned and unplanned physical activity recorded in the time diaries were examined across the subgroups of gender, race, BMI category, age, grade, and season. T-tests were performed to examine difference in physical activity levels between groups. Additionally, the participants' categorization/meaning of the activity (work, rest, play, leisure, self-care) and the pleasure, productivity, rejuvenation, and time pressure rating for each of these planned and unplanned activities were compared across subgroups. The percent of students meeting physical activity guidelines will be reported by subgroup and comparisons made across groups using t-test to determine characteristics and experiences associated with college students receiving the recommended activity levels.

## **WISCONSIN WETLAND ASSOCIATION PROMOTIONAL VIDEO**

Scott Hennelly, Julian Cooper, Madeline Kalicka, Patricia Loew (Mentor), Life Sciences Communication

As part of Patty Loew's video production class last fall, the final assignment was to partner with a local non-profit organization and collaborate with them to create video content. The Wisconsin Wetland Association was our team's client and we helped them make this video to attract new members to join the WWA.

## **THE JOURNEY OF UW-MADISON RECYCLING**

Scott Hennelly, Jill Sakai (Mentor), Office of Sustainability

The goal of this video is to show UW-Madison students and faculty the journey of their recycling, from the moment they use it to when it reaches the recycling center. A side outcome of this video is to display the correct disposal of the 3 parts of coffee cups (lid, sleeve, cup) which are widely used on campus but rarely separated correctly.

## **ISOLATION OF BORRELIA BURGdorFERI IN ENVIRONMENTAL SPECIMENS**

Stefanie Henry, Rebecca Osborn (Mentor), Pathology

Lyme disease is an infectious disease caused by the bacteria *Borrelia burgdorferi*. It is transmitted most often in the U.S. by the bite of a black-legged tick (*Ixodes scapularis*). *B. burgdorferi* is maintained in the environment between ticks and rodents in a primary enzootic cycle. There is a potential for the presence of novel strains of the bacteria that are not pathogenic to humans and we aim to quantify the diversity of lyme disease. We have collected biological specimens from small mammals and ticks from Portage County, Wisconsin, to test the hypothesis that there are cryptic cycles of *B. burgdorferi* that have not been identified in a clinical setting. All specimens collected were cultured in BSK broth and then analyzed under dark field microscopy for the presence of *B. burgdorferi* spirochetes. Genetic sequencing using the Illumina System was performed on all positive cultures to determine strain type. Novel strains of *B. burgdorferi* that have not been clinically described may have potential significant public health implications.

## **THE EFFECTS OF MGLUR2 AGONIST DCG-IV ON HIPPOCAMPAL DENTATE GYRUS EPILEPTIFORM ACTIVITY**

Christian Hernandez, Brandon Wright (Mentor), Neuroscience

Hippocampal circuitry has long been associated with epileptogenesis. The dentate gyrus has been implicated in epileptiform activity, possibly due to the intrinsic robust excitatory feedback circuitry in this region. Extensive investigations have been conducted to understand the circuit mechanisms involved in epileptiform activity. This project addresses the different circuit contributions to epileptiform activity in the dentate gyrus using voltage imaging with voltage sensitive absorbance dye. Drugs were employed to tease apart circuits, and voltage imaging in rat brain slices revealed the spatial spread of responses to electrical stimulation. (2S, 2'R, 3'R) - 2 - (2', 3' - dicarboxycyclopropyl) glycine (DCG-IV) is a potent group II metabotropic glutamate receptor agonist (mGluR2) which has been shown to suppress transmission at the synapses of the principle cell type of the dentate gyrus called granule cells. This drug has been used to investigate the circuitry of the dentate gyrus, and was shown to have anticonvulsant effects. We performed voltage imaging experiments to determine if DCG-IV alters the threshold at which epileptiform activity occurs. These thresholding experiments were carried out by increasing the stimulus current applied to a slice in 5 $\mu$ A increments from 5-100  $\mu$ A in the presence and absence of the drug. We expect to observe an increase in the threshold for epileptiform activity due to the suppressive effects of DCG-IV on excitatory synaptic transmission. Suppression of epileptiform activity at the point of origin could prevent hyperactivity from generalizing to other brain regions.

## **TIME-VARYING POINT CLOUD DATASETS**

Evan Hernandez, Matthew Nelson, Markus Broecker (Mentor), Wisconsin Institute for Discovery

The purpose of our project was to gather 3-dimensional point clouds of time varying data sets such as a deflating balloon or the process of a tree budding its leaves in the spring. Various methods were used to create the point clouds such as camera based or using a LIDAR scanner. In addition to creating the 3D point clouds an online directory has been created to house the point clouds that were created so that the public has access to all of the point clouds for viewing and for download. The goal of the project is to increase the current technology in place to render and process 3D movies. The lab will be able to use these point clouds in future developments and projects.

## **TEACHING HELPING AND PATIENCE: TV MESSAGES TO PROMOTE PRO-SOCIAL BEHAVIOR IN CHILDREN**

Alexis Hernandez Abrego, Marie-Louise Mares (Mentor), Communication Arts

Prior research suggests that pro-social TV shows are often ineffective in changing children's behavior. However, there are indications that priming feelings of love and tenderness may promote pro-social behavior, and that making messages more explicit may also improve comprehension of the intended lesson. This study, conducted by the Children and Media Lab, examined the effects of loving versus funny primes, and the effects of explicit pro-social messages about waiting and helping. 120 children, ages three to five, were randomly assigned to different clips from Daniel Tiger's Neighborhood. Those who saw the loving prime demonstrated significantly greater patience in a delayed gratification task; those who saw helping messages were more likely to spontaneously help. These findings suggest routes toward designing more effective pro-social messages for children.

## **EXAMINING WAYS OF CONSTRUCTING BIOREGIONAL PLACE ATTACHMENT IN THE LOWER FOX RIVER VALLEY, WISCONSIN**

Ethan Heyrman, Francis Eanes (Mentor), Environmental Studies

This research is designed to explore the biophysical place attachment, or sense of place, that people associate with the landscapes and ecological features of the bioregion where they live. This attachment can be created from sociocultural, political-economic, or psychological elements, but we examined it from a biophysical perspective. First, we surveyed participants around northeastern Wisconsin for their environmental opinions and attitudes towards the bioregion in which they live. Next, we used a program called Atlas.ti to qualitatively code the survey data in order to discover dominant themes and to better understand the phenomenon of biophysical place attachment. With this research we can create better approaches to teaching environmental awareness and conservation on a widespread scale.

## **EXPRESSION AND PURIFICATION OF CORE COMPONENTS OF HIV-1'S REV-DEPENDENT NUCLEAR EXPORT COMPLEX**

Christina Higgins, Ryan Behrens (Mentor), McArdle Lab for Cancer Research

Murine cells do not support human immunodeficiency virus type 1 (HIV-1) virion production. This is due, in part, to a deficiency specific to the murine version of CRM1 (mCRM1), a host nuclear export receptor that poorly supports the nucleocytoplasmic transport of viral mRNAs. However, the provision of human CRM1 (hCRM1) rescues this defect. We hypothesize this reflects a differential interaction with the viral protein Rev, which conjugates viral mRNAs to CRM1. To study the mechanistic difference between hCRM1 and mCRM1, I have designed experiments to test CRM1-Rev interactions using an in vitro co-immunoprecipitation approach. I have successfully cloned, expressed, and begun the purification of recombinant Rev and Crm1 protein variants for these experiments. Understanding this mechanistic difference may inform new strategies for combatting HIV-1 infection.

## **EFFECTS OF TOPICAL CORTICOSTEROID ADMINISTRATION ON INTRAOCULAR PRESSURE IN CATS**

Adam Hoefs, Mary Mohr, Lauren Rutkowski, Daniel Shinsako, Gillian Mclellan (Mentor), Surgical Sciences

Purpose: To determine whether topical corticosteroid (CCS) administration results in a clinically significant increase in intraocular pressure (IOP) in feline eyes. Methods: One drop of 1% Prednisolone was administered to one randomly assigned eye of 6 cats with primary glaucoma and 2 normal cats, twice daily for 4-6 weeks. The opposite eye served as a saline-treated control. The IOP was measured 3 days a week, between 8:00 a.m. and 10:00 a.m. by rebound tonometry. IOP in the steroid-treated eye was assessed for CCS-response, defined as a consistent > 25% or > 15% increase in IOP relative to the control eye, for 2 consecutive weeks in glaucomatous and normal cats, respectively. Results: will be presented.

## **EVALUATION OF THE EFFICACY OF TELEVISION AS ENRICHMENT IN RHESUS MACAQUES (MACACA MULATTA)**

Stephanie Hoker, Katherine Habel, Peter Pierre (Mentor), Psychology

This study evaluates the efficacy of television as environmental enrichment. Video stimuli, in the form of television, were presented in 1-hour sessions to 20 rhesus macaques (*Macaca mulatta*). Snapshots of animals looking at the video were taken every two minutes. The study presented two types of content. First subjects were shown an animated feature (familiar content) and second a video of conspecifics (novel content). Looking percentage was determined by taking the total number of 'looks' of each subject and dividing it by the total possible observations for the session. Subjects watched for an average of 30% of the hour (18 minutes). Animals preferred conspecific content (34.1% or 20.5 minutes) to animated content (25.1% or 15.1 minutes).

## **HOUSING FIRST FOR FAMILIES: A REVIEW OF CASE MANAGER BEST PRACTICES**

Matthew Holtz, Peter Miller (Mentor), Educational Leadership & Policy Analysis

The goal of Housing First programs is to help families achieve long-term housing stability by providing subsidized housing with intensive case management. Housing First is a new concept that differs from traditional housing models by minimizing time spent in homeless shelters and placing homeless families and individuals in housing as soon as possible. Research has demonstrated that this model of housing is extremely effective in meeting the needs of its clients. Because this model is relatively new, there is still a great deal to learn about best method of implementing Housing First. The goal of this project will be to research other communities that have implemented Housing First models, analyze the current state of Housing First in Dane County, and apply the knowledge gained from the research in order to optimize the effectiveness of United Way's housing programs. This project will improve collaboration between University of Wisconsin faculty and community organizations resulting in a mutually beneficial relationship. Additionally, this project will provide data demonstrating the effectiveness of Housing First and the societal benefits of reducing homelessness in Wisconsin. This data can serve as justification for increased public support to meet the needs of the homeless. Finally, this project will have a direct impact on the families and individuals currently enrolled in Housing First programs by improving the practices of case managers so that they can better assist those families in need.

## **BIOCHEMICAL MODIFICATIONS AND FOLATE INDUCED REGENERATION**

Kaitlyn Hopfensperger, Charles Withington, Bermans Iskandar (Mentor), Neurosurgery

Recent studies in our laboratory have shown that folate treatment promotes axon regeneration in the central nervous system (CNS) in rats after injury. The purpose of this experiment is to identify the magnitude of the effect of folate and folate agonists methionine and methylcobalamin on CNS regeneration. This will elucidate the biochemical pathway through which folate activates the CNS repair process. After spinal cord injury, CNS regeneration is measured by counting axons through a fluorogold backfill process. Biochemical measurements of relevant folate metabolites will follow. Completion of these studies will provide a better understanding of the biochemical mechanism underlying the folate effect in CNS repair, as well as potential combinatorial therapies for CNS injury.

## **ALTERED MICRORNA EXPRESSION PROFILE IN HUMAN FETAL CELLS FROM PRE-ECLAMPSIA**

Grant Hoppel, Chi Zhou (Mentor), Obstetrics & Gynecology

Pre-eclampsia (PE) is a leading cause of maternal and fetal morbidity and mortality during pregnancy. MicroRNA (miRNA) is a class of short RNA molecules (18-24nt), which play important roles in cellular functions by regulating the expression of their target genes. The goal of this research is to identify the altered miRNA profile in PE pregnancies. In this study, miRNA of human umbilical cord vein endothelial cells (HUVECs) were isolated from PE and normal pregnancies. The miRNA expression profile of 1008 human miRNAs was analyzed using a human miRNome miRNA real-time RT-qPCR array. Preliminary results show that a number of miRNA were expressed differently in PE HUVECs. Results from this study may lead to discovery of new early diagnosis markers or therapy targets.

## **DAMPING OF BOLTED METAL PLATES IN VIBRATIONAL ENVIRONMENTS**

Kurt Hoppmann, Matthew Allen (Mentor), Engineering Mechanics

Through this research, I hope to be able to assess on how bolted connections between two metal plates influence the damping and dissipation of the plates vibrations. In order to accomplish this objective, an instrumented hammer was used to induce vibrations into the square, bolted metal plates. The metal plates were suspended using bungee cords to simulate free-boundary conditions and the vibrational data was collected using accelerometers. This data was compared with data collected from a solid plate in order to see where damping comes from. My results will hopefully agree with the Iwan Model for mechanical joints and determine the parameters for this relationship. This research will allow us to predict energy dissipation in assembled structures due to vibrations, yielding more efficient engineering designs.

## **REDUCING BARRIERS TO SOIL TESTING: DEVELOPING AN INEXPENSIVE BIOAVAILABLE LEAD TEST**

Josh Horman, Shannon Plunkett, Douglas Soldat (Mentor), Soil Science

Potentially hazardous levels of lead are common in urban soils. Exposure to lead is particularly dangerous for childrens' cognitive development. Lead exposure primarily occurs through ingestion or inhalation of soil. The forms of lead in soil are complex. Lead minerals with low solubility, particularly lead phosphates, are less likely to enter the bloodstream. The proportion of total lead that will enter the bloodstream is termed bioavailable lead. Estimating bioavailable lead in soil is important for protecting human health. The Environmental Protection Agency (EPA) method for estimating lead bioavailability is effective, but its cost and complexity make it inaccessible to the public. Our research attempts to identify a quick and inexpensive alternative method to estimate lead bioavailability in soil. We incubated soils with different amounts of lead and phosphorus to create a range of bioavailability, then compared the results with the EPA method to seven widely available and inexpensive soil testing methods.

## **COMBINATORIAL COMPLEXITY AND CLOCK PHOSPHORYLATION IN THE CIRCADIAN CLOCK OF DROSOPHILA MELANOGASTER**

Alyssa Hotz, Laurence Loewe (Mentor), Genetics

CLOCK is a protein in the circadian clock of *Drosophila melanogaster* that cycles through stages of phosphorylation; these stages affect the stability of CLOCK and play an important role in determining the fruit flies' daily rhythm. There may be 3, and up to 19 phosphorylation sites on CLOCK. This could create combinatorial complexity when constructing a model, where each phosphorylation site combination has its own functional significance. We investigated research on CLOCK homologs to gain a perspective on how these sites may function and how they could be grouped to accurately model CLOCK phosphorylation with minimal complexity. The goal of this work is to determine the extent of combinatorial complexity in CLOCK phosphorylation and whether this can be modeled manually or requires more automated approaches.

## **SYNTHESIS AND CHARACTERIZATION OF A LIBRARY OF SUB-MONOLAYER OXIDE-ON-OXIDE CATALYSTS**

Fangying Huang, Martin Martinez, Jesse Panger, Carlos Carrero Marquez (Mentor), Chemistry

Monolayer (M1Ox)<sub>m</sub>/(MOz)<sub>bulk</sub> and (M1Ox)<sub>m</sub>-(M2Oy)<sub>n</sub>/(MOz)<sub>bulk</sub> catalysts are ideal systems to investigate the molecular/electronic and structure-activity/selectivity relationships for various catalytic applications. Different MOx surface species, ranging from two-dimensional isolated monomers and oligomers at sub-monolayer coverage, to three-dimensional MOx nanoparticles above monolayer coverage, can be formed. Avoiding the formation of three-dimensional MOx species at low coverage is challenging as high MOx dispersion is desired. Indeed, for many catalytic applications like the Oxidative Dehydrogenation of Propane, two-dimensional MOx surface species are desired over less selective nanoparticles. Our work aims to obtain dispersed (M1Ox)<sub>m</sub>/(MOz)<sub>bulk</sub> and mixed (M1Ox)<sub>m</sub>-(M2Oy)<sub>n</sub>/(MOz)<sub>bulk</sub> systems, preferentially at sub-monolayer and monolayer coverage. The utilization of in situ Raman and UV-vis spectroscopy, combined with N<sub>2</sub> physisorption and ICP-OES, is required to determine the monolayer coverage for different metal oxides.

## **THE SCHOOL EXPERIENCES OF TRANSGENDER AND GENDER NON-CONFORMING YOUTH IN WISCONSIN SCHOOLS**

Sean Hubbard, Maurice Gattis (Mentor), Social Work

Little empirical evidence exists documenting the school experiences of transgender and gender non-conforming youth. The present study serves to systematically assess the experiences of transgender and gender non-conforming youth in Wisconsin schools to fill in the knowledge gaps about their unique needs. This study was conducted in four urban areas throughout Wisconsin: Milwaukee, Racine, Green Bay, and Madison. Researchers facilitated focus groups with 21 participants between the ages of 13-24 who identify as transgender and/or gender non-conforming. Preliminary analysis revealed six themes: learning environment; physical facilities; health and wellness; safety; institutional and social support; and acceptance and respect.

## **SCAFFOLDS FOR THREE-DIMENSIONAL NEURAL CELL CULTURE**

Joann Huynh, Lindsey Jager (Mentor), Neurology

Stroke is a leading cause of mortality and disability worldwide. Significant potential exists in the ability of human-induced pluripotent stem cells (hiPSC) to differentiate into neural cells and improve post-stroke recovery. However, in order to facilitate proper adhesion, differentiation, and proliferation, thereby increasing the rate of success in vivo, hiPSC must be seeded into a suitable scaffold. Desirable properties for scaffolds to be used in vivo include: avoids changes in pH or osmotic pressure, and heat and free radical production in preparation of the scaffold, is minimally invasive, and allows for gradual degradation. This paper aims to provide an analysis of available scaffolds and their efficacy to provide insight for future research involving animal trials to study stem cell therapy after cerebral ischemia. A meta-analysis of selected full-text, peer-reviewed articles with unique experimental data, available on PubMed, will be conducted, based on, but not limited to, the following selection criteria: the scaffold proved to be unresponsive to light and not pH-altering, and there was a possibility of transplantation.

## **EFFECTS OF EMPLOYEE-CLIENT CO-MOBILITY**

Leah Jacobs, Joseph Raffiee-Shirazi (Mentor), Management and Human Resources

My research investigates employee-client co-mobility, which is the joint mobility of an employee and existing client to a different firm. Our research primarily focuses on when employee-client co-mobility is likely to occur and use this logic to explain why certain types of employee mobility are more detrimental to source firm performance than others. My mentor has analyzed detail data collected from all lobbying disclosure reports filed with the Senate Office for Public Records between 1998 and 2014, while I have researched the lobbyists' gender, located references, and developed spread sheets. This will allow us to build a database that tracks the movement of lobbyists and their clients over time. We hope to find the various effects of employee-client co-mobility.

## **TOXIC TORTS: WIN BIG OR LOSE WORSE**

Nathan Jamieson, Richard Keyser (Mentor), Legal Studies Program

When a large chemical or other company causes in part or whole harms onto people through environmental disturbances, one of the few ways to remedy this and provide important compensation to the victims is through the use of a classic class-action tort claim. These claims, however, are by nature incredibly difficult to resolve favorably for the Plaintiffs and, while certainly recovered damages can be huge, there exists a severe degree of risk. More importantly, these claims wildly failed in the 1970s and 1980s, yet by the 1990s some suits were able to recover millions. This paper will seek to illustrate the reasons behind the success using case-studies of notable environmental class-action lawsuits including looking at differences in the legal, scientific, and environmental frame-work.

## **ULTRA HIGH PRESSURE LIQUID CHROMATOGRAPHY METHOD SEPARATES 21 FRESHWATER ORGANIC NITROGEN COMPOUNDS**

Kaitlin Jasper, Katherine McMahon (Mentor), Civil & Environmental Engineering

Nitrogen is an important nutrient source for the growth and energy of freshwater microbial communities. Typically inorganic nitrogen such as nitrate, nitrite, and ammonium are considered the major nitrogen sources, but little is known about the role of organic nitrogen compounds such as amino acids and polyamines. These degradation products of cellular compounds have been studied in saltwater ecosystems, but not in freshwater. We have developed an Ultra High Pressure Liquid Chromatography- Fluorescence spectroscopy (UPLC-FL) method that can detect these degradation products at nanomolar concentrations. Using an elution gradient with only two mobile phases, our method separates 21 polyamine and amino acid compounds within 15 minutes. We also optimized the molar ratio and reaction time of the o-phthalaldehyde-ethanethiol (OPA-ET) derivatization, which adds a fluorescent marker to primary amine groups. This method can now be used to detect dissolved amino acids and polyamines in freshwater ecosystems and to study their effect on bacterial community composition over time.

## **GENDER, RACE, AND POLITICAL INCORPORATION IN THE ANDES**

Joyce Jimenez, Christina Ewig (Mentor), Gender & Women's Studies

This project compares the rise of women in politics in Peru to the rise of the indigenous peoples in politics over the past few years. The project as a whole seeks to compare the patterns by which the two groups are able to get their interests onto the political agenda. One component is to examine role of social movements by coding news stories on social movements of all kinds. This involves reading through a Spanish newspaper called La Republica Peru that has news on protests and social movements in different areas in Peru. The method used to track all the quantitative data is 'Protest Event Analysis,' which is a systematic way to map, analyze and interpret protests occurring in a certain region, in this case Peru.

## **A COMPARISON OF INTENTIONAL COMMUNITIES IN NORTH AMERICA AND THE LAWS INFLUENCING THEM**

Mandy Joers, Richard Keyser (Mentor), Legal Studies Program

Through comparing at minimum two country's various laws, the intention of this research project is to elicit how laws impact creation and continuation of intentional communities and what devices specific intentional communities have utilized to abide by them. My hypothesis is that the stricter a country's laws are, the more challenging and less likely it is for a given community to comply. The hope is to uncover how laws could be revised, allowing intentional communities to implement their mission and vision statements, which mainly address living sustainable human existences. These communities provide valuable insight regarding alternatives to our Western consumerist lifestyles, and it is in all of our best interests that, so long as their objectives remain clear, they are as uninhibited as possible.

## **FUNNY, PRETTY, OR RICH? FACEWORKS IN SELFIES**

Asia Johnson, Nhu Quynh Nguyen, Thanh Thanh Nguyen, Nancy Wong (Mentor), Consumer Science

The science of impression management in social interactions is constantly evolving. The ‘selfie’ is a relatively new social phenomenon on social networking sites such as Facebook and Snapchat. In this research, we first interviewed 18 university students (9 men and 9 women) on the subject of selfies. A common theme that emerged shows males tend to portray themselves as comical while females portrayed themselves as attractive. We next conducted a 2 (Male vs Female) X2 (Selfie alone vs Selfie with luxury brand) experiment to explore viewers (men and women) evaluations of these selfies. Attractiveness and humor are gender specific factors, and wealth will be between subject independent variables with evaluations (8 bipolar items) and behavioral intentions as outcome measures.

## **STRUCTURE AND FUNCTION OF ADCK3, AN ANCIENT MITOCHONDRIAL PROTEIN IN COENZYME Q BIOSYNTHESIS**

Isabel Johnson, David Pagliarini (Mentor), Biochemistry

Coenzyme Q (Q) is an essential lipid best known for its role as an electron carrier in the electron transport chain. Although required for human health, Q biosynthesis is not completely understood and the functions of many Q biosynthetic proteins remain unclear. The atypical mitochondrial kinase, ADCK3, is a Q biosynthetic protein of unknown function belonging to the UbiB protein kinase-like family. Here, we determine a crystal structure of ADCK3, the first crystal structure of a UbiB protein. We characterize the unique alanine-rich nucleotide binding loop that dictates an unusual binding preference for ADP over ATP. We find that this preference can be reversed with a single alanine to glycine mutation, which also enables autophosphorylation while inhibiting Q biosynthesis *in vivo*. Furthermore, we identify an N-terminal domain that blocks the substrate binding pocket--another inhibitory feature. This work serves as a foundation for further structure-function analyses aimed at defining the role of ADCK3 in Q biosynthesis as part of a larger effort to treat human Q deficiency.

## **ANALYSIS OF THE D. MELANOGASTER GENE, BOND, INVOLVED IN THE PRODUCTION OF THE MALE PHEROMONE, CH503**

Jessa Justen, Hock Chung (Mentor), Molecular Biology

Chemical cues play important roles in the social behaviors of insects. Without the production of pheromones, it is difficult for insects to differentiate between members of their own species and members of other species. Therefore, evolutionary changes of these cues could cause changes in the way a species interacts with conspecifics, leading to reproductive isolation. In this project, we will examine the regulation of the fatty acid elongase gene, bond (CG6921), which is involved in the production of the male pheromone CH503 in *Drosophila melanogaster*. CH503 is only synthesized in species expressing bond in the ejaculatory bulb. The aim of our project is to determine where the cis-regulatory element (CRE) for ejaculatory bulb expression for bond is located in *D. melanogaster*.

## **THE EFFECTS OF POSITIVE AND NEGATIVE MOOD ON LEARNING**

Finola Kane-Grade, Seth Pollak (Mentor), Psychology

We are investigating the influence of positive and negative mood on short-term learning. Previous research has revealed that positive mood improves memory capacities in individuals, and negative mood often has a deleterious effect on learning and memory processes. Unknown is whether positive and negative mood can influence performance on a short-term learning task. In our study, adults (18-25 years old) undergo a positive mood induction, comprised of a series of pictures and mood-supportive music, or a negative mood induction, comprised of a psychosocial stressor (a public speaking task). The results found in this study will contribute to a better understanding of how mood affects learning in adults, which has implications for education.

## **IMPLICATION OF THE SOCIAL SECURITY NOTCH ON INTERGENERATIONAL WEALTH TRANSFER**

Malcolm Shao Fong Kang, Teng Kok Tan (Mentor), Economics

The Social Security Notch was a policy change that reduced retirement income of people. Previous literature examined the effects of this exogenous income shock on a variety of socioeconomic indicators like mortality and elderly labor supply. Using empirical data from the Wisconsin Longitudinal Study, I investigate the repercussions of the Notch on intergenerational wealth transfer. I uncover a significant causal relationship between the Notch and the resultant change in parental bequest behavior. Preliminary results suggest a statistically significant reduction in bequest levels when parents were affected by the Notch. Late-life income indeed serves as a policy lever for parental bequests. My findings will serve to inform lawmakers when they consider future reforms to retirement schemes and social pensions.

## **PREVENTION OF RETINAL GANGLION NUCLEAR ATROPHY THROUGH SPECIFIC INHIBITION OF HDAC3**

Nitin Kanneganti, Heather Schmitt (Mentor), Ophthalmology & Visual Sciences

As the second leading cause of blindness, glaucoma affects an estimated 2.2 million people leading to more than 120,000 being blind in America alone. Previous studies have shown glaucoma results from a loss of vision caused by retinal ganglion cell death. A molecule involved in the process of cell death is histone deacetylase-3 (HDAC3). Intravitreal injections of HDAC3 specific inhibitor RGFP-966, TSA positive control, and vehicle negative control were given to mice post optic nerve crush. Using cell counts, qPCR, immunofluorescence, and electron microscopy, we found that treatment prohibited nuclear atrophy but not cell death. Therefore, further experimentation with repeated injection of inhibitor RGFP-966 is necessary to determine whether the inhibitor can be used therapeutically for retinal ganglion cell death.

## **PHONETICS OF HERITAGE SPEAKERS OF SPANISH**

Monica Kapp, Rajiv Rao (Mentor), Spanish & Portuguese

This research study investigates the speech production of Spanish speakers that grew up speaking Spanish at home, but were educated in the United States at English speaking schools. The purpose of the study is to gain an understanding if being educated in English affects the Spanish pronunciation of the heritage speakers. There are key phonemes in Spanish that are pronounced differently than in English, one of which is /b/, which can be differentiated by measuring its intensity relative to a following vowel. By taking this measurement of /b/ in different word contexts and comparing it to expected outcomes of native Spanish and English speakers, we can determine if heritage speakers' production of this sound in Spanish contains any influences of English.

## **DEVELOPMENT OF BEHAVIORAL LATERALIZATION IN INFANT RHESUS MACAQUES (MACACA MULATTA)**

Chloe Karaskiewicz, Allyson Bennett (Mentor), Psychology

Handedness, or hand preference, is a behavioral expression of the brain's functional asymmetry. To understand stable behavioral lateralization in adults, we must investigate the developmental process for influences on handedness. Subjects were 15 rhesus macaque mother infant dyads. Fifteen-minute observations were conducted once daily for 15 days following birth to examine dam and infant nursing posture and lateral biases. Dam and infant nursing postures were recorded. Hand preference of subjects will be assessed to determine later lateral biases. We will identify the critical time period for infants' preferential nursing side and head orientation to understand patterns of development and the importance of pre and post natal experience in this area.

## **THE IMPLICATIONS OF U.S. CORPORATE INVESTMENT IN GIRLS EDUCATION IN THE GLOBAL SOUTH**

Arashjot Kaur, James Lapierre, Kathryn Moeller (Mentor), Political Economy & Education

In our current research, we are investigating the emerging phenomenon of U.S. transnational corporate investment in girls education with a specific focus on Nike, Inc.. Drawing on empirical ethnographic data collected in the U.S. and Brazil at the Nike Foundation, non-governmental organizations and multi-lateral agencies, we aim to understand the reasons behind corporate interest in girls in the Global South. We are investigating the consequences of these programs using a theoretical framework comprised of critical theories of education, feminism, and development. Our research considers how the Nike Foundation's investments focus on educating girls to be instruments for ending poverty and promoting economic growth, rather than as ends in and of themselves. Our research will contribute to the publication of a book.

## **RESEARCH NOTEBOOKS, INFORMATION OVERLOAD, AND THE DIGITAL HUMANITIES**

Ethan Kay, Joshua Calhoun (Mentor), English

This study used student-created "Research Notebooks" to develop an effective introductory research assignment, specifically for students in English literature classes. A complementary website was designed to offer guidance and examples for students completing the assignment. The website also serves as a point of reference for educators who wish to implement this type of research-based assignment. The design process for the site generated questions and conversations about Universal Design for Learning (UDL), accessibility, online pedagogy, and the Digital Humanities. Effective methods for combined analog/digital research publication were reviewed and will be presented in a subsequent research paper.

## **ECHO SUPPRESSION AND SOUND LOCALIZATION IN 2- TO 3-YEAR OLD CHILDREN**

William Keener, Erica Ehlers (Mentor), Communicative Sciences and Disorders

The emergence of auditory perception, and especially sound localization abilities in children, is a fascinating topic that is challenging if one tries to conduct experiments in order to unravel its mysteries. Unique challenges occur when testing children who are difficult to keep focused, and who cannot respond to stimuli in the same way as older individuals who can talk or press buttons. Nonetheless, this is the population of interest here, because development in this stage of life is fundamental for social, cognitive and language development. The 'reaching for sound' methodology is a unique approach that will be used to test sound discrimination and localization abilities in 2 to 3 year old toddlers. Moreover, this technique is being adapted to test the extent to which toddlers can suppress echoes. Echo suppression is important for learning and socializing in complex environments in which these young children spend much of their time. Testing echo suppression and mapping out the development of localization skills in toddlers has significance for answering basic scientific questions about development of humans, and it has implications for testing children who are hearing impaired and for whom complex environments are even more challenging.

## **EFFECT OF PAST VEGETATION CHANGE ON SOIL FORMATION NEAR PRAIRE-FOREST BORDER IN NORTHERN MINNESOTA**

Hawa Keita, Joseph Mason (Mentor), Geography

The purpose of this study is to learn more about how vegetation changes in Northern Minnesota spanning the last 3,000 to 4,000 years affect clay movement within soil profiles. Organic matter of soil was studied to better understand the past vegetation through isotopic analysis of carbon and nitrogen. Also, exchangeable cations, soil acidity, and particle size are measured to further investigate factors of clay movement. Preliminary results have been consistent with normal decomposition trends with depth for carbon and nitrogen isotopes. Forest soils have shown evidence of clay movement, with the clay mineral smectite being scarce in higher A and E horizons, and abundant in deeper Bt horizons. Prairie soils have shown little clay movement. Thus, this information provides more insight into soil formation processes.

## **A DESIRE TO CONTACT: THE USE OF SOCIAL MEDIA USE IN INDIVIDUALS WITH GENETIC DISORDERS**

Erin Kelleher, Philip Giampietro (Mentor), Pediatrics

Patients with genetic disorders often have a difficult time coping with their conditions which can impact their outlook on life. Social media may enable persons with these conditions a venue for support. The purpose of this study was to examine the use of social media by adolescents and young adults with connective tissue disorders. To study the utilization of social media in patients with connective tissue disorders we surveyed adolescents and young adults with MS and Ehlers Danlos syndrome (EDS) for their usage of social media. Study subjects completed a short survey describing their experiences with their connective tissue condition, means of self expression, existing network of persons to communicate with, future goals and their use of social media. Surveys were sent to 45 patients. The average age of participants was 18.1 years. All participants used some type of social media. The majority (73.7%) of participants said they never use social media to discuss their condition. Only 26% knew someone online with a similar condition. However, the remaining 74% of participants said they would communicate with someone with a similar disorder if they could. We found that most individuals with connective tissue disorders did not use social media to discuss their condition. However, most persons surveyed were interested in finding others who are similarly affected. Future efforts could aim at helping adolescents and young adults with connective tissue disorders learn about online websites and provide information regarding opportunities to connect with other people who have similar conditions.

## **MBD1 REGULATION OF NEURONAL MATURATION THROUGH GAMMA-PCDH**

Laurel Kelnhofer, Xinyu Zhao (Mentor), Neuroscience

Methyl-CpG binding domain protein 1 (MBD1) is known to be a reader of DNA methylation. By binding to methylated DNA, MBD1 mediates gene repression, and has been shown to play a role in adult neurogenesis, the formation of new neurons. In previous studies, our lab published that MBD1 deficiency leads to reduced differentiation of adult neural stem cells and impaired neuronal dendritic development. However the role of MBD1 in regulating neuronal maturation is unclear. The goal of my project is to determine whether MBD1 regulates maturation through  $\gamma$ -protocadherins ( $\gamma$ -PCDH), a transmembrane protein previously shown to influence neuronal maturation. Through the use of ChIP and RNA sequencing we have identified gamma-PCDH (10 and 12) as potential targets of MBD1, and using qPCR confirmed it is upregulated in MBD1-KO tissue. To determine if the MBD1 regulates neuronal maturation through  $\gamma$ -PCDH, the intracellular domain (ICD) of PCDH will be overexpressed in cultured neurons as they mature. Morphological differences between these in vitro neurons and their respective wild-type neurons will be assessed using neuron tracing and Scholl analysis.

## **ARE STATE SUPREME COURTS USING THEIR PUBLIC INFORMATION OFFICES STRATEGICALLY?**

Donya Khadem, Kayla Hui, Ryan Owens (Mentor), Political Science

The purpose of this research is to identify whether state courts (and their judges) use their public information offices (PIOs) strategically to enhance judicial power and their own chances of staying in office. We theorize that courts do in fact use PIOs, which serve as the link between the courts, the media, and the public, to help advance both these policy and career goals. Through interviews of PIO staff, archival research of state court cases, and the press releases issued by PIOs, we hope to determine whether state courts of last resort use PIOs for more than simple information provision.

## **TEMPORAL PROCESSING AND AGING IN THE AUDITORY SYSTEM**

Najeeha Khan, Cynthia Fowler (Mentor), Communication Sciences and Disorders

Older adults often have difficulty comprehending speech in noisy environments. Cognitive and auditory systems are known to decline with age. We are investigating how much these systems influence the difficulty that older adults have. Participants undergo a cognitive test (the Montreal Cognitive Assessment; MoCA), a Speech Perception in Noise Test (SPIN), a Behavioral Masking Level Difference Test (BMLD) to determine how auditory function affects the differentiation of sounds from background noise, and an Electrophysiological Masking Level Difference Test (EMLD) to measure the role of the brain in this task. We expect the BMLD to be smaller with lower MoCA and SPIN scores, and EMLD results to be larger than BMLD results. Analysis will determine the relative contribution of hearing loss and cognition on the BMLD.

## **CANDIDATUS ACCUMULIBACTER PHOSPHATIS POPULATION STRUCTURE: DESIGN AND EVALUATION OF PPK1 CLADE-SPECIFIC PRIMERS**

Jia Hui Khoo, Pamela Camejo Medranda (Mentor), Civil and Environmental Engineering

Candidatus Accumulibacter phosphatis (CAP) is one of the most important organisms responsible for enhanced biological phosphorus removal (EBPR) in many full-scale wastewater treatment plants. Based on phylogenetic distance of the *ppk1* gene, CAP has been classified into two major divisions (Type I and II) and several clades (IA-E and IIA-G) within these divisions. Previously, *ppk1* clade-specific primers were designed for detection and quantification of CAP; however, this set of primers only targeted five out of the twelve different clades and had poor coverage and specificity. Here, we designed and evaluated a new set of *ppk1* primers. We quantified the relative abundance of CAP clades by using quantitative polymerase chain reaction (qPCR) in sludge samples and compared these results with previously constructed *ppk1* clone libraries.

## **KINETIC PROFILING OF CANDIDATUS ACCUMULIBACTER PHOSPHATIS AND LAB-SCALE REACTOR OPTIMIZATION**

Eng Hoe Khor, Brian Owen, Francisco Moya Flores (Mentor), Civil and Environmental Engineering

Enhanced biological phosphorus removal (EBPR) has been widely implemented in wastewater treatment plants using polyphosphate accumulating organisms (PAO). Kinetics of release and uptake of phosphorus, nitrate, nitrite and relevant carbon sources of various PAO sludge over the EBPR cycle has been studied, but not to Candidatus Accumulibacter phosphatis (CAP) clades. We propose to attribute such kinetic parameters to CAP by combining molecular characterization and analytical chemistry tools. We routinely ran batch tests on two lab-scale reactors with biomass containing the PAO using HPLC and spectrophotometry. We used Fluorescence In Situ Hybridization (FISH) and quantitative Polymerase Chain Reaction (qPCR) to specify clade abundance in each reactor. Over the course of this study, several optimization procedures were implemented to increase efficiency and consistency of batch test results.

## **MAELSTROM**

Taylor Kiesow, Katherine Corby (Mentor), Dance

This project, a dance piece for nine performers, was inspired by Chaos Theory, the behavior of complex systems highly sensitive to initial conditions. The process began with a base phrase of movement that eventually took on a new life through repetition and spatial interruptions. The result is an unpredictable yet non-random exploration of time and space through contemporary dance.

## **INTERFERENCE OF MTDH-SND1 INTERACTION IN TGF 1-CANCER CELL SIGNALING**

Yeonjun Kim, Yongna Xing (Mentor), McArdle Laboratory

Our recent studies demonstrated that SND1 and MTDH interacts with each other to promote breast cancer. The structure of SND1/MTDH duplex has been recently resolved, but the functional mechanism of this duplex in promotion of different stages of cancer remains elusive. Recently, SND1 was suggested to mediate TGF $\beta$ 1 cancer signaling pathway acting as a Smurf1 stimulator that in turn affects cytoskeleton dynamics and cancer metastasis. For the undergraduate symposium 2015, I would like to present a literature review about molecular mechanism of SND1/MTDH metastasis promotion. Then, preliminary result of an experiment that investigates 1) the effect of MTDH-SND1-targeting inhibitors on cellular interactions between MTDH and SND1, and 2) how MTDH interaction affects the role of SND1 in stimulating Smurf1 expression in TGF $\beta$ 1 cancer signaling pathway will be presented in the symposium. Presentation will include brief overview of experiment procedures used in this study.

## **TARGETING THE PPK1 GENE TO INVESTIGATE POLYPHOSPHATE ACCUMULATING ORGANISMS IN THE ACTIVATED SLUDGE**

Char'Lee King, Francisco Moya Flores (Mentor), Civil and Environmental Engineering

Enhanced Biological Phosphorus Removal (EBPR) is a variant of the activated sludge wastewater treatment process; the most widely used environmental biotechnology system worldwide. The goal of EBPR is to remove excess phosphorus from wastewater, and the dominant bacteria is a Polyphosphate Accumulating Organism (PAO), named *Candidatus Accumulibacter phosphatis* (hereafter referred to as *Accumulibacter*). Studies have revealed that *Accumulibacter* is subdivided into two main Types (Clade IA and Clade IIA), each of which contains several coherent clades. To determine clade dynamics, we targeted the polyphosphate kinase (*ppk1*) gene using the Polymerase Chain Reaction (PCR) technique with activated sludge samples obtained during a six-month period. We also identified phylogenetic distribution of such samples using molecular characterization tools.

## **CHILDREN'S PERCEPTIONS OF SOCIAL HIERARCHIES**

Rachel King, Kristin Shutts (Mentor), Psychology

The present research focuses on when and how young children come to use nonverbal information (e.g. posture, eye gaze direction) to make inferences about the nature of other people's relationships--in particular, hierarchical relationships where one person has more power than another person. Previous research shows that 5- and 6-year-old children succeed, but 3- and 4-year-olds fail, when they are asked to determine power differences using only nonverbal information. We tested whether young children's poor performance was due to an inability to understand the nonverbal cues, or as a failure to make spontaneous use of these cues to guide inferences. Overall, this study improves our knowledge of how young children come to understand important aspects of their social world.

## **CARDIORESPIRATORY FITNESS IS ASSOCIATED WITH HIPPOCAMPAL GLUCOSE METABOLISM IN ADULTS AT RISK FOR AD**

Taylor Kirby, Ozioma Okonkwo (Mentor), Medicine

Decreased cerebral glucose metabolism is one of the pathological hallmarks of Alzheimer's disease (AD). Physical activity has been linked to many positive health outcomes, including brain health. The objective of this study was to investigate the relationship between cardiorespiratory fitness (CRF) and glucose metabolism in specific brain regions vulnerable to AD, i.e., the hippocampus and posterior cingulate. Ninety-five cognitively healthy, late-middle-aged adults from the Wisconsin Registry for Alzheimer's Prevention underwent FDG-PET imaging to measure cerebral glucose uptake and a graded maximal exercise test to quantify CRF. Covariate-adjusted regression analyses showed that better CRF was significantly associated with higher FDG-PET uptake in the hippocampus ( $p=.006$ ) but not the posterior cingulate ( $p=.251$ ). These results suggest that midlife physical activity may protect against brain changes seen in AD.

## **DETERMINATION OF COLLOID OSMOTIC PRESSURE IN CATTLE AND ITS RELATIONSHIP TO OTHER SERUM PROTEINS**

Jennifer Kish, Sheila McGuirk (Mentor), Medical Sciences

The goal of this study was to examine colloid osmotic pressure (COP) in both cows and calves in order to define a normal value and to determine if there was a correlation between COP and other blood proteins. The goals of this research was to aid in the diagnosis of critical care patients who exhibit signs of illness potentially due to fluid leaking out of the blood vessels. The results showed an average COP of 22.520 mmHg for cows and 19.596 mmHg for calves, with strong correlations shown between COP and the protein albumin in cows, and between COP and serum total protein (STP) content in calves. Major conclusions from this study include the determination of a normal value for COP in cows and calves, as well as determination of a way to calculate an approximate COP from simpler tests that determine the protein concentrations in the blood of a patient.

## **COASTAL ZONE MANAGEMENT IN MEXICO**

Rachael Klicko, Jade Arneson, Jessica Brings, Jill Gorges, James Berkelman (Mentor), Wildlife Ecology

Our study examines the recent increase in coastal zone activity in Mexico and its impact on coastal ecosystems. The dynamic interface of land and water that defines coastal zones harbors a wide variety of ecosystems which encourages human development but also causes conflicts. For example, threatened sea turtles are dependent on coastal zones for reproduction but humans are also reliant on the coast for development and recreation. Despite their inherent importance, coastal zones have been neglected and their management is not considered a national objective in Mexico. To avoid conflicts between uses and to protect sea turtles, we recommend administrative continuity and efficiency as well as education and community involvement to promote coastal management and sea turtle conservation in the Gulf of California.

## **POLICE EQUIPMENT IN A FORD UTILITY: OPTIMIZING LOCATION WITH THE TOOLS OF PHYSICAL ERGONOMICS**

Brittney Kline, Robert Radwin (Mentor), Industrial and Systems Engineering

The safety conditions in a police vehicle are becoming an increasing source for concern. Police officers multitask while driving to perform their job duties. To date, no standards or research exist for where police equipment should be placed in the vehicle to reduce injury and enhance safety. This presentation follows a case study that applies the tools of physical ergonomics to enhance the interior setup of police equipment in a Ford Interceptor Utility.

## **POLLEN COMPETITION IN ALFALFA (MEDICAGO SATIVA)**

Joshua Kluever, Austin Bauer (Mentor), Entomology

Pollinator mediated pollen transfer between plants results in pollen from multiple sources reaching the stigma. Many of those pollen grains will never successfully fertilize an ovule leading to pollen competition. Pollen competition can occur within species (conspecific) and among closely related species (heterospecific). In alfalfa (*Medicago sativa*), there may be a difference in competitive ability in pollen between conventional and Round-up Ready (RR) resistant varieties. Plants with more competitive pollen are more successful at producing offspring. This competition among pollen grains may result in unequal patterns of inheritance. Our goal is to determine the competitive relationship between conventional and RR resistant alfalfa in a controlled setting without added stress. We predict that in the absence of stress, conventional alfalfa will be the reproductive winner.

## **FLYING INSECT ABUNDANCE IN RESPONSE TO TEMPERATURE, PRECIPITATION, WIND SPEED, AND HUMIDITY**

Valerie Knurr, Paul Schilke (Mentor), Wildlife Ecology

My goal is to determine if changes in temperature, precipitation, wind speed, and humidity affect flying insect activity and abundance. Flying insects are important to many different organisms because they are common food sources, pollinators, and pests. Understanding how weather affects insects is important because they impact many other species. We collected insects on sticky traps weekly around northern Wisconsin lakes between May and August of 2013 and 2014, then identified the insects by order and calculated their biomass. I compared the biomass to four weather variables to determine if there was a correlation between flying insect abundance and weather conditions. The completion of this study will allow us to better understand how weather and climate change impact flying insect abundance.

## **THE POWER OF URBAN AGRICULTURE TO TRANSFORM A CITY**

Aislinn Koehler, Leann Tigges (Mentor), Community and Environmental Sociology

Urban agriculture projects have increased dramatically within the past decades in cities across the United States. While most projects stem from a desire to teach environment sustainability or create local food systems, some cities are using urban agriculture as a way to begin restructuring a city and its economic potential, while increasing civic engagement. Focusing on Detroit, I study the impact urban agriculture has within its neighborhoods through journal articles and field work already completed on the subject. For many communities, urban agriculture does more than promote healthy, sustainable eating habits to their citizens, but it also combats food insecurity, brings food justice to communities, and acts as a catalyst to inspire infrastructural change and redevelopment in America's 'shrinking cities.'

## **IDENTIFYING GnRH PROGENITOR CELLS IN THE THIRD VENTRICLE OF ADULT RHESUS MONKEYS**

Lucille Kohlenberg, Ei Terasawa-Grilley (Mentor), Pediatrics

Gonadotropin releasing hormone (GnRH) neurons regulate reproductive function. Kallman Syndrome (KS) patients who lack GnRH neurons in the hypothalamus exhibit hypogonadotropic hypogonadism. In a subset of KS patients, hormone treatments for symptomatic improvement result in the spontaneous recovery of reproductive function. We hypothesize that hormone treatments assist in generating functional GnRH neurons, as GnRH mRNA expressing neurons are observed during the embryonic stage. In the first step of testing this hypothesis, we are examining GnRH neurons in the adult monkey hypothalamus using dual in situ hybridization for mRNA expression and immunocytochemistry for peptide expression. Results indicate the presence of cells with GnRH mRNA, but not peptide, expression in the periventricular region of the third ventricle. It appears that progenitor cells are impacted by hormone treatments.

## **RIC-8A REGULATION OF INTERCELLULAR INTERACTIONS IN THE DEVELOPING BRAIN**

Adam Korte, Shang Ma (Mentor), Neuroscience

The protein Ric-8a can be genetically deleted through the usage of a cre-lox technology in order to discover the neurological mechanism by which Ric-8a regulates interactions between interneurons and blood vessels. My preliminary data reinforced the conclusion that the majority of interneurons in the cerebral cortex are located in the ventral part of the brain compared to the dorsal area, as well as the fact that Ric-8a excision causes severe neonatal hemorrhaging. Through the excision of the Ric-8a protein, I quantified the role that this specific gene plays in not only interneuron migration, but additionally in pyramidal cell development. My genetic model helps to clarify and identify the role that the Ric-8a protein plays in interneuronal migration and production during development.

## **CONTEMPLATIVE PRACTICE AND THE INTERACTION OF STRESS, AFFECT, AND SELF-REGULATION**

Rachel Koszalinski, David Findley (Mentor), Waisman Center

Stress impacts people around the globe, and no two individuals experience stress in the same way. Due to the prevalence of stress and its widespread impacts, there is increasing interest in ways to both reduce and buffer against the negative effects of stress on areas of human functioning. The current study aimed to explore subsets of contemplative practice (loving kindness, breath awareness, and gratitude) in consideration with stress and its interactions with affect and self-regulation. It was expected that taking part in a brief contemplative practice would increase positive and decrease negative affect, and decrease the negative effects of acute stress on self-regulation and affect. Findings from this study could expand the understanding of stress and its impact on human functioning, while also providing a more holistic perspective on the human experience. This broader perspective could benefit the ways in which professionals treat stress-related issues, and provide diverse coping strategies for a wide range of individuals.

## **ORGANIZATIONAL USES OF CULTURAL RESOURCES TO FORMULATE IDENTITIES**

Oudom Kour, Shannon Younger (Mentor), Management and Human Resources

The goal of our project is to understand how entrepreneurs use cultural resources to frame their identities. It is important for an organization to develop an identity because it makes a company more relatable, it gives them legitimacy, and it creates separation within the market, so companies are not too similar. My main tasks are to collect the data from distilleries' websites, as well as help to code the data for key words or phrases that are common throughout the data. Coding will provide valuable data to help better understand the nuances between how different organizations use cultural resources in their identities.

## **SPACING YOUR OWN LEARNING: DIFFERENCES IN STRATEGY ADOPTION BETWEEN PRESCHOOLERS AND ADULTS**

Carla Kraft, Emily Katz, Molly Pugh, Haley Vlach (Mentor), Educational Psychology

The spacing effect describes the phenomenon that distributing learning events over time promotes memory to a greater degree than presenting learning events in immediate succession. The current study examined whether children or adults are more flexible in altering their learning strategies based on what type of learning schedule (massed or spaced in time) they perceived to be more optimal for memory. The results showed that children were more accurate than adults in predicting the optimal learning schedule. These findings suggest that children can be taught about spaced learning and more readily see the benefits of the method than adults. Indeed, teaching young learners about spaced learning may help them to remember more information learned during self-studying.

## **ARTIFICIAL GRAMMAR LEARNING IN ADULT MONOLINGUALS AND BILINGUALS**

Megan Kratzer, Margarita Kaushanskaya (Mentor), Communication Sciences & Disorders

Language is a unique and complex system, acquired over years of development. As a result, it is difficult to study language learning as it occurs naturally. One method that can improve our understanding of language learning is the use of an artificial grammar. An artificial grammar is a set of arbitrary symbols that follow a specific pattern. In this study, we examined whether bilingualism influences language learning abilities in adults by comparing the performance of adult monolinguals and bilinguals on an artificial grammar learning task. Given evidence of cognitive differences between monolingual and bilingual speakers, it was hypothesized that bilinguals would perform better than monolinguals on the task. However, our preliminary findings suggest that bilinguals and monolinguals perform similarly on the artificial grammar learning task, indicating that the ability to learn hierarchical rules and underlying syntactic structures may be impervious to language experience.

## **ENGINEERING SACCHAROMYCES CEREVISIAE TO IMPROVE PRODUCTION OF SECOND GENERATION BIOFUELS**

Molly Krause, Audrey Gasch (Mentor), Genetics

The increased demand for alternative fuels is driving the development of second-generation biofuels, which uses agricultural waste to produce ethanol. Plant biomass contains lots of sugars that can be extracted using several chemical pretreatment processes, and then sugars can be fed to various fermenting microbes such as *Saccharomyces cerevisiae* to produce ethanol. This process is environmentally friendly, but not efficient due to two major problems, which make this process economically unviable. First, the second most abundant sugar; xylose, cannot be consumed by *S. cerevisiae*. Second, pretreatment of biomass not only releases sugars but also a lot of byproducts that are toxic to *S. cerevisiae*. The Great Lakes Bioenergy Research Center (GLBRC) engineered a strain to consume xylose by introducing genes required for xylose metabolism. In order to improve this strain so that it can be tolerant to toxins, this xylose consuming strain was mated with strains known to be tolerant to toxins. These diploid hybrids were shown to be tolerant to toxins but were unable to consume xylose. From these results it was concluded that tolerance to toxins is a dominant trait, while xylose consumption is recessive. For my project, I am working with these hybrids by promoting recombination of the genome through meiosis, followed by isolation of haploid recombinants. My hypothesis is that by dissecting hybrids, I will be able to find the right combination of genes that allow xylose consumption while maintaining tolerance.

## **EVALUATING SURFACE COVER EFFECIVENESS FOR CONTROLLING FLUXES AT URANIUM MILL TAILING DISPOSAL SITES**

Joel Krech, William Likos (Mentor), Geological Engineering

Disposal facilities for uranium mill tailings have been constructed as required by the Uranium Mine Tailing Radiation Control Act (UMTRCA). Nearly all UMTRCA facilities rely on a surface cover to control the rate at which contaminants migrate in the gas and water phases from the tailings into the environment. The primary layer of a typical surface cover, commonly referred to as the 'low-permeability radon barrier' (or Rn Barrier), is the primary component that controls fluxes in the gas and water phases. This study will evaluate the effects of soil structure formation by abiotic and biotic process, gaseous diffusivity of Rn Barriers, how structural development varies with depth and thickness of the Rn barrier, and how structure influences transmission of radon and seepage carrying ground water contaminants. Additionally, the deterioration of the Rn barrier due to climate effects is of particular interest to study the life cycle and long-term performance of disposal cells. The experiments in this study will be conducted by the University of Wisconsin-Madison, in collaboration with investigators from the U.S. Department of Energy's Office of Legacy Management and the Desert Research Institute.

## **OROGRAPHIC BARRIERS AND THEIR EFFECTS ON PRECIPITATION**

Cody Kuchinski, Tristan L'ecuyer (Mentor), Atmospheric and Oceanic Sciences

In North America and particularly the United States, the eastward flow of the atmosphere inevitably crosses the vast expanse of the Rocky Mountain range. As such, this flow will be forced up over these mountains. This might substantially affect the amount of precipitable moisture condensed within this flow. Precipitation in mountains can have a huge impact on snow packs (which has large implications in global and regional weather patterns) and even avalanche possibilities (a constant danger for those who dwell near areas of high elevation). The goal of this research is to conclude whether these orographic barriers do have substantial effects on mountainous precipitation, and will help advance our understanding of precipitation dynamics and thermodynamics that could advance predictions for weather patterns and dangerous incidents.

## **EYE GAZE IN ADOLESCENT FEMALES WITH FRAGILE X SYNDROME**

Aleah Kuchta, Audra Sterling Von Glahn (Mentor), Communication Sciences and Disorders

Fragile X syndrome (FXS) is the most common inherited form of intellectual disability. Females with FXS do not generally express severe cognitive or language disabilities. However, they do demonstrate marked impairments in pragmatics, a domain that is critical to look at within the social context of adolescence. To investigate pragmatic abilities of adolescent females with FXS, we examined differences in conversational eye gaze behavior between girls with FXS and girls with typical development. It is expected that girls with FXS will exhibit abnormal patterns of eye gaze behavior, with more instances of gaze avoidance and shorter durations of eye contact. Findings will help clinicians to understand more about pragmatic deficits in this population in order to apply that to best meet their clinical needs.

## **RECEPTIVE VOCABULARY IN JAILED PARENTS, THEIR CHILDREN, AND THEIR CHILDREN'S CAREGIVERS**

Melissa Kuik, Julie Poehlmann-Tynan (Mentor), Human Development and Family Studies

As of 2007, approximately 1.7 million children had a parent in prison; this number does not include children with a parent in jail. This current report is part of a larger study being conducted by Dr. Julie Poehlmann that examines the effects of incarceration on young children. Using results from the Peabody Picture Vocabulary Test (PPVT), this report will examine receptive vocabulary scores in jailed parents, their young child, and their child's caregiver, looking at correlations among these family members. In research, the PPVT is often used as a broad indicator of oral vocabulary and verbal ability. By understanding the relationship between the jailed parent, caregiver, and young child's receptive vocabulary, intervention tools could be created and implemented in the hopes of improving the oral vocabulary and verbal ability in this high-risk population.

## **CHEMOTACTIC GRADIENT HYDROGELS FOR AXONAL GUIDANCE**

Susanna Kwok, Megan Jensen (Mentor), Neurology

Neurons, specifically their axons, are guided by gradients of attractive or repulsive molecules during development in order to properly orient themselves to establish the proper neuronal connections needed for the creation of neural networks. To recapitulate this system in vitro, we would like to establish chemotactic gradients in hydrogel scaffolds and study changes in neuronal and axonal directionality and orientation with the hope that such a system can be used to effectively model or be used in treatment of neurodegenerative diseases, brain injury, and stroke.

## **WHAT IS THE BEST METHOD TO MODEL ASTROCYTOSIS?**

Jin Kwon, Matthew Jensen (Mentor), Neurology

After a central nervous system injury, astrocytes migrate and form a glial scar possibly for the purpose of mechanically reinforcing structurally disrupted tissue. The glial scar formed by reactive astrocytes however inhibits axon recovery by acting as physical/biochemical barrier after injury. In vitro modeling of astrocytosis would provide a model for testing substances that would speed research of mechanisms and treatments, but it is unclear what methods might be optimal for this purpose. We performed a systematic review of modeling astrocytosis in vitro. We found advantages in models that used 3D matrigel culturing of astrocytosis. We also found various chemical/physical/environmental methods of insult techniques; however, specificity of injury type leaves the best astrocytosis model ambiguous. Further comparison study needs to be accomplished.

## **SOCIAL STRUCTURE AND TEMPERATURE INFLUENCE THE DAILY FORAGING PATTERNS OF WINTERING BIRDS**

Cody Lane, Benjamin Zuckerberg (Mentor), Wildlife Ecology

During the winter months, Black-capped Chickadees (*Parus atricapillus*) form flocks structured by dominance hierarchies with dominant and subordinate individuals experiencing different levels of risk for predation and starvation. These two risk factors represent a major behavioral trade-off potentially influencing individual variation in foraging patterns and resource acquisition. As winter is a time of shifting environmental pressure, these trade-offs could also be mediated by fluctuations in daily temperature. I hypothesize that foraging strategies by winter birds is driven by a combination of social status and dynamic winter temperatures. To test this hypothesis, I recorded pairwise interactions at a fixed feeding station to establish dominance classes and used radio-frequency identification (RFID) to record the feeding activity of individual birds.

## **EARLY LIFE STRESS, DEPRESSION, AND CORTISOL'S EFFECTS ON EMOTIONAL MEMORY**

Amy Lang, Heather Abercrombie (Mentor), Psychiatry

Depression is associated with dysregulation of the stress hormone cortisol. Cortisol enhances emotional memory. However, cortisol's effects are altered in depression. We hypothesize that early life stress (ELS) explains variation in cortisol's effects on emotional memory in depression. We tested effects of cortisol (versus placebo) on emotional memory in 19 women with and 15 women without depression. We also tested whether variation in ELS moderated cortisol's effects on emotional memory. Preliminary findings showed a Drug X Group X ELS interaction,  $F(1,30)=7.83, p>.01$ . Only depressed subjects with ELS showed cortisol-related enhancement of emotional memory, suggesting that stress hormone effects on emotional memory in depression depend upon variation in ELS. In our poster we will present tests of these hypotheses in our larger sample from this ongoing study.

## **DANE COUNTY ALTERNATIVE EDUCATION INITIATIVE**

Lauren Lange, Maxwell Courtright, Kimber Wilkerson (Mentor), Rehabilitation Psychology and Special Education

Educational reformers constantly bring into question the efficacy of programs for students with challenging qualities, be them academic or behavioral. Our research team looks to see if behavioral-remediation and academic-remediation-focused alternative high schools are in fact effective in serving their students relative to their traditional counterparts. Moving forward, this project entails looking at enrollment trends in new districts with demographics that closely mirror those of our completed research, and finding appropriate quantitative measures of a student's level of contact with their school as a treatment. For the former, a paper is being drafted that breaks down qualities of schools and student bodies in our next district focus. For the latter, a "dosage" paper is being drafted detailing more specific measures of school treatment and how they predict student outcomes.

## **DIFFERENTIAL EXPRESSION OF CYTOKINES AND GROWTH FACTORS IN GLIOBLASTOMA STEM CELLS**

Carolina Larrain, Umadevi Wesley (Mentor), Neurological Surgery

Glioblastoma (GBM) is the most malignant brain tumor, and is challenging to treat due to its invasiveness. Cancer stem cells (GSC) that produce cytokines and growth factors in the tumor environment contribute to its aggressiveness. In this study, we examined the changes in cytokine and growth factor expression in GSC as compared to the differentiated GSC cell line. We examined the levels of Hypoxia Inducible Factor-1a, galectin-3, Vascular Endothelial Growth Factor and Urokinase Plasminogen Activator, which are involved in the GBM progression. Our results showed that the GSC cells express higher levels of the factors including Gal-3, VEGF, and UPA as compared to differentiated cells. It is likely that differentiation of GSC cells may lead to decrease in aggressiveness of GBM.

## **CARDIORESPIRATORY FITNESS ALTERS THE EFFECT OF FAMILY HISTORY OF ALZHEIMER'S DISEASE ON MEDIAL TEMPORAL BRAIN STRUCTURES**

Lena Law, Ozioma Okonkwo (Mentor), Medicine

The objective of this study is to determine whether cardiorespiratory fitness (CRF) modifies the adverse effect of family history (FH) of Alzheimer's disease (AD) on brain volume. Brain tissue loss is inevitable with age but FH of AD has been shown to increase this loss, especially in the entorhinal cortex (ERC) and hippocampus. CRF has been shown to have a positive effect on brain health, including brain volume, cognitive function, and dementia risk. This study will obtain data regarding participants' CRF levels using graded exercise testing (GXT) and data on brain volumes using magnetic resonance imaging (MRI) and FreeSurfer analysis. The relationship between these two variables will be analyzed to determine whether increased CRF may prove beneficial to individuals with FH of AD.

## **IN VITRO LEPTIN RECEPTOR LEVELS IN OVINE UTERINE ARTERY ENDOTHELIAL CELLS: LEPTIN AND ANGIOGENESIS**

Kurtis Lawe, Vladimir Vargas (Mentor), Obstetrics and Gynecology

The follicular phase and pregnancy are physiological states of elevated estrogen levels and uterine blood flow. Leptin is an adipokine that regulates obesity, reproductive processes, blood pressure, and angiogenesis. We hypothesized that: 1) In vitro Leptin receptors are upregulated in nonpregnant uterine artery endothelial cells (NP-UAECs) and late pregnant ewes (P-UAECs); and 2) in vitro Leptin treatment will modulate cell proliferation in ovine UAECs from NP-UAECs less than P-UAECs. Leptin receptors, and angiogenesis were evaluated in passage 4 NP-UAECs and P-UAECs. Leptin receptors were expressed in passage 4 UAECs at similar levels between groups. Leptin treatment significantly increased cell proliferation in UAECs from follicular phase and P-UAECs. In summary, Leptin may play an angiogenic role during these physiologic states of high estrogen levels.

## **PLANT GENETICS AND ENVIRONMENT SHAPE PLANT TOLERANCE AND RESISTANCE TO HERBIVORY**

Sophia Lawrence, Hilary Bultman (Mentor), Zoology

A plant's genetics and environment shape its traits (tolerance to herbivory). I hypothesize aspen (*Populus tremuloides*) grown in high nutrient environments will have higher tolerance. To test this hypothesis, I monitored aspen clones grown in pots with different nutrient and competition levels and removed 75% of the leaf tissue to half of the trees to simulate herbivory. My findings will shed light on how both genetics and environment influence the success of the plant via herbivore selection.

## **THE EAST GREEKS AND EGYPT: THE ART AND GRAFFITI OF CARIAN AND IONIAN MERCENARIES IN THE SAITE PERIOD**

Erin Lawrence, William Aylward (Mentor), Classics

The study of Greek populations living in Ancient Egypt has often been limited to the Ptolemaic and Roman periods, which produced such famous historical figures as Alexander the Great and Cleopatra VII. However, prior to Alexander's conquest, Egypt's Saite Period (685-525 BCE) was home to several Greek settlements and populations. While Greek traders based in the city of Naukratis were strictly regulated and had access only to the extreme northern part of the Nile, mercenaries from Caria and Ionia were employed by the Saite Pharaohs and spread throughout both the land and culture, often assimilating partly or wholly into Egyptian society. By studying the art and graffiti left behind by these mercenaries, we can form a better understanding of Greco-Egyptian syncretism in its earliest stages.

## **EFFECT OF POACIC ACID BIOFUNGICIDE ON DROSOPHILA SUZUKII MORTALITY AND DEVELOPMENT**

Kathryn LeClaire, Christelle Guedot (Mentor), Entomology

*Drosophila suzukii* or Spotted Wing *Drosophila* (SWD) is an invasive and highly pestiferous species of vinegar fly that causes significant fruit crop losses. Recent studies suggest fungi affect *Drosophila* reproduction and development. Poacic acid, a decarboxylated 8-5-diferulate agent, acts as a biofungicide targeting cell wall integrity. This project addresses whether poacic acid affects SWD survival and development with a focus on adult mortality, number of eggs laid, number of larvae, and adult emergence of SWD under different concentrations of poacic acid. It is expected that adult mortality will not be affected while other factors will be negatively influenced by exposure. This information will provide better understanding of the effect of diferulate biofungicides as pesticides or repellents and could lead to improved management strategies against SWD.

## **INVESTIGATION OF CEREBRAL WHITE MATTER TRACT INTEGRITY IN PARKINSON'S DISEASE**

Rebecca Leda, Catherine Gallagher (Mentor), Neurology

Parkinson's disease (PD) is characterized by the degeneration of dopaminergic neurons of the substantia nigra. We hypothesized that PD participants will have altered white matter tract integrity between the substantia nigra and putamen, located primarily on the side of disease onset. To investigate this, we performed probabilistic tractography implemented in FMRIB Software Library (FSL) in 29 PD participants and 28 older controls. The average probabilistic value in a white matter tract was used to determine the difference in white matter connectivity between PD patients and controls, as well as side-to-side asymmetry in PD patients. Detection of the alterations in white matter tracts may not only assist in earlier detection of pathophysiological changes in PD, but also aid in the prediction of disease progression.

## **THE ANALYSIS OF HMONG-ENGLISH CODE-SWITCHING**

Iaong Lee, Hong Yan (Mentor), East Asian Languages & Literature

Living in the United States, Hmong people's native language is unavoidably surrounded by English and, therefore, their language becomes a mix of Hmong and English. This project investigates the factors that cause code-switching between Hmong and English. 'Code switching, or language mixing, occurs when a word or a phrase in one language substitutes for a word or phrase in a second language' (Li, 1996; Heredia and Altarriba, 2001). In this project, code-switching is first analyzed through recordings of conversations, and then tested by experiments on speakers' response time to the two languages. The results show that both linguistic factors (e.g. principles of language economy), and non-linguistic factors (e.g. identity), influence the code-switching process. This project gives people a deeper understanding of the mechanism of bilingualism.

## **CHARACTERIZATION OF THE ROLE OF FYVE-DOMAIN CONTAINING PROTEINS IN AUTOPHAGY ROUTE IN ARABIDOPSIS**

Christopher Lee, Faqiang Li (Mentor), Genetics

Autophagy is a conserved intracellular recycling process by which superfluous or damaged cytoplasmic material and organelles are encapsulated into autophagy vesicles and delivered to the vacuole for breakdown. A key component mediating vesicle transport is FYVE domain-containing protein (FYVE) that interacts with autophagic membrane-associated protein ATG8 and microtubule (MT) motor protein kinesin, thus promotes MT plus end-directed vesicle transport. Here, we have identified two *Arabidopsis thaliana* FYVE proteins, and characterized their functions through detailed gene co-expression analysis, the exploitation of a fluorescent FYVE protein to track its subcellular localization, and phenotypic analyses in *fyve1* and *fyve2* double mutants, to show that FYVE proteins play a central role in autophagy vesicle transport.

## **POPULATION DYNAMICS OF CANDIDATUS ACCUMULIBACTER IN EBPR SYSTEMS**

Yujin Lee, Ben Oyserman (Mentor), Civil and Environmental Engineering

Enhanced biological phosphorus removal (EBPR) is an economical and sustainable wastewater treatment method to remove phosphorus from wastewater. Although EBPR has been used for more than 60 years, it is prone to unexpected failures due to an incomplete understanding of EBPR microbiology and population analysis. Enrichment cultures in laboratory scale bioreactors are studied to get a better insight of the physiology of EBPR microorganisms. Here, we look at a 10-year time series qPCR data of “*Candidatus Accumulibacter*,” a PAO that has been most widely studied in the wastewater treatment system. Combining this data with the corresponding reactor metadata, we investigated the correlation between the environmental disturbance (within the reactor) and the stability of *C. Accumulibacter* clades IA and IIA.

## **ESTABLISHING SYSTEMS TO EXAMINE ANTI-TUMOR EFFICACY AND IMMUNE INHIBITION OF NOVEL TK INHIBITORS**

Lauren Lever, Paul Sondel (Mentor), Human Oncology

The use of multi-targeted tyrosine kinase (TK) inhibitors has proved beneficial in the treatment of several cancers. However, these drugs also inhibit TKs involved in immune activation. This study aims to create systems to examine the anti-tumor effects and immune inhibition of novel TK inhibitors with a goal to select those which inhibit tumors but not immunity. Anti-tumor efficacy was measured in vitro and in vivo using c-Kit expressing Ba/F3 cells transfected to be either sensitive or resistant to TK inhibitors. Immune inhibition is thought to be explored through the creation of a Ba/F3 line expressing Lck, a kinase involved in T-cell activation and proliferation. Systems to quantify anti-tumor efficacy were established, while the systems to quantify immune inhibition are in progress.

## **WHAT MATTERS IN MENTORING? EFFECT OF MENTOR CULTURAL AWARENESS ON MENTEE OUTCOMES**

Aemilia Leyden, Patrice Leverett (Mentor), Educational Psychology

This research investigates the extent to which a research mentor’s cultural diversity awareness impacts the effectiveness of the mentor. Research suggests that mentors who are proficient in their own cultural understanding are cognizant of cultural differences and sensitive to occasions to be culturally aware. However, there are no measures for cultural diversity awareness as it relates to STEM mentoring practices. Undergraduate research scholars that participated in a summer research program at UW–Madison are being interviewed about their mentoring relationship, their overall experience and the potential impact of cultural diversity awareness. The project is expected to identify elements in the research mentoring relationship that leads to positive outcomes for culturally diverse mentees and determine practices that can be applied by mentors that promote cultural diversity awareness.

## **ALKALINE PHOSPHATASE STRUCTURE EXPECTED TO INFLUENCE HEAT STABILITY**

Joseph L’Huillier, Adam Miller, Michelle Harris (Mentor), Biocore

Alkaline phosphatase (AP) enzyme structure is highly conserved among phyla, but differences in AP heat stability exist. Human placental AP (HPLAP) contains a heat-stable amino acid 429, a hydrophobic pocket, and an RY cluster—all likely involved in AP stability. We hypothesize that HPLAP will be most heat stable compared to bovine intestinal AP (BIAP) which will be least heat stable due to the absence of these structures. Human intestinal AP (IAP) is expected to have an intermediate level of heat stability due to the presence of a hydrophobic pocket only. Heat stability will be determined by measuring enzyme reaction velocity with substrate p-nitrophenol phosphate run at 37°C and 55°C. The results will help elucidate the relative importance of AP structural components in heat stability.

## **BEATS EMPLOYMENT INITIATIVE: DEVELOP A COMMUNITY CAREER SERVICE MODEL AND LINK UNEMPLOYED POPULATION**

Silun Li, Anna Haley-Lock (Mentor), Social Work

The goal of “Building Employment and Technology Skills” (BEATS) Employment Initiative project is to develop a career service model for community centers that are not specialized in employment programs as well as create opportunities for greater population in West Madison to enhance their career skills and prepare them to better match employment. My community partner, Lussier Community Education Center (LCEC) implements BEATS to provide certain services related to the job search, including resume development and mock interviewing for low-income and unemployed population. While the program staff and volunteers observed the existence of both underutilized services and unmet demand, we were trying to research and create a new model to make more people benefited from BEATS program. This new model was identified and illustrated through research, which included a need assessment, literature review on other theories, and data analysis. The new model is comprised of stable partnership and coordinated efforts with other community organizations in current or expanded network as well as an on-site job fair incorporated into this project. Developing this new model will allow more insightful consideration of expansion and improvement of community career service programs, as well as future research directions associated with this topic.

## **PHOSPHOINOSITIDE REGULATION OF ATG14 FUNCTION IN AUTOPHAGY**

Yihan Liao, Richard Anderson (Mentor), Molecular and Cellular Pharmacology

Autophagy plays key roles in maintaining cell homeostasis by digesting part of the cytoplasm contents in the lysosome in response to nutrient starvation or other stresses. Autophagy deregulation is closely related to human diseases such as cancers and diabetes. Initiation of autophagy requires the Beclin1-Vps34-ATG14 complex. The Barkor/ATG14 Autophagosome Targeting Sequence (BATS) domain of ATG14 is required for its membrane binding and selectively binds Phosphatidylinositol 4,5-bisphosphate (PI4,5P2) and PI3P, but the functional relevance of PI4,5P2 binding to ATG14 is unclear. This study identified two PI4,5P2 binding residues in the ATG14-BATS domain and confirmed that PI4,5P2 binding is important for the assembly of the ATG14 complex in autophagy. This finding reveals a role for PI4,5P2 in ATG14 functions in autophagy.

## **ANALYSIS OF FUNCTIONAL FEATURES OF CTD KINASES USING AN IRREVERSIBLE INHIBITION STRATEGY**

Jiayue Liu, Juan Rodriguez-Molina (Mentor), Biochemistry

The C-terminal domain (CTD) of Rpb1, the largest subunit of RNA polymerase II, consists of highly conserved heptapeptide (YSPTSPS) and serves as a binding scaffold for a variety of protein-protein interactions during transcription. In the eukaryotic model *Saccharomyces cerevisiae*, the CTD is composed of 26 heptapeptide repeats in tandem. All hydroxyl-bearing residues (Y1, S2, T4, S5 and S7) are phosphorylated, whereas proline residues (P3 and P6) undergo isomerization. The current knowledge indicates that the dynamic patterns of CTD modifications, in particular phosphorylation and dephosphorylation, dictate most of the steps in the transcription cycle. Aiming toward the goal of uncovering the functional features of kinases that are responsible for CTD phosphorylation, we have applied a novel strategy in which we specifically and irreversibly block CTD kinase activity *in vivo*. We have applied this strategy to Kin28, Bur1 and CTK1, which are the three major kinases that phosphorylate the CTD at different stages of transcription. Covalent inhibition of Kin28 or Bur1 results in growth arrest, consistent with their essential role in transcription and proliferation. Moreover, irreversible inhibition of Kin28 and Bur1 results in a marked reduction in Ser5 and Ser2 phosphorylation levels respectively. Upon inhibition of Kin28, RNA Pol II is able to initiate transcription and engage in active elongation, suggesting that Kin28 is not required for general Pol II transcription initiation or promoter release. Importantly, our data reveal Kin28 and Bur1 are both major Ser7 kinases in cells. Covalent inhibition of CTK1, while viable (due to the non-essential nature of Ctk1), shows a stark decrease in Ser2 phosphorylation levels. Our covalent inhibition approach is enabling the discovery of additional functions of CTD kinases beyond transcription regulation.

## **CHILDREN'S SOCIAL INFERENCES IN THE FOOD DOMAIN**

Kailyn Longueville, Ashley Jordan (Mentor), Psychology

What information helps guide young children's inferences about others' social relationships? Studies have shown children are sensitive to behaviors displayed in food contexts. These behaviors may assist children in learning how people are connected. In the present study, 3-6-year-old participants rated the closeness and type of relationship others shared based on their preferences for, and behaviors with, food. Participants viewed two targets expressing liking or disliking for food or performing a motion with food. In half of the trials the targets' behavior matched, and in half of the trials it differed. Overall, children rated targets as closer when their behavior matched rather than differed ( $F(1,40) = 27.47, p > .001$ ). Tracking individuals' behavior in food contexts may aid children in understanding and forming social relationships.

## **QUANTITATIVE INVESTIGATION OF FLOWERING TRAIT GENES IN B. RAPA AIMED AT ENHANCING GENETICS EDUCATION**

Alexander Lopez, Noah Richter, Jacob Zasada, Scott Woody (Mentor), Biochemistry

This study seeks to determine the location and nature of genes that control flowering in *Brassica rapa*, a model organism used for teaching genetics principles, for future application in classroom settings. Time and height of first flower were recorded for 371 self-breeding, homozygous *B. rapa* families derived from three parental lineages. BLAST comparisons with *Arabidopsis thaliana*, a closely-related species, were used to identify likely gene locations in *B. rapa*. We performed a quantitative trait loci (QTL) statistical analysis which uses family crosses and trait inheritance patterns to approximate gene location. Ultimately analogous methods may be used as an educational tool for instruction in introductory genetic principles such as recombination, inheritance, and incomplete dominance.

## **REFLECTANCE OF GLAUCOMATOUS AND NON-GLAUCOMATOUS SCLERA TISSUE**

Melanie Loppnow, Gillian McLellan (Mentor), Surgical Sciences

The high intraocular pressure that glaucoma patients experience can lead to blindness by damaging the optic nerve. Differences in structural and mechanical properties of scleral collagen affect disease progression. Tissue optical properties can be used to identify structural differences. The purpose of this study is to determine whether optical properties of scleral tissue from glaucoma subjects differ significantly from normal. Multiple confocal microscopy images were acquired from age-matched, fixed, 4mm diameter biopsy samples of glaucomatous and non-glaucomatous cat sclera. Scattering coefficient and anisotropy were analyzed by fitting depth dependent reflectance values and compared between groups. If differences in collagen can be identified through optical properties, this could serve as a means of identifying individuals at greatest risk of blindness caused by glaucoma.

## **TRUST IN EDUCATION POLICY IMPLEMENTATION**

Sylwia Los, Erica Turner (Mentor), Educational Policy

The implementation of set standards and assessments for English learners has the potential to raise achievement for a group of students that is rapidly growing in U.S. schools. Through a systematic method, qualitative analysis of 21 interviews conducted with district administrators from public schools in Massachusetts, this study draws attention to the role of trust in implementation of a policy for English learners. Previous research indicates that trust is a key component in the success of school improvement efforts. Our results examine the trust issues that arise and affect the implementation process. Our findings could have the possibility of advising groups that are implementing policies.

## **MODELING THE TEMPORAL DYNAMICS OF HUMAN CATEGORIZATION BEHAVIOR**

Qihong Lu, Timothy Rogers (Mentor), Psychology

Behavioral experiments have shown that people are faster and more accurate at categorizing things at the basic level (e.g., bird), although they have access to superordinate level concepts (e.g., animal) first. To capture the temporal dynamics of human categorization behavior, a computational theoretical model was implemented with the assumptions of the Parallel Distributed Processing (PDP) theory. The modeling results show that the pattern of interest emerges naturally under the PDP framework. When the model ‘views’ an object, basic level concepts are activated most strongly, since items from the same basic category are represented as highly similar and thus benefit from similarity-based generalization. The superordinate level, however, was slightly more activated at the earliest phase of visual processing, as superordinate level categorization requires less information.

## **RELATIONSHIP BETWEEN LAKE SIZE AND FISH SPECIES COMPOSITION IN WISCONSIN LAKES**

Collin Ludwig, Tyler Tunney (Mentor), Natural Sciences

A lake’s size may affect fish species composition. Bigger lakes may offer more habitat types that may allow more species to coexist by reducing negative interactions among them. Using data from 84 lakes in Vilas County, Wisconsin, I investigated the probability of finding walleye, yellow perch, smallmouth bass, and largemouth bass in different sized lakes (min = 4.1 ha; max = 665.6 ha). Preliminary results suggest that the proportion of lakes with walleye and smallmouth bass increases from small to larger sized lakes. The percentage of lakes that contained all four species also increased with lake size. However, as a group these species are generally overrepresented across lake sizes, and are not absent from small lakes any more than expected from their observed individual proportions.

## **SLEEP QUALITY MEASURES PREDICT PSYCHOLOGICAL FUNCTIONING FOLLOWING STEM CELL TRANSPLANTATION**

Alicia Luedtke, Erin Costanzo (Mentor), Psychiatry

We examined which aspects of sleep most affect psychological functioning following hematopoietic stem cell transplantation (HSCT). Participants (N=426) undergoing HSCT for hematologic cancers completed measures of sleep and psychological functioning (well-being, depression, anxiety) at 3 and 6 months post-transplant. Nighttime disturbance measured at 3 months post-transplant predicted poorer psychological functioning on all measures at 3 months ( $\beta = .234-.367$ ;  $p > .001$ ) and poorer well-being and greater anxiety at 6 months post-transplant ( $\beta = -.174, .195$ ;  $p = .004, .003$ ). A similar pattern was observed for sleep quality and sleep latency. However, fewer or no relationships were observed for sleep efficiency or duration. Results suggest that nighttime disturbances, sleep latency, and sleep quality appear to affect psychological functioning most, while sleep efficiency and duration may not significantly affect quality of life after HSCT.

## **THE HUMAN ETHER-A-GO-GO RELATED GENE IS EXPRESSED IN GLIOBLASTOMA**

Will Lyon, John Kuo (Mentor), Neurological Surgery

The hERG1 gene encodes the pore-forming subunit of the hERG voltage-gated potassium channel. Our lab has shown that, in glioblastoma, high expression of hERG1 is correlated with poor patient survival. Given this clinically interesting connection, we sought to characterize the expression of hERG in glioblastoma stem-like cells (GSCs). Using western blot and immunohistochemistry, expression of hERG1 isoforms was studied. Our findings indicate that a potential splice variant of hERG1 is overexpressed in glioblastoma multiforme. This points to the possible utility of hERG1 as a prognostic marker and therapeutic target.

## **TEACHOLOGY: WHERE TECHNOLOGY MEETS EFFECTIVE TEACHING.**

Daniel Ma, Grace Binder, Leah Bullock, Karissa Giller, Lars Lindqvist,  
Lindsay Stoetzel (Mentor), Curriculum and Instruction

In the world of education, technology continues to take on a growing role. The Teachology organization was created by preservice teachers for preservice teachers; assisting them to use technology as a resource in order to enhance student engagement and understanding. Our first workshop provided opportunities for preservice teachers to explore and design with technology in their classrooms to inform their future lesson design, approach to management, and integration of technology tools in the future. The upcoming second workshop will model how preservice teachers can serve as mentors; helping peers think critically and creatively when designing curriculum with technology. Our framework and workshops are supported through the RITI (Replicable Instructional Technology Infusion) grant to provide new resources for faculty, TA's, and School of Education students.

## **RECYCLED MATERIALS RESOURCE CENTER SYSTEM-WIDE LIFE CYCLE BENEFITS OF RECYCLED MATERIALS**

Bharat Madras Natarajan, Angela Pakes Ahlman (Mentor), Geological Engineering

Using recycled materials in highway construction has the potential to achieve significant benefits affecting the triple-bottom line (environment, prosperity and society). Such benefits include requiring fewer virgin materials, reducing environmental impacts, and reducing life cycle costs. Although state departments of transportation (DOTs) have been in the forefront of introducing recycled materials, they have not been able to clearly convey their benefits in a quantitative manner, due to the difficulty in tracking these quantities of recycled materials used in their projects. To better define their benefits, the Recycled Materials Resource Center is developing a means of tracking and reporting the recycled materials used in state DOT projects annually, and is providing a tool to quantitatively analyze their environmental and life cycle cost benefits in highway construction.

## **SYNTHESIS OF SEMIFLUORINATED AMPHIPHILES DESIGNED TO FORM MICELLES FOR USE IN DRUG DELIVERY**

Eric Madsen, Sandro Mecozzi (Mentor), Pharmaceutical Sciences

Although many promising anti-cancer agents have been developed, they are often difficult to deliver effectively. There has been much research in using micelles formed by amphiphilic polymers to deliver anti-cancer drugs because of their ability to solubilize hydrophobic drugs, allow for sustained release of drugs, and passively target cancerous tumors. Unfortunately, micelles are often unstable upon intravenous injection due to dissociation caused by hydrophobic blood proteins. Research by the Mecozzi lab has shown that incorporating fluorinated tails into the polymers can increase micelle stability. The tri-perfluoro-tert-butyl (Tri-PFtB) group stabilizes micelles and its unique branched structure allows for medical imaging. Polymers with the Tri-PFtB group were synthesized to form micelle self-assemblies in water, showing promise in developing new potential drug carrier designs that can impact anti-cancer therapy.

## **URINARY BIOMARKERS OF FOOD, MEDICINE AND DISEASE IN PRETERM NEWBORNS**

Brad Maerz, Emily Sheely, Kristy Stevlingson, Sarah Brenner (Mentor), Biochemistry

Necrotizing enterocolitis (NEC), urinary tract infections (UTIs), and sepsis are conditions that occur in low birth weight infants (>2500g) early in life. These conditions are difficult to differentiate and diagnose, but treatment protocols for each condition are significantly different. Therefore, early differentiation and targeted treatment that is specific for each condition can save lives. Primary obstetric risk factors for many conditions of the preterm neonate include maternal smoking, medications given to mother and baby, and neonatal nutrition. However, the effects of these factors on the neonate are currently difficult to quantify, because the extent of placental transfer of these metabolites is poorly characterized. Additionally, it is likely that placental transfer differs with respect to gestational age (GA), birth-weight (BW), and other confounding factors, but this has not been studied. We will characterize various metabolites in newborn urine from a large cohort of preterm neonates, born at a variety of GA and BW. We will correlate this information to outcomes including suspected sepsis, UTI, and NEC. Furthermore, we will explore whether maternal smoking or medication impacts neonatal ability to metabolize important sources of nutrition in the first days of life.

## **CORPORATIZED DEVELOPMENT IN PUBLIC EDUCATION IN BRAZIL**

Joao Pedro Magalhaes Souto Maior, Kathryn Moeller (Mentor), Educational Policy

Brazil has experienced rapid economic growth in the past years. In spite of this, economists claim that the deficit in public education in the country might be an obstacle for a further development. This condition has led Brazilian corporations to invest in education. This project analyzes how, and to what extent, these private initiatives are influencing public education by focusing on the motivations and the forms of education provided by corporations. While the research is in the preliminary stages, it is expected that the project will explain the intended and unintended effects of these corporate practices for diverse social actors, and, in doing so, it will illuminate the broader consequences of transforming relationships between corporations, the state, and civil society in the field of education in Brazil.

## **A MIXED-METHODS APPROACH TO IDENTIFYING AND DESCRIBING HEALTH PRIORITIES IN RURAL UGANDA**

Carly Malave, Sarah Paige (Mentor), Pathobiological Sciences

The Kibale EcoHealth Project explores complex disease ecologies for human and animal populations in and near Kibale National Park, Uganda. Our overall goal was to identify the illnesses and conditions that community members experienced most frequently, along with how people understand individual health etiologies. Data were collected through surveys containing both closed and open-ended questions. The top five health concerns for adults (n=391) were cough (45.0%), malaria (37.1%), fever (24.0%), headache (19.4%), and backache (12.0%). Statistical analyses identified individual-level characteristics (i.e. age and education) of people who accurately reported transmission routes of malaria, typhoid, flu, or ulcers. Our results will improve the targeting of limited resources by Uganda's public health sector.

## **THE EFFECT OF FOLIC ACID ON CENTRAL NERVOUS SYSTEM REGENERATION IN VITRO**

Evan Maltz, Bermans Iskandar (Mentor), Neurological Surgery

Central nervous system (CNS) injury is both pervasive and largely irreversible. The folic acid (FA) metabolic pathway, while known to stimulate DNA methylation, has shown significant promise in encouraging regeneration through epigenetic regulation of anti-regenerative genes in CNS cells. The goal of the dose response experiments is to identify a correlation between dosage and CNS regeneration. The in vivo aspect of the project aims to elucidate this correlation, while the in vitro work serves to isolate the effect in the neuronal cells. Preliminary data indicates a biphasic trend in efficacy of FA in inducing regeneration with a peak in effect at 80 micrograms per kilogram. By focusing on these effects on the cellular and molecular levels, general regenerative effects can be augmented.

## **PART OF YOUR WORLD: 19TH-CENTURY DEPICTIONS OF MERMAIDS AND IRISH XENOPHOBIA IN VICTORIAN BRITAIN**

Bronte Mansfield, Nancy Marshall (Mentor), Art History

My thesis is an exploration of the relationship between 19th-century depictions of mermaids in Britain and their relationship to emerging theories of evolution. This relationship has revealed a complicated picture of 19th-century understanding of evolution as inextricably entwined with contemporary ideas of empire, racism, and xenophobia. Specifically, my research discusses the late nineteenth and early 20th-century mermaid paintings of John William Waterhouse, late Pre-Raphaelite painter and Royal Academician, and their relationship to popular depictions of mermaids as monstrous (such as half-monkey, half-fish fake mermaid hybrid specimens and illustrations of mermaids in periodicals). Ultimately, I argue that Waterhouse's mermaids are racialized and othered, embodying the close threat of the Irish, long ostracized by Victorian Britain.

## **THE RELATION BETWEEN AGING AND HABITUATION OF THE RESPONSE TO EMOTIONAL STIMULI**

Phoebe Marquardt, Stacey Schaefer (Mentor), Psychology

Older adults report higher levels of positive affect than younger adults. To investigate a potential cause for this age effect, we are examining the relation between aging and habituation-like processes to emotional stimuli in 108 subjects aged between 26-65 years. Habituation is defined here as the diminishing of a response after repeated presentations of stimuli of similar valence. Corrugator supercilii muscle (frowning muscle) activity is recorded during the presentation of a random ordering of positive, negative, and neutral pictures. The ability of age to predict the participants' rate of change in activity across similarly valenced picture trials is tested. We predict older people habituate less to positive stimuli and more to negative stimuli, suggesting a potential mechanism underlying older people's greater happiness.

## **COMMUNITY COMPOST COLLECTION**

Anna Marsicek, Tyler Anderson, Jackson Froiland, Norah Ntambi,  
Elizabeth Sequin, James Ntambi (Mentor), Biochemistry

This project, made possible by the Wisconsin Idea Fellowship Undergraduate Grant, included the implementation of a compost collection program in Lweza, Uganda. This program provided the community with a sustainable way to improve sanitation. Students created and managed a community-led program to run the biogas system that was installed at Lweza Primary School. The program is benefitting Lweza economically by employing several community members as well as providing a sustainable, locally-led solution to sanitation problems. The project seeks to permanently improve the sanitation conditions of the Lweza community by providing residents with the knowledge and skills necessary to independently manage the biogas system and sanitation problems when they arise. Through educational presentations at both Lweza Primary School and Wisconsin schools, school-aged children had the opportunity to learn about sanitation in other parts of the world.

## **DHEA AND DHEA-S CONCENTRATIONS PREDICT SUBJECTIVE SLEEP QUALITY**

Kelly Martin, Danielle Rendina (Mentor), Psychology

The steroid DHEA (Dehydropaindrosterone) and its sulfated form, DHEAS, are the most abundant circulating hormones in the body. DHEA is thought to play a crucial role in the sleep cycle, but due to inconsistencies in prior research, the present study was done to further knowledge on DHEA/DHEAS and its associations with self-reported sleep quality. Using data from the Midlife in the U.S. study (MIDUS), sleep quality in relation to DHEA/DHEAS plasma concentrations was assessed using the Pittsburgh Sleep Quality Index (PSQI), a self-report questionnaire consisting of seven components and a global score. Our study indicated that lower levels of DHEA and DHEAS are related to poorer sleep quality in both males and females, supporting the role DHEA plays in the sleep-wake cycle.

## **VITAMIN D3, BUT NOT 25-(OH)D3 OR 1, 25-(OH)2D3, IS REQUIRED FOR THE DEVELOPMENT OF EAE**

Victoria Martino, Yanping Wang (Mentor), Biochemistry

Multiple Sclerosis (MS) is a debilitating autoimmune disease characterized by demyelination and axonal degeneration in the central nervous system (CNS). Studies have shown vitamin D and its receptor (VDR), but not 1,25-dihydroxyvitamin D3 (1,25-(OH)2D3), are required for the development of EAE. To further explore the immunological role of vitamin D compounds in EAE, 25-hydroxyvitamin D3(25-(OH)D3), 1,25-(OH)2D3, and vitamin D3 were introduced to vitamin D-deficient (VDD) mice and compared to vitamin D-sufficient (VDS) mice. Clinical score, body weight, serum calcium, and RT-PCR were analyzed. Vitamin D3 supplementation restored EAE, but neither 25-(OH)D3 or 1,25-(OH)2D3 did. Decreased mRNA expression of pro-inflammatory markers (IFN- $\gamma$  and IL-2) in the spleen suggests VDD suppressed EAE through Th1 inhibition. These results confirmed an immunological role for vitamin D3 in EAE.

## **UNDERSTANDING SOCIAL JUSTICE FOR FAMILIES WITH CHILDREN WITH DISABILITIES**

Andalusia Masad, Elizabeth Larson (Mentor), Kinesiology

This talk highlights the struggle for social justice that families with children with disabilities face regularly. The current availability and ease of access to appropriate and affordable services remains dismal for many families. This presentation qualitatively analyzes interviews with families that described a problematic circumstance when interacting with school or health professionals. Analysis reveals key features of these encounters and the need for improvement in the assistive services system. The interview excerpts are adapted from studies done by the project mentor, Dr. Elizabeth Larson. Larson's work investigates how effectively children's daily needs are met and its impact on caregiver wellbeing.

## **FLEXURE COMPENSATION FOR THE ROBERT STOBIE SPECTROGRAPH**

Dustin Mason, Marsha Wolf (Mentor), Astronomy

As a ground-based astronomical instrument such as a telescope tracks a celestial object across the sky, that motion changes the orientation of the instrument relative to gravity's direction. For a sufficiently large instrument such as the Near Infrared (NIR) addition to the Robert Stobie Spectrograph (RSS), due to be installed on the 11-meter diameter Southern African Large Telescope (SALT), this change in the gravity vector significantly alters the optical alignment of the instrument causing the image on the detector to move. This subsystem of the RSS-NIR project undertaken at Washburn Astronomical Laboratories will compensate for that flexure by precise control of a moveable, 3 axis mirror to 'reorient' the image, using a piezo-electrically controlled stage.

## **U1C WILD TYPE AND MUTANT L13F PROTEIN BINDING AFFINITIES TO 5' SPLICE SITE RNA**

Hannah Mast, Aaron Hoskins (Mentor), Biochemistry

U1C is an essential protein component of the U1 small nuclear ribonucleoprotein (snRNP). It is well known that U1 snRNP is the first unit of the spliceosome to interact with 5' splice site (5'SS) of pre-mRNA during spliceosome assembly. In addition to U1 snRNA-5'SS basepairing, U1C is thought to play a crucial role in 5'SS recognition by stabilizing the U1 snRNA-5'SS duplex. Mutants of U1C, such as the well-characterized L13F mutant, are thought to destabilize the complex, further suggesting that U1C is important in 5'SS recognition. However, the specific mechanism of 5'SS recognition is still uncertain. This research project intends to compare the binding affinities of wild type and L13F mutated U1C to fluorescently labeled RNA substrates containing a 5'SS using electrophoretic mobility shift assays. The results of this study should help to better understand the role of U1C in 5'SS recognition.

## **ARE YOU PREPARED FOR COASTAL HAZARDS? RISK COMMUNICATION IN THE GREAT LAKES**

Leanna Mata, Jane Harrison (Mentor), Sea Grand Institute

This study relies on risk communication theory to understand how weather information providers disseminate warning messages to the public. The research focuses on coastal hazards in the Great Lakes region. A literature analysis revealed available social science methods used in risk communication ranging from visual mental models to factor analysis. Mental modeling was used to visually represent National Weather Service warning communication and how it is perceived by broadcast meteorologists, the weather communicators most familiar to the public. Apart from the content of the communication message, social networks, access to communication platforms, socioeconomic status, transportation, and geography all influence vulnerability to coastal hazards. Future research should develop mental models for the public that incorporate these many factors to reduce vulnerability.

## **UNDERSTANDING THE CONSEQUENCES OF EMPLOYEE-CLIENT CO-MOBILITY IN KNOWLEDGE INTENSIVE SERVICE FIRMS**

Sanchay Mathur, Joseph Raffiee-Shirazi (Mentor), Management and Human Resources

Client retention is a key factor influencing firm performance. Yet employees often quit and have incentive to take clients with them. The purpose of this study is to examine this phenomena. To do so, we construct a novel longitudinal database using data from the Lobbying Disclosure Act of 1995, tracking the employment of all registered lobbyists and their client attachments between 1998 and 2014. We expect mobile employees are most likely to take clients with them when they exit collectively rather than individually, and when they exit to start their own firms. Importantly, we also expect to find that the majority of the negative effect associated with collective mobility and mobility to entrepreneurship on source firm performance will be mediated through client-retention rates.

## **GEOHERMAL HEATING AND COOLING PERFORMANCE MONITORING AT EPIC SYSTEMS**

Adam McDaniel, James Tinjum (Mentor), Geological Engineering

District-scale geothermal borefields face the unique challenge of overheating as a result of their size and heat exchanger density. An ongoing study is being performed at the cooling-dominant district-scale borefields at Epic Systems (Verona, WI) that have dealt with overheating in the past. Implementation of a Fiber-Optic Distributed Temperature Sensing (FO-DTS) network will allow for a 4D grid of subsurface temperature measurements throughout a borefield. In partnership with Epic, this data will be used to predict best-practice operational cycles as well as optimally design future borefields at Epic's ever-expanding campus. In addition to borefield-wide heat transfer, fiber-optics networks have been placed within two state-of-the-art ground heat exchangers to assess heat transfer optimization in the subsurface surrounding individual geothermal wells.

## **RELATING CHRISTIAN EXILES AND CARTOGRAPHICAL DEVELOPMENTS IN THE 16TH CENTURY**

Maeve McDermott, Lee Wandel (Mentor), History

The religious reformations of the 16th c. displaced Christians, leaving them wondering 'where do I belong?' In our research, we are exploring the relationship between Christian exiles and the new cartographical representations of the 16th century. We believe that the developments and accessibility of 2-dimensional maps provided Christian exiles for the first time with the means to determine their exact location on a 2-dimensional representation. By comprehending the mathematics behind the revolutionary world map created by Gerard Mercator during this time, and by scanning letters from Christian refugees for evidence of geographical and geometrical language, we hope to find a connection between the human experience of displacement and new technology for representing space.

## **IDENTIFICATION OF THE CYTOCHROME P450 GENE SUPERFAMILY IN THE COPEPOD EURYTEMORA AFFINIS**

Alexandra Mechler-Hickson, Carol Lee (Mentor), Zoology

Cytochrome p450s (CYPs) are a ubiquitous superfamily of genes found in most domains of life. These genes are functionally diverse, but are arguably best known for their contributions to detoxification systems. The recently sequenced comprehensive genome of *Eurytemora affinis*, a copepod and model organism for freshwater invasions, allowed for a study of this gene family. Annotation of this genome resulted in the discovery of 36 CYP genes. Similar to other closely related taxa (e.g., *Drosophila melanogaster*, *Daphnia pulex*), these genes belong to 4 clans: CYP2, 3, 4 and mitochondrial. The CYP4 clan proportionally decreased and the CYP2 clan proportionally expanded relative to similar taxa. This study provides insight into the response of *E. affinis* to environmental toxins, meaningful given its frequent use in toxicological studies.

## **INTRINSIC MIGRATORY ABILITY OF INTERNEURON PROGENITORS IN DOWN SYNDROME**

Margaret Medo, Anita Bhattacharyya (Mentor), Waisman Center

Down syndrome (Ts21) occurs one in every 691 births in the United States, making it the most common genetic condition causing cognitive disability. Previous studies show that the development of the cerebral cortex in individuals with Down syndrome is flawed and fewer interneurons accumulate in the cortex. We believe that reduced migration of Ts21 interneuron progenitors may lead to fewer interneurons in the cortex. Using interneuron progenitors differentiated from human induced pluripotent stem cells (hiPSC), we found that two distinct genes are critical in interneuron migration (DLX and COUPTFII) are mis-expressed in Ts21 progenitors. To analyze the migration of interneurons with and without Ts21, progenitors will be differentiated from Ts21 and control iPSCs and plated as neurospheres. Cells will be allowed to migrate out from the neurospheres. Cell count, as well as migration distance, will be analyzed. Our goal is to test the intrinsic migratory ability of the progenitors in order to see if it is altered in Ts21 individuals.

## **EVALUATION OF JAGUAR AND PUMA POPULATION SAMPLING TECHNIQUES AND MANAGEMENT ACROSS THE AMERICAS**

Haley McLampy, Tori Fuller, Brooke Klesmith, Haley Melampy, James Berkelman (Mentor), Forest and Wildlife Ecology

Jaguars (*Panthera Onca*), the largest cat in the Americas, are near threatened globally and endangered throughout their northern range. Sympatric with the jaguar, the puma (*Puma concolor*) is threatened globally. Both species have large home ranges and are experiencing decreasing populations, making it difficult to estimate population sizes. However, knowing relative population sizes for these species is integral for implementing effective management practices. Studies across the Americas, in countries such as Mexico, Brazil, Venezuela, and Guatemala have estimated population sizes for jaguars and pumas using various sampling methods, such as camera-traps, scent stations and scat analyses. This study seeks to compare the effectiveness of multiple population sampling techniques as well as the effectiveness of management practices implemented in different jaguar and puma subpopulations.

## **RELATIONSHIP SATISFACTION, QUALITY OF LIFE, AND SEXUALITY FOLLOWING A KIDNEY TRANSPLANT**

Anna Melville, Rebecca Muehrer (Mentor), Nursing

Relationships are important to a person's health and well-being. The impact of relationship quality on outcomes after kidney transplant (KTx) has not been carefully examined. The purpose of this study is to describe the association between relationship satisfaction, quality of life (QOL), and sexuality following a KTx. Three hundred seventy-four people returned questionnaires containing relationship, QOL, and sexuality measures. Correlations between relationship satisfaction and these measures were examined. The majority of subjects were male (58%), white (85%), and in relationships (82%). Relationship satisfaction was significantly positively correlated with QOL and sexual depression. Persons with higher levels of relationship satisfaction had higher levels of QOL and lower levels of sexual depression. Findings from this study will inform future interventions designed to improve relationships for KTx recipients.

## **OBTAINING INFORMATION THROUGH EDUCATIONAL VIDEO GAMES**

Vanessa Meschke, Craig Anderson (Mentor), Curriculum and Instruction

The purpose of this study is to investigate how middle school students obtain, evaluate, and communicate information while playing the iPad game *Virulent*, developed by the Games + Learning + Society (GLS). We hypothesize students will primarily use the almanac provided in the game to gain knowledge of a virus and will communicate this information by teaching one another how to beat tricky levels. Students will be assessed through pre- and post-tests, telemetry data from the iPads using a software called ADAGE, their interactions with other players (recorded both through audio and video), and through their final presentations to a large group. This study is beneficial because it could discover more ways for students to obtain and share information in the classroom.

## **THE 2013–2014 TREMPEALEAU ARCHAEOLOGY PROJECT (TAP) EXCAVATIONS**

Molly Mesner, Victoria Pagel, Danielle Benden (Mentor), Anthropology

A thousand years ago, one of America's great prehistoric cities was established at Cahokia, the largest pre-Columbian site north of Mexico, near present-day East St. Louis, Illinois. Nearly 20,000 people, called Mississippians by archaeologists, inhabited Cahokia. Mississippians were large-scale agriculturalists who farmed corn intensively and lived in a socially hierarchical society ruled by a chiefly elite. At the same time that Cahokia was becoming a city, a group of Mississippians traveled nearly 530 miles up the Mississippi River and settled at Trempealeau, Wisconsin. The 2013-2014 excavations uncovered two ditch features at the Schaffner and Knepper localities within the Uhl site (47-Tr-0159). Analysis of this data provides insight into how the Mississippian community was organized at Trempealeau.

## **A COMPARISON OF RECEPTIVE VOCABULARY ASSESSMENTS FOR TODDLERS WITH AUTISM SPECTRUM DISORDERS**

Kaitlin Meyer, Susan Ellis Weismer (Mentor), Communication Sciences and Disorders

Impaired social communication is a hallmark trait of autism spectrum disorders (ASD) and greatly influences child outcomes. To provide effective interventions, accurate assessments must be used to gauge what the child understands. In this study, I will compare two assessments of receptive vocabulary, the MacArthur-Bates Communicative Development Inventories (CDI) and a Looking-While-Listening (LWL) word comprehension task, in toddlers with ASD. Their results will be analyzed to assess the level of agreement between them. I hypothesize that the LWL results will correlate with the CDI scores, but the LWL task will be more sensitive to vocabulary knowledge than the CDI. This study will allow for a better understanding of receptive vocabulary knowledge in toddlers with ASD and provide valuable insight into these two different assessment methods.

## **STRUCTURE AND EVOLUTION OF SERPENTINIZED FAULT ZONES, PINDOS PERIDOTITE MASSIF, GREECE**

Melissa Meyer, Basil Tikoff (Mentor), Geology & Geophysics

This study investigates the kinematic evolution of serpentine-bearing fault zones within the ultramafic rocks of the exhumed Pindos peridotite massif (Greece). The serpentinite faults cut and displace mylonitic harzburgites of a ~500 m wide ductile shear zone. The fault zones vary in width from mm- to m-scales, contain a spectrum of rock types (cataclasites, foliated fault rocks, and highly foliated fault cores), and thereby exhibit brittle to brittle-ductile behavior. Mapping and mesoscale structural analyses reveal the existence of two mutually crosscutting sets of faults, oriented NE-SW and WNW-ESE. Kinematic analyses of C/S structures show dextral sense of shear for both sets, with an additional reverse component for the NE-SW set. Paleostress analysis of fault-slip data yields compression orientations ranging from NNW-SSE to WSW-ENE.

## **INVESTIGATION OF PLANT TRANSLATION INITIATION FACTOR MODULATION BY TRITICUM MOSAIC VIRUS**

Nicole Mihelich, Aurelie Rakotondrafara (Mentor), Plant Pathology

The Potyviridae family is the largest and most agronomically influential group of plant viruses. Better knowledge of the mechanism of viral infection can be a basis for the advancement of crop protection. Viruses have evolved unique strategies to take over the cellular protein synthesis machinery for efficient infection. Preliminary data suggests that the recently emerged Triticum Mosaic Virus has a unique ability to directly control the level of host translation initiation factors, which has not yet been observed in other plant viruses. This project investigates whether different host translation initiation factors are modulated upon TriMV infection, and whether this is a direct consequence of the viral infection. This potential causative relationship may shed light on virus-host evolution interactions, especially among plant-infecting viruses.

## **LIQUID MICROJET PRODUCTION**

Chris Miller, Jennifer Faust (Mentor), Chemistry

Molecular beam scattering and evaporation experiments provide a useful way to probe the dynamics of the interaction between gases and liquids at the liquid-gas interface. High vapor pressure liquids, which have historically proved to be particularly difficult to study in vacuum, can be investigated by introducing the liquid into the vacuum chamber via a liquid micro jet usually 5 to 50 micrometer s. Several methods for the fabrication of these liquid micro jets have been employed, but involve significant disadvantages that limits the practicality associated with each individual method. In this project several new methods of borosilicate liquid micro jet production are proposed and analyzed after successive trials in various beam scattering and evaporation experiments. disadvantages that limits the practicality associated with each individual method. In this project, several new methods of borosilicate liquid micro jet production are proposed and analyzed after successive trials in various beam scattering experiments.

## **SOX9B IS NECESSARY FOR EARLY ZEBRAFISH NEUROVASCULAR DEVELOPMENT**

Kevin Miller, Jessica Plavicki (Mentor), Pharmaceutical Sciences

The transcription factor *sox9b* is involved in many developmental regulatory processes in zebrafish. However, its spatial and temporal expression patterns and function(s) in zebrafish neural development remain poorly understood. In order to characterize *sox9b* expression in the developing nervous system, we utilized a *sox9b:EGFP* transgenic reporter line and fluorescent immunohistochemistry to show that *sox9b* is expressed in differentiated neurons and other neuronal cell types. To determine how loss of *sox9b* function impacts nervous system development, we injected a dominant-negative *Sox9b* (*dnSox9b*) construct into one-cell stage embryos to globally inhibit the transcription of *sox9b* target genes. Injections of *dnSox9* mRNA resulted in brain and vascular malformations thus indicating that *sox9b* is necessary for proper development of both the brain and its vasculature.

## **METHODS OF MEASURING TIME DILATION AND FREQUENCY DRIFT**

Michael Miranda, Duncan Carlsmith (Mentor), Physics

The overall goal of this research is to determine the effectiveness of different methods in measuring gravitational time dilation. The method being researched uses rubidium atomic oscillators to measure time. We hypothesized that the oscillators could only be accurate enough to measure time dilation under temperature extreme conditions. The oscillators' results will be measured side-by-side to calculate inherent accuracy and Allan Variance, which are predicted to be on the order of  $10^{-11}$ . Once these measurements are analyzed and compared to theoretical predictions, which predict a ratio difference on the order of  $10^{-14}$ , the oscillators' time measurements will be studied under abnormal temperatures to provide a conclusion to this part of the research.

## **SENECA'S EPISTLE 47: AN INSTRUCTIONAL ATTEMPT FOR IMPROVED TREATMENT OF SLAVES**

Gretchen Miron, Marc Kleijwegt (Mentor), History

The Roman philosopher Seneca wrote on a variety of topics concerning daily Roman life, including politics, family structure, and Stoic teachings. But one Epistle in his prose stands out due to its rarity. Seneca's Epistle 47 is one of the only documents in Ancient History that exclusively discusses slavery and advocates for more humane practices. His writing provides an atypical aristocratic viewpoint of slavery, but to what degree did his writing change the treatment of slaves within the Roman institution of slavery? Evaluating Epistle 47 as an instructional piece of literature unearths additional arguments that suggest Seneca's deeper motivations and hopes for change in Rome.

## **CARBON-TO-NITROGEN RATIOS IN PUERTO RICAN SOILS OF DIFFERENT LAND USES**

Sanober Mirza, Maria Marin-Spiotta (Mentor), Geography

Carbon and nitrogen are involved in a number of important processes in soils, which affect soil fertility and the chemical composition of the atmosphere, with direct effects on climate. Land management can affect these processes by changing elemental composition of soils. The carbon-to-nitrogen (C:N) ratio of soils is used as an indicator of microbial processes and the decomposition state of organic matter. In this study, I processed soils from natural forest vegetation and pastures from Puerto Rico. Elemental analysis was used to calculate and compare total carbon and nitrogen. I hypothesized that forest soils will have higher C:N ratios than pasture soils due to the C:N ratios of differing vegetation: the main input of organic matter into soils.

## **DETERMINING THERMOPHYSICAL PROPERTIES OF WISCONSIN-NATIVE ROCKS FOR GEOTHERMAL APPLICATION**

Levi Mitchell, James Tinjum (Mentor), Geological Engineering

Thermophysical properties of Wisconsin-native rocks vary and in turn affect the ability of rocks to store and transmit heat. Determining these properties, such as thermal conductivity and specific heat, are particularly useful for geothermal applications. Knowing specific values of thermophysical properties aid in modeling and designing appropriate sized ground source heat pumps to meet heating and cooling needs. This research aims to provide an accurate method of experimentally testing these thermophysical properties using unsaturated rock cores and determines specific parameters that can be used to gauge thermal properties of rocks (mineralogy, density, rock type, etc.)

## **THE ROLES OF GLIAL CELLS IN THE ADULT DROSOPHILA BRAINS POST INJURY**

Kent Mok, Grace Boekhoff-Falk (Mentor), Cell and Regenerative Biology

The fruitfly *Drosophila melanogaster*, like humans, has glial cells in its nervous system. These glia serve numerous functions, including clearing cellular debris, ensheathing neurons, and providing neurotrophic support. Different subtypes of glia perform distinct functions that are crucial to neurological processes. The focus of this project is to determine which glial subtypes are crucial to recovery from traumatic brain injuries. My laboratory has previously shown that the adult *Drosophila* brain responds to a penetrating injury with migration of glia and cell proliferation, resulting in the replacement of damaged neurons. However, it is not known which glial subtypes are required for this regeneration. I am using glial-subtype specific markers to identify the glia that participate in post-injury recovery.

## **HOUSE OF REPRESENTATION**

Alison Montenegro, Jonathan Maasho, Jennifer Brookhart (Mentor), Political Science

Press releases were gathered from those released by the members of the House of Representatives of the 113th Congress. From here a machine-learning topic model separated press releases into categories. At this point, a sample of press releases in each category were read in order to figure out the common topic. After verifying the topic for each category, the same process was done for each sub-category. When that was completed, each category and sub-category was labeled by representation type. This research is done in order to provide the public with an idea of what these members focus on, as seen by their press releases.

## **3D PRINTING THE PERFECT TRUMPET MOUTHPIECE**

Daniel Montez, Duncan Carlsmith (Mentor), Physics

The brass tubing of a trumpet, as well as any brass instrument, amplifies the sound generated in the mouthpiece. As an Undergraduate Research Scholar working in Garage Physics under Professor Duncan Carlsmith, I have fabricated a complete trumpet using additive manufacturing (3D-printing) and I am testing various 3D-printed mouthpiece shapes, sizes, and materials with the goal of improving on the traditional mouthpiece designs. My research aims to improve various performance aspects, including tone quality and range with these changes. The effects will be characterized by analyzing the acoustic power frequency spectrum, as well as human perceptions to the sounds produced by the instrument when in use.

## **THE IMPACT OF CORTICOSTEROIDS ON GENIOGLOSSUS MUSCLE**

Natalie Morel, Mihaela Teodorescu (Mentor), Medicine

Obstructive sleep apnea (OSA) is more common in asthmatics, but reasons are not well understood. Inhaled corticosteroids may be one factor, as corticosteroids are known to cause muscle atrophy and weakness. The aim of this study was to test the effects of corticosteroids on tongue muscle properties and fiber composition. Sixteen male albino rats were divided into groups of eight. One group received saline injections, while the other received injections of dexamethasone (a common corticosteroid in clinical practice). After receiving injections for two weeks, the rats' genioglossus muscle (tongue) were harvested. From here, computerized images were rendered facilitating the analysis of muscle fiber composition. This research could make a big impact on the asthma community, and improve many peoples' quality of life.

## **COMPARING INSECT BIOMASS VARIATION AROUND NORTHERN WISCONSIN LAKES**

Ingrid Moreno, Paul Schilke (Mentor), Forest and Wildlife Ecology

As a primary food source for many northern birds, like the Barn Swallow, flying insects contribute to the balance of the environment. This project looks specifically at the abundance and biomass of flying insects in forested areas around four northern Wisconsin Lakes. The insects were collected with sticky traps, then measured and categorized into their corresponding orders. The goal is to determine how variable the flying insect community is around different types of lakes. This study can be used in later studies to demonstrate broader implications on insect dispersal and any ecological impact on Wisconsin Lakes.

## **AMYOTROPHIC LATERAL SCLEROSIS IN THE DIAPHRAGM: EFFECTS AND POTENTIAL TREATMENTS**

Alexander Moroz, Masatoshi Suzuki (Mentor), Comparative Biosciences

Amyotrophic Lateral Sclerosis, a neurodegenerative disease, results in the denervation of motor neurons at the neuromuscular junctions (NMJ), eventually reaching the diaphragm and causing suffocation. Stem cell therapies using the growth factors GDNF and VEGF have been proven to slow the disease, but the progression of the disease and these treatments within the diaphragm are still not fully understood, which this project will help shed light on. The presence of these growth factors in overexpressing mesenchymal stem cells is tested using ELISA before their use. In order to understand the progression in the diaphragm, however, an untreated control group of rats' diaphragms is harvested, cryo sectioned, stained with immunohistochemistry, and analyzed with microscopy during different stages of the disease to study denervation at the NMJ.

## **THE EFFECTS OF OBESITY ON RECOVERY AFTER ENDOMETRIAL CANCER SURGERY**

Keayra Morris, Erin Costanzo (Mentor), Psychiatry

This study examined relationships between body mass index (BMI) and quality of life among women recovering from surgery for endometrial cancer. Surgery type, physical activity, and inflammation were evaluated as mediators of these relationships. Participants (N=85) completed measures of depression, insomnia, and fatigue at 1, 4, and 16 weeks post-surgery. Actigraphy assessed activity level, and inflammatory cytokines were quantified in peripheral blood. Higher BMI predicted greater depression and fatigue ( $z=2.16-2.54$ , all  $p=.02$ ), but not insomnia. Higher BMI was also associated with more invasive surgery, less activity, and elevated IL-6 ( $z=2.38-2.85$ , all  $p>.05$ ). Activity level mediated the relationship between BMI and fatigue. Surgery and IL-6 were not significant mediators. Findings suggest that obesity is a risk factor for a slower recovery after endometrial cancer treatment.

## **RHODOPSEUDOMONAS PALUSTRIS AS A PLATFORM FOR SELECTIVE REMOVAL OF AROMATICS FROM COMPLEX MEDIA**

Kaitlin Morse, Alexandra Fasking, Julian Oshlag (Mentor), Civil & Environmental Engineering

Technologies that deconstruct lignocellulosic biomass into a fermentable product may also produce a stream of aromatic monomers derived from the lignin. This diverse class of compounds is underutilized as a carbon source for biofuel production and can inhibit fermenting organisms. The bacterium *Rhodopseudomonas palustris* has the ability to degrade some aromatic compounds anaerobically. Our goal is to expand the appetite of *R. palustris* to include the full complement of monoaromatic compounds found in lignocellulosic biomass-derived products. We are exploiting the naturally occurring diversity among different strains of *R. palustris* in conjunction with adaptive evolution and genetic engineering to discover and characterize novel routes of aromatic metabolism. These efforts have the capacity to increase yields in many emerging biomass-to-biofuels pipelines.

## **DOES THE I427V-SNTA1 MUTANT LEAD TO AN INCREASE IN LATE SODIUM CURRENT ASSOCIATED WITH LQTS?**

Joseph Mueller, Jonathan Makielski (Mentor), Medicine

A dynamic complex of proteins regulate cardiac sodium current (INa) flowing through the ion channel SCN5A, and the complex includes the cytoskeletal protein Alpha-1-syntrophin (SNTA1), neuronal nitric oxide synthase (nNOS) and the plasma membrane Calcium-ATPase (PMCA4b). Mutations in SNTA1 can disrupt the SCN5A/SNTA1/nNOS/PMCA4b complex leading to increased arrhythmogenic late INa. A novel mutation in SNTA1 (I427V) was recently discovered in a patient with Long QT syndrome (LQTS) characterized by a prolonged QT interval on the ECG that can be caused by late INa. I hypothesize that I427V-SNTA1 disrupts association of PMCA4b and causes increased late INa. The I427V-SNTA1 was made and late INa will be measured in transfected HEK cells co-expressing SNTA1/SCN5A/nNOS/PMCA4b, and I predict a significant increase in late INa in these cells.

## **USING CAMERA CAPTURING TO ASSESS WHITE-TAILED DEER BROWSE INDICES IN NORTHERN WISCONSIN FORESTS**

Andy Muench, Eric Kruger (Mentor), Forest & Wildlife Ecology

White-tailed deer over browsing has led to significant alteration of the Great Lakes region's vegetation. To characterize these effects, land managers and researchers have used browse indices to estimate the amount of pressure exerted by deer on the vegetation of a forest ecosystem. In this study, video from movement-capture cameras placed in Northern Wisconsin forests were analyzed for deer presence and browsing duration. The corresponding sites to these cameras had their vegetation analyzed for community composition and evidence of deer browsing. We then used various deer browse indices developed by past researchers to give multiple estimates on the browsing pressure to each camera site. The indices were then tested individually for correlation with the video data to give insight on their accuracy.

## **STAR EMPLOYEE EFFECTS ON COWORKER PERFORMANCE**

Jared Muench, Paul Davis (Mentor), Management and Human Resources

This research examines how star employees influence their organizations through their effects on their coworkers' performance. In order to analyze these relationships, we assessed whether the presence of star athletes (in organizations including the NHL, NBA, and MLB) influenced the teams' other players. Our tests indicate that for each additional star, a teammate's win contribution increases on average by .59 points, depending upon the significance of the star being considered. A fixed-effects method, a specific regression type that removes the influence of individual differences in order to eliminate biased results, was applied. This research furthers our understanding of stars' influences on organizations and helps organizations evaluate the effect that hiring a high-performing employee has on its individual employees and on the organization as a whole.

## **BETA-CATENIN (CTNNB1) AUGMENTS ANGIOGENESIS IN DEVELOPING MOUSE PROSTATE**

William Mulligan, Chad Vezina (Mentor), Comparative Biosciences

Background: Mechanisms of prostatic vascular development are not fully known, but vascular development impacts normal growth, prostate cancer progression, benign prostatic hyperplasia, and associated lower urinary tract symptoms. This study's objective was to determine if beta-catenin (Ctnnb1), a protein selectively activated in tips of developing prostate ductal epithelium, influences prostatic vascular patterning. Methods: A genetic approach involving mice that conditionally express a gain-of-function (GOF) Ctnnb1 allele in fetal prostate epithelium was used to examine the impact of activated CTNNB1 signaling on prostatic vascular development. Vascular patterns were examined by immunostaining fetal male mouse urogenital sinus (UGS) epithelium. Angiogenic activity of primary Ctnnb1 GOF and control mouse UGS epithelial cells was determined using microchannel cell culture. In situ hybridization was used to identify potential Ctnnb1-induced angiogenic factors, and a genetic approach was used to test whether vascular endothelial growth factor a (Vegfa) mediates vascular recruitment by Ctnnb1 GOF UGS epithelium in vivo. Results: Ctnnb1 GOF UGS epithelial cells were highly vascularized in vivo, induced sprouting from three dimensional human umbilical vein endothelial cell vessels in vitro, and expressed high levels of Vegfa mRNA. Blood vessels were present when Vegfa was deleted in Ctnnb1 GOF UGS epithelium. Conclusions: CTNNB1-dependent signals appear to be an important factor that shapes vascular patterns in the developing mouse prostate.

## **BLACK WOMEN WRITING BILDUNGSROMAN STORIES: THE METAPHYSICAL AS LIBERATING TROPE**

Kiana Murphy, Amaud Johnson (Mentor), English

Although critics began to re-imagine intersectional childhood stories with the ethnic Bildungsroman, they continued to ignore and invalidate marginalized writers' roles as writers, creators, and storytellers. By critically analyzing a well-known text, "I Know Why The Caged Bird Sings" by Maya Angelou, and a work with little formal criticism, "Bone Black" by bell hooks, this project explores the how of Black women's storytelling. Although these two texts seem to be vastly different in their approaches to understanding the experiences of Black girls/women growing up, I argue that unconventionality is seen in both and is crucial for their stories of girlhood. By focusing on the metaphysical, occurrences when both novels allude to dreams, fantasies, magic, or the spiritual, this paper proposes an extension of the ethnic Bildungsroman that recognizes unconventional stories like Bone Black, which deserves the critical acclaim as a captivating Bildungsroman of a young Black girl.

## **TEACHING ENGLISH IN RURAL HONDURAS**

Hasan Nadeem, Lori Diprete Brown (Mentor), Civil Society and Communication Studies

In the Summer of 2014, I set out to promote nutrition and hygiene awareness in rural Honduras. A series of unforeseen occurrences left me alone in a village without means or support to carry out my original project to fruition. With limited time, I offered my services in the best way I could, which was to teach English at the local high school. While there I taught for eight hours a day, five days a week for a total of two months. Ages of students ranged from 10-25+ years old. Lessons were catered to the desires and interests of the students, however, it was the knowledge lessons I learned from my students that had the most profound impact on my life.

## **LIFETIME PHYSICAL ACTIVITY AND HIPPOCAMPAL VOLUMES IN HEALTHY MID-LIFE AND OLDER ADULTS**

Lynn Nakad, Elisa Torres (Mentor), Nursing

The purpose of this study was to compare the size of the hippocampus of mild to moderately active versus vigorously active individuals. This study consisted of 27 healthy adults age 50-81 (M=62.9, SD=6.9). Physical activity was measured with the Lifetime Total Physical Activity Questionnaire. Hippocampal volume was obtained from magnetic resonance imaging scans. The group that reported a lifetime of more vigorous physical activity had higher mean hippocampal volumes (M=2.75, SD=0.36) than the mild to moderately active group (M=1.98, SD=0.27), which was statistically significant after controlling for education ( $F_{1,24} = 42.1, p > 0.001$ ). We conclude that a lifetime of more vigorous physical activity may be an effective method for preventing or delaying age-related decreases in hippocampal size in healthy mid-life and older adults.

## **ABC'S OF WASTE**

Breana Nehls, Marie Faust, Miles Tryon-Petith, Sabrina Bradshaw (Mentor), Geological Engineering

The Office of Sustainability engages in a variety of strategies to foster sustainable waste management on campus. The ABC's of Waste (Academic Building Commitment to eliminating Waste) implements and assesses the effectiveness of waste reduction campaigns executed in partnership with academic buildings, Physical Plant, and WE CONSERVE. Aspects of the project include research to assess campus waste streams and initiatives to minimize and divert waste to more responsible places. The ABC's of Waste project engages the campus community through educational programming, infrastructural changes, and messaging campaigns to encourage sustainable behavior. Strategies such as trash audits on campus facilities and subsequent facility presentations and discussions help drive the project to evaluate, educate and expand sustainable waste management.

## **ANTI-BULLYING PUBLIC SERVICE ANNOUNCEMENT: MELVIN GORDON'S STORY**

Zachary Nelson, James Adeyanju, Melvin Gordon, Patricia Loew (Mentor), Life Sciences Communication

This project is for an assignment for the class Life Sciences Communication 314: Introduction to Video Production. For the assignment we had to create a two to three minute public service announcement. As we began planning the video, Melvin informed us he had been bullied as a kid. We latched onto that idea and decided to film a one-on-one interview between Melvin and James. We added simulated bullying clips of younger children to drive home the issue of bullying in present day society. We hope that with Melvin and James delivering the story, it can be a powerful message and give kids around the country a reason to speak up and stop bullying. <https://www.youtube.com/watch?v=XFuek5ZG7bI>

## **EXAMINING THE ROLE OF FXR1 ON HIPPOCAMPAL NEUROGENESIS**

Kelsey Nemec, Xinyu Zhao (Mentor), Neuroscience

Neurogenesis plays a significant role in learning and memory, and its deficiencies are associated with many neurological diseases. Fragile X syndrome, the most common single gene contributor to mental retardation and autism spectrum disorders, is caused by the absence of the Fragile X mental retardation protein (FMRP). Two homologs of FMRP have been identified, FXR1 and FXR2. While our lab has shown that both FMRP and FXR2 regulate adult neurogenesis, little is known about FXR1. As such, this project investigates the role of FXR1 on neurogenesis in vivo and tests the hypothesis that FXR1 deletion leads to a decrease in proliferation of adult neural stem cells (aNSCs), as well as a decrease in differentiation into both mature neurons and astrocytes. Using an inducible knockout mouse line with a tdTomato reporter (cKO/Nes-CreERT2/tdTom), we were able to delete FXR1 and track the fate of aNSCs over time. Preliminary data suggest that FXR1 deletion in aNSCs leads to reduced cell genesis in the adult hippocampus.

## **CHILDREN AT WORK: CHILDHOOD LABOR IN THE ANCIENT GREEK WORLD**

Megan Ness, Claire Taylor (Mentor), History

The experience of childhood in the ancient world is a topic that, until recent years, has been widely neglected by historians and archaeologists alike. Recently, scholarship has begun to fill the gap, but discussion is broad and focuses on children as the objects, rather than subjects of research. My research narrows this discussion and analyzes the place children held in the ancient Greek world through an examination of children's labor within and outside the household. I have identified three primary outcomes of childhood labor: socialization, economic production and situated learning. These outcomes influence the way that childhood labor was organized and how it interacted with society. My approach is interdisciplinary combining written primary sources with archaeological evidence, ethnographic analysis and anthropological research.

## **THE EFFECT OF AN INMATES INCARCERATION HISTORY ON THE FREQUENCY OF PARENT-CHILD VISITATIONS**

Anthony Nestler, Julie Poehlmann-Tynan (Mentor), Human Development & Family Studies

The study focuses on 79 children, 2 to 6 years in age, with jailed parents. This analysis will determine the association between a parent's incarceration history and frequency of the child's visits with the incarcerated parent. Jailed parent self-report data will be used to examine jailed parents' history of arrest and incarceration as well as how often the target child visits the parent at the jail. Also, interview data will be used to describe the incarcerated parent's satisfaction for the current frequency of visits. The combination of approaches will provide insight how multiple incarcerations relate to frequency of child visitation in the jail setting.

## **CHANGES IN PSYCHOLOGICAL DISTRESS FOLLOWING HEMATOPOIETIC STEM CELL TRANSPLANTATION**

Jeni Nestler, Erin Costanzo (Mentor), Psychiatry

We examined the trajectory of psychological functioning among cancer patients recovering from hematopoietic stem cell transplantation (HSCT). HSCT recipients (N=432) completed measures of depression, anxiety, cancer-related distress, and positive and negative affect pre-transplant and 1, 3, 6, 12, and 36 months post-HSCT. Both depression and anxiety increased significantly from pre-HSCT to 1 month ( $p > 0.001$ ) and then declined significantly between 1 to 3 months ( $p > 0.001$ ) and 3 to 6 months post-HSCT ( $p > 0.001$ ). A similar pattern was seen for measures of affect. In contrast, cancer-related distress increased between 6 and 12 months post-HSCT ( $p = 0.018$ ). All measures stabilized by 1 year post-transplant. Results show that psychological distress is the greatest during the first month after transplant, and then decreases gradually to stabilize at 1 year.

## **BEHAVIOR OF POLYMER-MODIFIED BENTONITE IN CONTACT WITH AGGRESSIVE LEACHATES**

Alex Newell, Hulya Salihoglu (Mentor), Civil and Environmental Engineering

Polymer-modified bentonites (PMBs) have been developed to improve chemical compatibility of geosynthetic clay liners (GCLs) when contacted with aggressive leachate environments. In this study, the resistance of PMBs to increased hydraulic conductivity when subjected to aggressive leachates and the effects of polymer modification were investigated. Falling head-constant tail water hydraulic conductivity test (ASTM D 5084 Method B) was utilized to evaluate hydraulic behavior of the two PMBs and sodium bentonite. Polymer-modified GCLs and sodium bentonite GCLs were permeated with synthetic leachates representative of different coal combustion products (CCPs) and site-specific leachates. In a separate study, hydration characteristics of both sodium bentonite and PMBs were investigated with index tests such as swell index test (ASTM D 5091), fluid loss test (ASTM D 5891) and fall cone test (BS-1377 1990). Results obtained from index tests were correlated with the long term hydraulic conductivity test results. Preliminary results show improved performance of both PMBs with respect to hydraulic conductivity with higher polymer content exhibiting a lower hydraulic conductivity. Initial results from index tests also indicate a strong correlation with hydraulic conductivity for sodium bentonite, while the PMBs display a decoupled relationship.

## **INVARIANTS AND MOVING FRAMES FOR POLYGONS IN GALILEAN AND LORENTZIAN GEOMETRIES**

Phu Nguyen, Adrien Bossogo-Egoume, Thomas Hameister, Gloria Mari-Beffa (Mentor), Mathematics

A moving frame is a frame of reference in which the observer moves along curves, surfaces, etc. A discrete moving frame is a similar concept, with a frame associated to each vertex of a polygon, usually described by a variable element of a geometric group. These discrete frames provide an algorithm for computing the invariant generators (or curvatures) for these polygons. In this project, we determine explicitly the group-based discrete moving frames for polygons in Galilean and Lorentzian geometries for one, two, and three spatial dimensions. We choose both the discrete group-based moving frames and the generating invariants along polygons so that those in Lorentzian geometry approach those in Galilean geometry as the speed of light approaches infinity. We also describe the general dimensional case.

## **STATISTICAL ANALYSIS OF CRISPR-CAS9 GENETIC ENGINEERING REACTION PARAMETERS IN DROSOPHILA**

Jennifer Nguyen, Jill Wildonger (Mentor), Biochemistry

The purpose of this study is to determine the reaction parameters that optimize survival and transformation efficiency of the CRISPR-CAS9 nuclease system in *Drosophila*. Data on various injection experiments were collected from the *Drosophila* embryo injection company BestGene Inc. A total of 44 injection experiments were included in this study. Regression analysis was employed using R statistical software. Controlling for target gene lethality and injected plasmid concentration, there was weak evidence that the promoter type, the number of guide RNAs, and the number of guide plasmids had a significant role in the survival rate and transformation efficiency. Future studies should take care to reduce external sources of error by obtaining sufficient sample sizes, considering potential gene lethality, and reducing off-target effects.

## **TRANS-NATIONAL FAMILIES AND IDENTITIES**

Thang Nguyen, Catherine Lilly (Mentor), Curriculum & Instruction

The objective of the research is to find out how children make sense of their cultural identity. Qualitative research, or case study, is one of the methods that we used. We also use ethnographic method, which is interviewing the parents, teachers, and child. Furthermore, we conduct observations across multiple settings such as school, home, public facilities, etc. Some findings that we found is that the families use technology to further expose their culture to their children. In our case, our subject does not reflect his culture at school; the teacher thinks that he is not from a trans-national family. He does not have an idea of a nation. He sees boundaries differently than we do.

## **LONG-TERM EFFECTS OF EARLY LIFE EXPERIENCE ON IMMUNE FUNCTION IN NON-HUMAN PRIMATES**

Mengyao Niu, Allyson Bennett (Mentor), Psychology

A large body of evidence suggests that early life stress (ELS) can result in altered immune function. Previous studies demonstrated differences in immune function in monkeys reared by their mothers (MR) and in a nursery (NR); however, the results are limited. More recent studies suggested that chronically stressed individuals were pro-inflammatory compared to the control group, which partially resulted from glucocorticoid resistance. In this current study, we examined cellular responses to antigen stimulation and the regulatory effects of hydrocortisone in a well-validated rhesus macaque model of ELS. We hypothesized that pro-inflammatory markers are more prevalent in NR monkeys and immune cells from NR monkeys are less responsive to hydrocortisone suppression. Our hypotheses were tested with cell culture, in vitro hydrocortisone administration, and flow cytometry.

## **THE PATTERNS OF SOIL-TRANSMITTED HELMINTH INFECTION IN RURAL UGANDA**

Mengyao Niu, Ryan Fuglestad, Cesar Gutierrez, Carly Malave, Quinn Mallery, Julia Purnell, Nicholas Segel, Sagan Friant (Mentor), Pathobiological Sciences

Soil-transmitted helminth (STH) infections are one of the most common infections worldwide, especially in tropical and subtropical regions. Several studies have suggested that footwear use was associated with lower odds of STH infections. Our group promoted the use of flip-flop sandals in rural Uganda, collected fecal samples from local participants, and examined the samples for presence of soil-borne helminths with microscopy. The current study aims to characterize the STH infection patterns in people from the three local villages that received different interventions (control, plain flip-flop, flip-flop with a hologram) within six months after de-worming. The incidence of different types of STH infections are calculated and demographic data, including sex, age, and household information, is also used to identify susceptibility to STH infections in selected communities.

## **DESIGN THINKING FOR DEVELOPMENT: DANCE-POWER AND OTHER RENEWABLE MICROGRID TECHNOLOGIES**

Eric Obscherning, Tricia Raab, Lesley Sager (Mentor), Design Studies

Inspired by Dance Dance Revolution, an eco-friendly nightclub in Amsterdam, and people's love for dancing in Gatunga, Kenya, we aimed to design and create a flexible, portable, and durable mat that would generate electricity with applied pressure and the piezoelectric effect. While technologically feasible, the cost, upkeep, and life-cycle of the design were of concern. Moving forward, we intend to explore other microgrid technologies using renewable energy sources like solar, wind, and water.

## **WHITE INDIVIDUALS' CONCERN FOR THEIR BLACK PARTNER IN AN INTERRACIAL INTERACTION**

Cecilia Olin, Patricia Devine (Mentor), Psychology

Research on White people's concerns about appearing prejudiced has generally assumed that these concerns arise out of a fear of social sanction if one were to appear biased. This approach fails to account for distinct kinds of concerns in race-related situations. The current study explores whether some people are also concerned about their minority partner's experience during a race-related discussion. Participants anticipating an interracial interaction were offered a computer program that would purportedly make their interaction partner more comfortable during the subsequent discussion. Time spent on the program provides a behavioral measure of the participants' concern about their minority partner's comfort. We anticipate that concern about the partner will vary based on participants' combinations of internal and external motivation to respond without prejudice.

## **SOCIAL MEDIA AND #SUSTAINABILITY**

Sarah Olson, Jill Sakai (Mentor), Office of Sustainability

The main objective of the project is to evaluate social media use to increase student engagement in sustainability at UW–Madison. I used social media metrics tools provided by Twitter as well as observed metrics to evaluate the effectiveness of the Office of Sustainability's Twitter activity. Results achieved so far include increased social media following (measured by followers on Twitter) and increased engagement by audience members in social media content. Intended results include further improvement in social media engagement, especially an increase in the number of interactions and the quality of interactions. This project is significant because it provides a case study for effective use of social media to engage college students in sustainability.

## **THE EMPIRICAL RELATIONSHIP BETWEEN FINANCIAL LEVERAGE, TRADING VOLUME, MONETARY POLICY, AND MARKET VOLATILITY**

Ramon Ortiz, Bjorn Eraker (Mentor), Finance

This paper analyzes the relationship between financial leverage, trading volume, monetary policy, and the market volatility of the United States. Using data from the Federal Reserve of Economic Data for the United States it is concluded that: (i) there is a strong statistically correlation between financial leverage and volatility which suggests a relationship between the two, (ii) there is also a statistical significant correlation between monetary policy and market volatility, (iii) trading volume in general has no apparent effect on volatility, however, large fluctuations in overall trading volume dramatically effects volatility. These finding are justified through use of statistical modeling, and are further explained through a contemporary literature review.

## **PARENTAL CARE IN THE EARLY ENVIRONMENT: RELATION TO DEPRESSION**

Elizabeth Osterbauer, Heather Abercrombie (Mentor), Psychology

Rodent pups that receive lower levels of parental care display alterations in learning and neuroplasticity into adulthood. Translating this animal research to humans, we are investigating how prior experience of lower levels of parental care is related to emotional memory alteration in adults with depression. As a first step, we examined whether women with depression (n=19) and never-depressed women (n=15) differed in retrospective reports of parental care assessed with the Parental Bonding Instrument. Replicating previous research, we found that women with depression (compared to never-depressed women) reported having experienced lower levels of maternal care,  $t(32)=2.42, p>.03$ , and paternal care,  $t(24)=3.51, p>.005$ . Future analyses will investigate how prior experience of lower levels of parental care is related to emotional memory alterations and depression severity in adulthood.

## **THE ACCURACY OF GLOBAL CIRCULATION MODEL (GCM) SNOW COVER PROJECTIONS IN A RAPIDLY CHANGING CLIMATE**

Craig Oswald, Tristan L'ecuyer (Mentor), Atmospheric and Oceanic Sciences

The effects of greenhouse gas-induced climate change continue to cause a warming trend globally which can be well simulated with current GCM projections. In order to be certain that GCMs remain as accurate as possible, both regionally as well as globally, it must be determined exactly how well the current projections match with the observed climate data of today. Regionally, the warming effect is most intense at high latitudes, this is known as arctic amplification. Therefore, one proxy to help further scrutinize the accuracy of GCMs is to examine how well they are currently accounting for more extreme climate change at high latitudes. By comparing observed land snow and ice cover data provided by the National Snow and Ice Data centers (NSIDC) Near-real-time Ice and Snow Extent (NISE) product gathered by the Defense Meteorological Satellite Program's (DMSP) F17 satellite for a five-year period from August 2009 through August 2014, with an ensemble of 30 different GCM projections produced by the Community Earth System Model (CESM) Large Ensemble Project portraying land snow and ice cover for the same period, the accuracy with which current GCM projections capture snow and ice cover is assessed. These analyses provide a useful indicator of how well current GCMs portray climate change at high latitudes and represent the effects of arctic amplification.

## **MRSA COLONIZATION AS A POTENTIAL TO REDUCE UNNECESSARY VACOMYCIN USAGE IN THE EMERGENCY DEPARTMENT**

Veronica Palma, Kurt Reed (Mentor), Pathology and Laboratory Medicine

Antibiotic resistance is a very prevalent problem these days. The research goal is to determine the value of Methicillin-resistant Staphylococcus aureus (MRSA) colonization detection in guiding antibiotic choices in the Emergency Department to prevent the unnecessary use of antibiotics. The presence of MRSA was determined at several anatomic sites in those that the antibiotic vancomycin was given to and clinical cultures were obtained for suspected MRSA infection. After finding the strains that are resistant to methicillin, molecular techniques were used to determine if the MRSA strains found at colonization and clinical cultures were the same. The virulence of MRSA strains found at colonization sites versus clinical cultures were compared in order to discover more about the process that leads from colonization to infection.

## **THE EFFECTS OF A CRIMINAL RECORD ON ONE'S WORKLOAD IN DANE COUNTY**

Da'Quan Palmer, Tiffany Trzebiatowski (Mentor), Management & Human Resources

The goal of my research is to understand whether there is a relationship between citizenship behavior in the community and pay. More specifically, does an individual's criminal record affect the amount of overtime hours they put in for work? I hypothesize that someone's criminal record does affect the amount of overtime hours they put in and those hours will increase with the amount of crimes they commit. Also, those with criminal records are in lower positions of power in the government, therefore they will make less money, which influences their decision to work more overtime hours. The research has been narrowed down to only look at the criminal records and overtime hours by employees of the Department of Administration (DOA) in Dane county. This search was narrowed down to one department in the government in Dane county so that I had enough data to analyze and my conclusions could be as clear and concise as possible.

## **UNDERSTANDING THE MECHANISMS DRIVING GENE EXPRESSION BY ZELDA IN THE FRUIT FLY**

Juliana Panelli, Melissa Harrison (Mentor), Biomolecular Chemistry

In all multicellular organisms, early zygotic development is controlled by maternally deposited products. Only later in embryogenesis does the zygotic genome take control of its own development. In the fruit fly, *Drosophila melanogaster*, the transcription factor Zelda is essential for assuming zygotic genome control. We are interested in how Zelda regulates this process and are using cutting edge technology to engineer the fruit fly genome for these studies. Our research should provide key insights on how this biological process is regulated in all organisms.

## **SECURITY OF EAST ASIA WITH FOCUS ON THE REPUBLIC OF KOREA**

Andrew Park, Edward Friedman (Mentor), Political Science

Although many great scholars and think tanks have been publishing literature and reports on the future of Korean peninsula and the security of East Asia in relation to that, it seems like these analyses are severely politicized with the division of the right and the left. Through this research opportunity, I will scrutinize the works of two great scholars from each ideological camp, Dr. Victor Cha from conservative camp and Dr. Jung-in Moon from progressive camp in order to produce an objective analysis on the security elements of the East Asia. The research will be divided into three parts: 1) How Republic of Korea (ROK) views North Korea and China, 2) How Republic of Korea views the U.S. and Japan, and 3) What is the implication of 1) and 2) and how Republic of Korea should behave. Part 1 and 2 will be divided into two sub-parts and each will be 3-page paper analysis on Dr. Moon and Dr. Cha.

## **WOMEN'S EMPOWERMENT IN AGRICULTURE AND FOOD SECURITY**

Patricia Paskov, Jennifer Alix-Garcia (Mentor), Agricultural and Applied Economics

Across the globe, gender inequalities persist in the agricultural realm, resulting in less food being grown, lower incomes, higher poverty, and higher levels of food insecurity. This project investigates the association between household food security and women's empowerment in agriculture (WEIA) in Oaxaca, Mexico, one of the country's most food insecure states. Using household level data collected by the author, the study measures WEIA as an aggregate of four indicators: resources, production, income, and leadership. The data reveals a statistically significant difference in WEIA between food secure and food insecure households. Further, the data shows a strong association between WEIA and food security in female-headed households, a section of society proven to be one of the most vulnerable to hunger.

## **TRAUMA AS A VECTOR FOR PEACEBUILDING IN POST-ATROCITY SOCIETIES**

Allison Perlin, Scott Straus (Mentor), Political Science

In 1948, the Universal Declaration of Human Rights was signed to protect human rights internationally. However, in current day, mass atrocities occur with uncomfortable frequency. In particular, post-conflict areas are most likely to slip into mass violence due to the habituation of violence (Harff). In fact, post-conflict areas have a surprisingly positive correlation with the incidence of mental illness, and there is an observable link between the conflict areas and decreases in mental health (Do). Yet despite the plethora of research, there is a paucity of knowledge of best practice mental healthcare in post-conflict societies. The question then becomes, what is the best practice mental healthcare in post-conflict societies and can it prevent future mass atrocities? In my research I aspire to further explore mental healthcare in post-conflict societies and, in particular, best practice mental healthcare in order to prevent future mass atrocities.

## **QUANTIFYING HABITAT AND PHYSIOLOGICAL STRESS OF NESTING ACADIAN FLYCATCHERS (*EMPIDONAX VIRESCENS*)**

Maia Persche, Anna Pidgeon (Mentor), Forest & Wildlife Ecology

This is a time of rapid environmental change as habitat fragmentation shapes landscapes throughout the western hemisphere. Acadian Flycatchers are Neotropical migrants that nest within continuous interior forests. Much of this habitat is found within protected natural areas (e.g., state parks) that are also used for recreation, especially hiking. The impact of trails on nesting songbirds remains largely speculative, however recent studies suggest that Acadian Flycatchers have lower abundance near heavily used trails and that size and frequency of groups of people using these trails is associated with low nesting success. Nineteen Acadian Flycatcher nests were located in interior forest habitat at least 100 meters from the nearest habitat disturbance. I conducted vegetation surveys to determine habitat characteristics that were associated with nest success and fledgling foraging activity. Successful nests and nests with lower rates of brood parasitism by Brown-Headed Cowbirds (*Molothrus alther*) were associated with greater substrate DBH and height, and the use of Eastern Hemlock as a substrate species. Nest success was more likely in areas with high basal area and high frequency of White Pine and Eastern Hemlock in the overstory. Fledglings were observed foraging in a greater range of habitat than nest sites, and were less associated with Eastern Hemlock. Four nests were also monitored with noninvasive in-nest heart rate monitors to measure physiological stress in response to human disturbance near nests. Because of a limited sample size, I focus on qualitative recommendations for using this method to study stress responses in small passerine species. This method holds promise as an index of the degree to which human trail use causes elevated metabolism, and thus energy spent on stress response rather than caring for progeny.

## **THE USE OF NEGATIVE LANGUAGE IN DISSENT BY THE US SUPREME COURT**

Minh Pham, Ryan Owens (Mentor), Political Science

In recent years, American politics has become increasingly polarized. It appears, at the same time, that political figures have increasingly used negative language toward one another. Has this pattern also occurred in the judicial branch? The goal of our research is to determine whether Supreme Court justices have increasingly used negative language toward one another in their dissents. We examine the language justices direct toward each other in Court opinions. We use these data to determine the relevant trends, and also to build a model of the relationships among the Justices.

## **IMPLICATIONS OF ATTRIBUTIONS FOR FATHERS OF CHILDREN WITH AUTISM SPECTRUM DISORDER**

Katie Phillips, Matt Walczak, Sigan Hartley (Mentor), Human Development and Family Studies

There is now a substantial body of research focused on the experiences of mothers of children with autism spectrum disorder (ASD). In contrast, little is known about the factors that contribute to the heightened levels of stress in fathers of children with ASD. Parental attributions for child behaviors (e.g., beliefs about the cause of these behaviors) have been shown to be an important determinant of psychological well being in parents in the general population. In this study, we examined the relation between fathers' parental attributions for their son or daughter with ASD's behaviors and their depressive symptoms. One-hundred and ninety fathers of children with ASD (aged 5-12 years) individually completed self-reported measures on their attributions for their child's behavior and reported on their depressive symptoms.

## **PRENATAL ALCOHOL EXPOSURE AND IRON DEFICIENCY INTERACT TO NEGATIVELY ALTER PLACENTAL FUNCTION**

Camille Plesha, Susan Smith (Mentor), Nutritional Sciences

Prenatal alcohol exposure (PAE) puts infants at risk for Fetal Alcohol Spectrum Disorders (FASD), and gestational iron deficiency (ID) exacerbates PAE's damage, increasing the risk for more severe FASD outcomes. PAE is also pro-inflammatory, and inflammation during pregnancy is known to increase the risk of placenta-associated syndromes, such as Intrauterine Growth Restriction (IUGR). Using a 2nd trimester rat PAE model, we investigated PAE's impact alone and in combination with gestational ID upon the intensity of the placental inflammatory response and iron transport to the fetus. Our results suggest that PAE, alone and in combination with ID, dysregulates optimal placental development and function. PAE likely reduces micronutrient transport capacity (iron specifically here) therefore increasing the risk of developing IUGR in the fetus.

## **OPERATION MAMMY**

Daria Powell, Nancy Buenger (Mentor), Library & Information Studies

The purpose of my research was to investigate images and personal narratives of 19th- and 20th-century African American mammies and domestic servants. I began by cataloging a collection of over 100 mammy images based on critical criteria. The second part of my project was to investigate first person narratives of black domestic servants for information on sexual exploitation they faced in their day-to-day lives. Finally, I helped facilitate and document a workshop on racial and sexual stereotypes for young Dane County women of color as part of a UW/Madison Public Library Bubbler outreach initiative for court-involved teens. Through this project, I hope to uncover a part of history that is incredibly overlooked and make it relevant to the present.

## **ACCEPTABILITY OF LONG-ACTING REVERSIBLE CONTRACEPTION (LARC) AMONG YOUNG WOMEN IN DANE COUNTY**

Helen Powling, Grace Skarda, Jennifer Higgins (Mentor), Gender and Women's Studies

Increased use of long-acting reversible contraception (LARC) could significantly reduce unintended pregnancies in both the United States and Wisconsin. However, few young adult women currently use LARC methods. This qualitative study is the first to assess contraceptive clients' acceptance of LARC, specifically regarding relationship status, sexuality, and predisposed fertility concerns. The data derived from 6 focus groups and 12 interviews with contraceptive-using women aged 20-29 in Dane County, Wisconsin. Respondents' interest in LARC methods was increased if they were striving to avoid pregnancy and in a temporary or newly formed relationship. Interest in LARC methods decreased among respondents who wanted an 'accidental' pregnancy to 'just happen' in a long-term relationship. These findings could improve clinical counseling, educational messages, and promotion of LARC methods.

## **ANALYZING GENE EXPRESSION CHANGES IN DOWN SYNDROME-INDUCED PLURIPOTENT STEM CELLS**

Aisha Prasad, Anita Bhattacharyya (Mentor), Waisman Center

Down Syndrome (DS) results from having an extra copy of chromosome 21. To study early brain development, DS and normal interneuron progenitors can be differentiated in vitro from human induced pluripotent stem cells (iPSCs) that have been generated from individuals with Down syndrome and unaffected controls. We are interested in the development of a specific neuron subtype, interneurons. Using iPSCs, we differentiated interneuron progenitors and analyzed their gene expression using microarray analysis. There is a difference in gene expression of DS interneuron progenitors relative to normal interneurons. The purpose of this study is to determine gene expression, confirm microarray results with the quantitative polymerase chain reaction (qPCR) analysis, and compare gene expression of DS with unaffected controls. Microarray results showed a significant decrease in the expression of specific genes that are important in interneuron development in DS cells relative to controls.

## **VISUALIZING EPIGENETIC AND MORPHOLOGICAL CHANGE VIA MULTI-TRANSGENIC HUMAN PLURIPOTENT STEM CELLS**

Ryan Prestil, Krishanu Saha (Mentor), Biomedical Engineering

Pluripotent stem cells possess the unique ability to differentiate into any somatic cell type, and several methods now exist to reprogram adult cells to a state of pluripotency. During these cellular transition processes, dramatic changes occur to the shape, size, and organization of both the nucleus and the cell body. Using modern transgene integration techniques in human pluripotent stem cell models, we have created cell lines with simultaneous mCherry-tagged histone H2B, GFP-labeled actin filaments, and doxycycline-induced reprogramming. These cells allow real-time observation of genetic material repackaging and cytoskeletal remodeling during cellular transitions and permit high-throughput screening of substrates and soluble factors to optimize these processes. Further studies will utilize these cells to better elucidate the timeline and subcellular mechanics underpinning differentiation and reprogramming.

## **PHYSICAL ACTIVITY, QUALITY OF LIFE, AND ANEMIA AMONG STEM CELL TRANSPLANT RECIPIENTS**

Ilana Primack, Erin Costanzo (Mentor), Psychiatry

We examined effects of physical activity on quality of life concerns prevalent among cancer patients recovering from hematopoietic stem cell transplantation (HSCT) including depression, fatigue and sleep disturbance. Links between physical activity and anemia were also examined. Adults undergoing HSCT (N=432) completed measures of quality of life and anemia (red blood cell count, hematocrit, hemoglobin) at 1, 3, 6, and 12 months post-transplant. Greater physical activity was associated with less fatigue ( $\beta=0.470$ ,  $p=0.002$ ) and depression ( $\beta=0.187$ ,  $p=0.001$ ) at 1 month. This pattern was also seen at 3, 6, and 12 month assessments. Greater physical activity was also associated with less evidence of anemia 3 months post-transplant ( $\beta=0.149-0.189$ ,  $p>0.05$ ), but not other time points. Findings illustrate the positive impact of physical activity on HSCT recovery.

## **SEX HORMONES AFFECT INSULIN SIGNALING IN MOUSE (MUS MUSCULUS) LIVER CELLS**

Cassidy Pumper, Dudley Lamming (Mentor), Endocrinology, Diabetes, and Metabolism

Rapamycin, a mechanistic target of rapamycin (mTOR) inhibitor, is shown in many instances to extend the lifespan of laboratory mice, while somewhat paradoxically also causing glucose intolerance. The drug does not historically affect males and females equally; female mice dosed with Rapamycin have benefitted significantly more than males, providing the basis for new research more closely focused on the difference in signaling of mTOR among genders. In this study conducted by Sebastian Arriola and myself in the Lamming Lab, cell cultures grown from AML-12 and primary hepatocytes of mice were treated with either Estradiol or testosterone. When stimulated with insulin and tested for mTOR signaling, there are inconclusive results suggesting that cells with higher Estradiol concentrations show more mTOR activity, and would therefore more likely reap the benefits of rapamycin treatments. Further tests work to solidify the relationship between sex hormones and mTOR activity by studying the effects in vivo.

## **PREDICTIVE MODELING FOR CHEMICAL SYNTHESIS IN CYANOBACTERIA**

Patrick Radish, Brian Pflieger (Mentor), Chemical and Biological Engineering

Constraint based modeling can be used to predict cellular behavior. The purpose of this research is to predict cellular metabolite flux and determine how genetic mutations can increase the production of high-value chemicals in the cyanobacterium *Synechococcus* sp. strain PCC 7002. Through the addition of specific reactions to an existing model via the COBRA Toolbox plugin for MATLAB, an organism producing a non-native metabolite can be simulated. The results of this analysis can be used to engineer a living mutant strain that can produce a valuable chemical. These methods will be used to examine cyanobacterial production of several industrially relevant molecules like propanal, octanoic acid, and glutaric acid. These findings may be useful in finding a renewable and efficient process for chemical synthesis.

## **CALIBRATION OF FUNCTIONAL MRI TO IMPROVE THE LONGITUDINAL ASSESSMENT OF MOTOR RECOVERY AFTER STROKE**

Ryan Raut, Vivek Prabhakaran (Mentor), Radiology

As stroke remains a leading cause of long-term disability, improved understanding of the post-stroke brain is critical to optimize treatment and the assessment of recovery. Functional MRI (fMRI) is a promising tool, albeit limited by cerebrovascular alterations after stroke. We are implementing a novel approach for calibrating motor fMRI responses with respect to cerebrovascular reactivity to allow for more reliable quantification of changes to the motor network over time following stroke. Motor recovery is being assessed in 12 patients at the acute (<7 days after stroke), subacute (between 1 and 6 months), and chronic (>6 months) stages. We hope to not only uncover physiological correlates of motor recovery after stroke, but to develop a new paradigm for clinical evaluation of recovery from stroke-induced deficits.

## **PAD4 DOES NOT AFFECT THE TRANSCRIPTIONAL REGULATION OF INFLAMMATORY CYTOKINES IN MURINE NEUTROPHILS**

Ryan Rebernick, Miriam Shelef (Mentor), Medicine

Peptidylarginine Deiminase 4 (PAD4) is a citrullinating enzyme with implications in the pathogenesis of rheumatoid arthritis, a chronic inflammatory autoimmune disease. However, the mechanism by which PAD4 acts is unclear. PAD4 acts as a transcriptional regulator in some cell types but its role as transcriptional regulator in neutrophils is unknown. We hypothesized that PAD4 was altering the transcription of inflammatory cytokines including TNF $\alpha$ , IL-1 $\beta$ , CCL3, and BAFF in stimulated neutrophils. To test this hypothesis, PAD4<sup>+/+</sup> and PAD4<sup>-/-</sup> murine neutrophils were stimulated and recruited through an intraperitoneal thioglycolate injection. Gene expression was analyzed using RT-qPCR. No significant difference was found between PAD4<sup>-/-</sup> and PAD4<sup>+/+</sup> mice for TNF $\alpha$ , IL-1 $\beta$ , CCL3, or BAFF, indicating PAD4 does not play a significant role in regulating cytokine expression in activated neutrophils.

## **MESENCHYMAL STEM CELL-EDUCATED MACROPHAGES ROLE IN GVHD AND RADIATION INJURY PROTECTION**

Lauren Reil, Myriam Bouchlaka (Mentor), Pediatrics

Total body irradiation is typically used to condition patients for allogeneic hematopoietic stem cell transplant, leading to release of inflammatory cytokines from damaged tissues. After transplant, many patients develop graft-versus-host disease (GVHD) resulting from donor T cells attacking host tissues leading to further inflammation. Mesenchymal stem cells (MSCs) have immunosuppressive and tissue repair properties, but clinical trials using MSCs to treat GVHD have shown mixed results. Macrophages (MQs) are important regulators of immunity and can promote tissue remodeling. We have previously shown that MSCs can educate MQs toward a unique anti-inflammatory phenotype, however the implications for in vivo models of inflammation have not been studied. Hereby, we propose to test the efficacy of MEMs in vivo for the treatment of GVHD and radiation injury using humanized mouse models.

## **HOW YOGA IMPROVES THE ADVERSE EFFECTS OF CANCER TREATMENT IN ADULTS: A SYSTEMATIC REVIEW**

Emi Reiner, Mary Hitchcock, Bianca Nelson, Laura Priddy, Emi Reiner, Brooke Sarver, Anna Spillers, Hannah Stellpflug, Mara Stewart, Elana Taute, Elisa Torres, Abigail Traylor, Elisa Torres (Mentor), Nursing

The side effects of cancer treatment can be debilitating for adults. Furthermore, current interventions for cancer-related symptoms are often expensive, ineffective, and associated with their own side effects. Behavioral interventions, such as yoga, are inexpensive and may be able to reduce some adverse side effects of cancer treatment. A systematic review of randomized controlled trials in the previous five years using Pubmed, Psychinfo and CINAHL found seven studies that determined yoga alleviates physical symptoms of cancer treatment such as sleep disturbance and fatigue; and shows positive emotional effects such as improved quality of life and less anxiety and depression. No studies found adverse effects. Yoga is an effective and feasible intervention to offer patients undergoing cancer treatment.

## **LEARNING, REPRESENTATIONS, AND TECHNOLOGY**

Aditi Renganathan, Martina Rau (Mentor), Educational Psychology

Learning, Representations, and Technology: The study of graphical representations and their effect on student's learning processes As a part of our research, we investigate the effect of graphical representations on a student's ability to understand an academic topic, and the interactions students have between multiple representations. Using an online tutoring system, researchers in our lab test student's chemistry competency by analyzing data from an eye tracking device and the answers they enter as they complete tutoring problems. Our research will lead to conclusions about the importance of making connections between different types of visual representations. The long-term effect of our research will include outsourcing our findings to conduct research in high schools around Madison, WI, and its surrounding cities.

## **EFFORTS TO DEVELOP $\alpha/\beta$ -PEPTIDE MIMICS OF THE Z-DOMAIN TARGETING TUMOR NECROSIS FACTOR- $\alpha$ SIGNALING**

Nicholas Rettko, Samuel Gellman (Mentor), Chemistry

Deregulation of TNF- $\alpha$  is a prominent characteristic in several inflammatory diseases, such as rheumatoid arthritis. A three-helix bundle peptide derived from the Z-domain of staphylococcal protein A has been shown to block the interaction between tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and the TNF- $\alpha$  receptor. However, Z-domain peptides are easily susceptible to proteolysis and are relatively large, making them biologically ineffective and difficult to synthesize. Incorporating  $\beta$ -amino acids into the peptide backbone, creating  $\alpha/\beta$ -peptide mimics, increases proteolytic resistance. We describe designs  $\alpha/\beta$ -peptide mimics of Z-TNF $\alpha$  that are less than half the size of Z-TNF $\alpha$  and block the TNF- $\alpha$ /TNFR interaction.

## **HYDRAULIC CONDUCTIVITY OF GEOSYNTHETIC CLAY LINERS USING COAL COMBUSTION PRODUCT LEACHATE**

William Reybrock, Jiannan Chen (Mentor), Civil & Environmental Engineering

The hydraulic conductivities (K) of geosynthetic clay liners (GCLs) are being measured with leachates using falling head constant tail conductivity tests (ASTM D 6766). Leachates with various levels of ionic concentrations are used to simulate the coal combustion product (CCP) at a landfill. Na-Bentonite (NaB) GCLs were tested because of their low hydraulic conductivity with water (>10<sup>-10</sup> m/s), low cost, and rapid landfill installation process. K values of NaB were found to be negatively correlated with the ionic concentration of the leachates. This is hypothesized to be the result of a cation exchange process during permeation. Two more GCL types containing chemically resistant bentonite were tested, Polymer Modified Bentonite (PMB), and Bentonite Polymer Composite (BPC). PMB contains bentonite and a polymer dry blend. The PMB GCLs had generally lower hydraulic conductivities than their NaB counterparts with the same leachate blends. BPC involves the polymerization of an organic monomer in a bentonite slurry. The BPC GCLs had the lowest hydraulic conductivity of the three types. The reason for the lower hydraulic conductivity in PMB and BPC is hypothesized to be the result of decreased cation exchange between the GCL and leachate. For all three GCL types, stress level was found to be negatively correlated with the hydraulic conductivity. This calls for rapid waste fill in a landfill to increase performance of the GCL.

## **COMPARISON OF METHODS FOR QUANTIFYING VIBRISAL FUNCTION IN RATS BEFORE AND AFTER STROKE**

Jacob Richie, Matthew Jensen (Mentor), Neurology

This review focuses on finding the most effective method for quantifying the behavior of rodents, specifically in the whiskers of rats in a stroke model. A systematic review was performed and articles were selected for review if they had a quantifiable behavioral task that targets the whiskers. Four major types of tasks were found, and they were compared based on the number of times they were found in the search, amount of human error and subjective decisions, and consideration of how these tests would apply to a stroke model. Findings show that a whisker-focused discrimination task would most likely be the best method to quantify whisker function in rats when researching stroke.

## **DEVELOPMENTAL CHANGES IN REGULATION OF GnRH RELEASE BY KISSPEPTIN IN THE MALE RHESUS MONKEY**

Dustin Richter, Ei Terasawa-Grilley (Mentor), Pediatrics

Previous work in female monkeys shows that the kisspeptin-GnRH neurocircuit undergoes developmental changes at puberty. In this study, the role of kisspeptin in the pubertal increase in GnRH release in male rhesus monkeys was examined using a microdialysis method. Main findings were: Similar to females, 1) a pubertal increase in GnRH and kisspeptin release and 2) an increased GnRH responsiveness to kisspeptin occurred after pubertal onset. However, there was a sex difference. Whereas GnRH response to kisspeptin was lost after gonadectomy in pubertal females, orchidectomy in pubertal males did not interfere with GnRH response to kisspeptin. Therefore, these preliminary data indicate that there is sex-difference in neurocircuitry of the kisspeptin-GnRH system. Additional experiments with a large number of animals are needed to confirm this conclusion.

## **USING LOSS ON IGNITION TO DELINEATE ZONES OF HIGH ORGANIC CONTENT IN LAKE SEDIMENT FROM ICE-PROXIMAL LAKES**

Morgan Ripp, John Williams (Mentor), Geography

On-going research in the Driftless Area of southwestern Wisconsin is analyzing lacustrine sediment from former ice-proximal lakes to better understand the local ecology during the last glacial period. Numerous locations were drilled for lake sediment to be analyzed for paleo-environmental proxies such as pollen, loss-on-ignition (LOI), and charcoal to better understand the environmental history. Among these proxies, loss-on-ignition (LOI) analysis provides a preliminary way to estimate organic matter and carbonate content in the lake sediment by burning the sediment at various temperatures and durations. The results provide guidance on zones from the lake cores that would have optimal pollen preservation because there is a direct relationship between organic material and proxy preservation. Sediment from an initial location of interest, Marsh Valley in northwest Dane County, WI, was sampled at 1-cm resolution to constrain the organic-rich zones along the core that would result in higher pollen and charcoal counts. This method was extended to 6 other locations along the lower Wisconsin River valley to identify organic-rich zones in other lake sediment cores which targets zones of better pollen preservation for subsequent processing and counting. Preliminary LOI analyses provide a general indication of the environmental history and the sediment content including the amount of organic material throughout the core and determine which zones in various cores that is most suitable for more intense analyses.

## **THE MICRO-DISTILLERY CATEGORY AND ITS IDENTITY AS PART OF THE AMERICAN ECONOMIC SYSTEM**

Steven Ritter, Shannon Younger (Mentor), Management and Human Resources

The micro-distillery category has recently emerged as a competitive market in the American economic system. Small to medium sized businesses produce low quantities of grain spirits while differentiating themselves from the much larger companies as well as other micro-distilleries. They do so by delving into their lore, explaining their artisan tactics, and/or claiming they use unique ingredients. This research seeks to understand the image that the micro-distillery category wants to portray, the cultural resources that micro-distilleries use to frame their unique identities, and the value that individual micro-distilleries place on membership in this category. The research is currently in the data collection phase, with numerous distillery websites being analyzed and coded.

## **DO FEELINGS OF POWER IMPACT RESPONSES TO ADVICE?**

Shawna Rivedal, Lyn Van Swol (Mentor), Communication Arts

Previous studies have found that feelings of power cause hormonal changes in saliva and sweat glands, increase risk-taking, increase creativity, and improve public speaking. The Emotional Benefits of Writing study, whose name is a purposely misleading misnomer, seeks to determine how different levels of perceived power influence reactions to unsolicited advice. This advice factor conversely adds an unexplored facet to a traditional study of power. Subjects answer writing prompts that prime them for either high or low power and then receive unexpected advice from an online chat. Then they answer a post-conversation questionnaire. Preliminary results show a potential correlation between feelings of high power and receptiveness to unsolicited advice. Potential ideas for future research include adding a solicited advice condition or introducing the role of apology to assess the primed subject's response to advice.

## **FOR TOURISTS' EYES ONLY**

Edel Roach, Ksenija Bilbija (Mentor), Spanish & Portuguese

For tourists benefit, Costa Rica presents itself as both an environmentally friendly country (Costa Rica Verde or Green Costa Rica) and as the happiest country on earth. While Costa Rica has a countryside landscape that is undoubtedly lush, its capital city has trash littering its streets, poorly maintained vehicles filling its air with pollutants, and few places to recycle. Meanwhile, women frequently face sexism and harassment, children participate in child labor despite laws against it, and abortions remain illegal, all debunking the theory that Costa Rica is the happiest country on earth. My partner and I would like to present our experiences in Costa Rica in order to compare how Costa Rica advertises itself to tourists with its reality.

## **A GENETIC SCREEN FOR MODIFIERS OF RADIOSENSITIVITY IN DROSOPHILA**

Brian Robichaud, Lisa Sudmeier (Mentor), Medical Scientist Training Program

Due to its efficacy in killing tumor cells, cranial radiation therapy (CRT) is used in the treatment of the majority of pediatric brain tumors. However, CRT during development causes a number of long-term neurological side effects including impaired motor function. My project aims to identify possible therapeutic targets for reducing the radio-sensitivity of healthy brain tissue. I tested adult flies that were given a 40 Gy dose of radiation in the 3rd larval instar and compared them to a control population with no radiation exposure. I have screened adult flies from approximately 160 lines with fully sequenced genomes using eclosion data to identify genetic loci involved in the biological response of the nervous system to radiation. I have identified two possible gene targets.

## **IMPACT OF ROBOTIC MILK PLAN ON TIME SPENT AT SOLID FEED BUNK FOR THREE-WEEK-OLD DAIRY CALVES**

Genesis Rodriguez, Melissa Cornett (Mentor), Dairy Science

Early solid feed intake, or Starter, is important for rumen development in dairy calves. High milk intake and social environment might affect Starter in calves. The study examined differences in third week Mean Starter time (S) for calves (N=16) on two milk plans (SLOW, FAST) in a robotic feeder. SLOW offered 15L/D, FAST offered 11L/D. Calves were concurrently enrolled on a DFM efficacy study. Video cameras recorded two 24-hour periods. Observers recorded S with Observer Software. PROC MIXED in SAS controlled treatments, age and initial wt. Actual age was  $24.19 \pm 1.30$  d (Mean  $\pm$  SD). Plans did not differ ( $P > 0.10$ ). Calves spent  $20.21 \pm 16.14$  min. (Mean  $\pm$  SD) and  $19.09 \pm 16.63$  min. (Mean  $\pm$  SD) at S for SLOW, FAST, respectively. Results suggest high milk does not compromise S in socially reared calves.

## **HOSPITAL NURSES' PERSPECTIVES OF FATIGUE AND COPING IN THE CONTEXT OF THE WORK SYSTEM**

Kelli Romine, Cassandra Brucker, Linsey Steege (Mentor), Nursing

Fatigue in hospital registered nurses has been linked to decreased nurse performance and decreased job satisfaction. This study aims to discover how Inpatient RNs at UW Hospital experience fatigue, what coping strategies they employ, and how work system design impacts fatigue. Qualitative interviews were conducted to encapsulate at how fatigue is experienced by nurses of varying experience levels and at how nurses are currently coping with fatigue. Several preliminary themes on the topics of the relationship between unit culture and fatigue, coping strategies for fatigue while at work, and ideas to address fatigue in nursing have been identified. Through exploration of how nurses experience and cope with fatigue, fatigue risk management programs can be developed to address the individual and systematic issues related to fatigue.

## **REGENERATING VOCAL FOLD TISSUE: BIOMATERIAL INJECTABLES FOR IN VIVO ANIMAL MODELS**

Katarina Rosich, Susan Thibeault (Mentor), Otolaryngology

The objective of the experiment was to regenerate damaged vocal fold tissue through the use of various biomaterials. These materials will be tested in a small animal model to optimize candidates for higher-level animal in vivo vocal fold testing. Each biomaterial (10 PEG derivatives) will be assessed for its capability to not cause a foreign body reaction or inflammation and its capability in regenerating new tissue. Each material is injected bilaterally subcutaneously into the backs of five mice. After the injection, at days 5 and 21, mice from each group will be sacrificed. The injected sites will be excised for histological assessment: H&E, trichrome, Elastin Van Geisen. Inflamed cells and newly generated cells will be graded according to predetermined criteria by a pathologist who is blinded to treatment. Further analysis will include quantitative polymerase chain reaction measuring transcript levels for proteins and inflammatory cytokines. The two most ideal biomaterials will be further tested in a rabbit vocal fold in vivo model.

## **SYNTHESIS OF FATTY ACID DERIVATIVES FROM FREE FATTY ACID OVERPRODUCING ESCHERICHIA COLI**

Austin Rottinghaus, Christopher Jones (Mentor), Chemical and Biological Engineering

Metabolic engineering enables the production of a variety of compounds with capabilities as fuels, pharmaceuticals, polymers, fragrances, and many others. Many of these chemicals can be produced as derivatives of free fatty acids. I am exploring the potential production of several of these compounds by inserting genes coding for the enzymatic synthesis pathways into *Escherichia coli*. Enzymes capable of modifying the functional groups of medium and long chain fatty acids have been discovered from the genomes of a variety of different cell types. Many of these enzymes have been tested and proven capable of activity following synthesis in *Escherichia coli* host cells. Such successes include the synthetic production of methyl esters, methyl ketones, and diacids through modification of exogenous free fatty acids. I am integrating intracellular free fatty acid overproduction with enzymes able to modify the alpha and omega ends of 12 carbon carboxylic acids in order to produce these compounds.

## **CONTRIBUTION OF OVERWEIGHT AND OBESITY TO CO-MORBIDITIES**

Philip Rudnitzky, Jarjeh Fang (Mentor), Family Medicine

The prevalence of obesity and non-communicable or chronic diseases has become the fastest growing health burden in the United States. Obesity contributes to the development of chronic illness through a variety of factors including accumulation of excess fat tissue and hormonal imbalance. Our goal is to calculate the Population Attributable Risk for overweight and obesity, and how it contributes to co-morbidities such as diabetes, asthma, hypertension, and cardiovascular disease using data from the National Health and Nutrition Examination Survey. We predict that a significant proportion of non-communicable diseases can be prevented by the reduction or elimination of overweight and obesity.

## **INVESTIGATING INTERFACIAL ELECTRON TRANSFER BETWEEN CHROMIUM AND IRON MINERALS DURING REDOX CYCLING**

Jared Rudolph, Elizabeth Tomaszewski (Mentor), Civil & Environmental Engineering

Chromium (Cr), a toxic redox active metal is stable as Cr(III) and Cr(VI). Cr(VI) is mobile and highly toxic, whereas Cr(III) is innocuous. Iron (Fe) (hydr)oxide minerals are widespread, redox active phases that are important substrates in the geochemical cycle of Cr. The interactions between Cr and Fe minerals are well characterized under anaerobic (reducing) conditions. Fluctuating redox conditions, such as those in wetlands, induce mineral transformations and changes in electron transfer processes unlike those observed in solely anaerobic environments. This study aims to examine how mineralogical transformations and changes in primary electron transfer mechanisms affect the ability of Fe minerals to participate in further electron transfer reactions and the subsequent fate of Cr in redox active environments.

## **INDUCTION OF CARDIAC FIBROBLASTS FROM CARDIAC PROGENITOR CELLS UNDER DEFINED CONDITIONS**

Edward Ruiz, Jianhua Zhang (Mentor), Cardiology

In this study we describe the induction of cardiac fibroblasts from cardiac progenitor cells (CPCs) under completely defined culturing conditions. Cardiac fibroblasts, a major cell type in the human heart along with heart muscle (cardiomyocytes), significantly influence cardiac remodeling and regeneration. Little progress has been made in efficiently deriving these cell types from CPCs under defined conditions, however. Using the GiWi protocol (Lian et al.) to initiate CPC differentiation from human pluripotent stem cells (hPSCs), we compare cardiomyocyte and cardiac fibroblast percentages after culturing with FibroGRO and modified DMEM media with basic fibroblast growth factor (bFGF) concentrations. Quantitative analysis via flow cytometry is described after examining MF20 and Fibroblast cell markers for cardiomyocyte and cardiac fibroblast cell populations. hPSCs cultured with DMEM and high concentrations of bFGF media showed populations with high cardiac fibroblast purity, suggesting that bFGF plays an essential part in cardiac fibroblast induction from CPCs.

## **OVEREXPRESSION OF SOX9B IN ZEBRAFISH CARDIOMYOCYTES PARTIALLY RECAPITULATES TCDD CARDIOTOXICITY**

Matthew Russell, Warren Heideman (Mentor), Pharmaceutical Sciences

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) exerts cardiotoxic effects during zebrafish (*Danio rerio*) embryogenesis. Recent research conducted in our lab has revealed TCDD causes a downregulation of the SRY (sex determining region Y)-box 9 (*sox9b*) gene in cardiac tissue. While loss of *sox9b* expression is believed to contribute to the cardiac abnormalities typical of TCDD exposed embryos, it is unknown whether or not it is misregulation of *sox9b* in the myocardium or adjacent cardiac tissues which leads to the cardiotoxic effects. To answer this question, newly fertilized zebrafish embryos were injected with a plasmid using the cardiac myosin light chain 2 (*cmlc2*) promoter to drive expression of *sox9b*:2A-tagRFP (*cmlc2:sox9b*) in the myocardium. Zebrafish embryos expressing tagRFP were evaluated morphologically and functionally at 96 hours post fertilization. These Tg(*cmlc2:sox9b*) embryos showed increased incidences of pericardial edema and heart chamber unlooping compared to control embryos injected with the *cmlc2* driven 2A-tagRFP (*cmlc2:tagRFP*) expression marker alone. A comparison between Tg(*cmlc2:sox9b*) and zebrafish embryos treated with TCDD shortly after fertilization revealed similar incidences of pericardial edema and chamber unlooping; however there were differences in heart rate and cardiac morphology. These experiments have provided new insights towards the cellular mechanism regulating TCDD cardiotoxicity and the role of *sox9b* in proper heart development.

## **IN VITRO EFFECTS OF THE ADJUPLEX VACCINE ADJUVANT ON DC2.4 CELLS**

Hani Rustom, Suresh Marulasiddappa (Mentor), Pathobiological Sciences

Our laboratory developed a novel mouse model for studying CD8+ T-lymphocyte (CTL) immunity to respiratory viruses. The model employs a non-replicating vaccine formulated with the commercial adjuvant Adjuplex to elicit CTLs in the respiratory tract. Adjuvants capable of safely eliciting memory CTL responses to non-replicating antigens are rare, and the necessary molecular mechanisms are poorly understood. In vivo, dendritic cells are specialized antigen-presenting cells crucial for the induction of CTL responses to viral infections, and likely targets for vaccine adjuvants. To examine whether the CTL-generating effects of Adjuplex involve alterations of DCs, we exposed a murine DC cell line to OVA, a model protein antigen, with and without Adjuplex. Here we report that Adjuplex alters DC activation, antigen uptake, and antigen processing in vitro. Using the murine DC2.4 dendritic cell line, we evaluated Adjuplex-associated alterations in DC activation, antigen uptake, and processing. Activation was assessed by FACS analysis of the DC surface markers CD80, CD86, CD11c, CD40, and IA-b (MHC-II). Fluorescently-labeled OVA-FITC and DQ-OVA were used to evaluate antigen uptake and processing, and analyzed by FACS and confocal microscopy. We observed that Adjuplex increased expression of IA-b and CD40, but not CD80, CD86, CD11c when compared to no adjuvant or the positive control LPS. Adjuplex also altered antigen uptake and processing and resulted in increased antigen uptake, delayed processing, and increased cell-surface and intracytoplasmic antigen aggregation. All of these alterations would be expected to influence DC interactions with CTLs in vivo.

## **INVESTIGATION OF THE FUNCTION OF MBTH-LIKE PROTEINS IN NONRIBOSOMAL PEPTIDE SYNTHETASES**

Jane Ryu, Michael Thomas (Mentor), Microbiology/Bacteriology

MbtH-like proteins (MLPs) are crucial components of many nonribosomal peptide synthetases (NRPS), which are involved in the production of natural products such as antibiotics and siderophores. YbdZ, the MLP involved in enterobactin biosynthesis in *Escherichia coli*, is required for growth in iron-limited conditions. Homologs of MLPs from other organisms complement the function of YbdZ to various extents suggesting that there is a level of specificity involved in NRPS/MLP interactions. In order to characterize MLP function, we will exploit a genetic selection to generate variants of these MLPs that are capable of functional complementation. Understanding the role of MLPs in NRPSs will allow us to engineer new biosynthetic pathways for new drugs.

## **HOW DO WE KNOW IF INTERVENERS CARRY OUT RESEARCH PROTOCOLS AS PLANNED?**

Hector Salazar, Heather Johnson, Wan-chin Kuo, Diane Lauver (Mentor), Nursing

If researchers are to make valid conclusions from studies, they need interveners to follow research protocols. Fidelity refers partly to how faithful interveners are to protocols. We are evaluating fidelity in the myHEART project. The project is designed to coach young adults to control their hypertension. With a descriptive design, we are assessing whether the intervener follows lifestyle coaching protocols with 40 clients. We created a tool to monitor fidelity based on similar peer-reviewed tools. After listening to audiotapes of contacts, we evaluate contacts using our tool. If we rate the intervener highly and our ratings are similar, then we will conclude myHEART can be delivered with fidelity. If so, myHEART can be developed further to partner with young adults to control hypertension.

## **OXYTHERMAL STRESS OF CISCO UNDER CHANGING CLIMATE IN WISCONSIN**

Alexa Sampson, Chin-hsien Wu (Mentor), Civil & Environmental Engineering

Cisco are a species of coldwater fish which require a particular oxythermal habitat of cold water temperatures and high dissolved oxygen levels. This habitat requirement for cisco causes them to be particularly susceptible to climate-induced changes to the physical system of the lake. This research examines the oxythermal stress of cisco in Lake Mendota, Madison, Wisconsin, and predicts changes to oxythermal stress under future climate scenarios. Field-obtained data of temperature and dissolved oxygen contents were used to calibrate a one-dimensional hydrodynamic model over the past climate. Historical die-off data was correlated with modeled cisco stress days to determine die-off criteria. This information was used to project future die-off scenarios and cisco population counts under future climates.

## **DETERMINING THE DNA BINDING SPECIFICITY OF TRANSCRIPTION FACTORS**

Delsin Sanghvi, Jose Rodriguez-Martinez (Mentor), Biochemistry

Transcription factors (TFs) target and regulate specific genes that ultimately determine cell fate. In the lab we developed Cognate Site Identification or “DNA Sequencing (CSI-Seq)” to determine the DNA specificity of TFs. In CSI-Seq a TF is exposed to DNA library that contains all permutations of 20 base-pair binding site (1012 sequences). TF-bound sequences are amplified by Polymerase Chain Reaction (PCR) and used in subsequent binding rounds leading to enrichment of preferred DNA sequences. After several rounds of binding the DNA is sequenced. Learning how TFs function can be useful in determining how malfunctioning transcription factors can lead to disease and or how to design therapies to fix the malfunctioning transcription factors.

## **IN VITRO CHARACTERIZATION OF A XENORHABDUS NEMATOPHILA TCCC MUTANT**

Claudia Santana, Angel Casanova-Torres (Mentor), Bacteriology

The bacterial entomopathogen *Xenorhabdus nematophila* engages in a mutualistic association with entomopathogenic nematodes. The nematodes serve as a vector that delivers the bacteria into the blood-containing body cavity of insect hosts. Inside the insect, *X. nematophila* produces virulence factors that suppress the immune system of the insect and kill it. The global regulatory protein Lrp is involved in both, immune suppression and virulence against insect larvae. Our goal is to examine the phenotype of several *X. nematophila* mutants for Lrp-regulated genes that may play a role in its pathogenesis against insects. We are currently working on characterizing the in vitro phenotype of a *X. nematophila* mutant for the toxin gene *tccC*.

## **FEELING STRESSED? PHYSIOLOGICAL AND PSYCHOLOGICAL HEALTH IMPLICATIONS**

Elizabeth Sargent, Mike Veldhuis, Marcia Slattery (Mentor), Psychiatry

Stress is a universal experience. While some stress may be beneficial to challenge us, it can also be negative and debilitating, and is linked to the development of several physical and mental health disorders such as depression, anxiety, cardiovascular disease, diabetes mellitus, cancer, and obesity. Understanding how stress affects individuals, both psychologically and physically, is therefore critical in order to develop interventions to prevent and/or treat stress-related disorders. The focus of research in our laboratory is to investigate specific stress mechanisms associated with adverse outcomes, using standardized stress paradigms, and collection of both biological and psychological markers of stress. This presentation will describe research approaches to studying stress, provide examples of specific studies underway, and discuss translational implications for the development of novel health interventions.

## **IDENTIFICATION OF RESIDUES GOVERNING LIGAND RECOGNITION IN LUXR HOMOLOGS**

Trevor Schell, Helen Blackwell (Mentor), Chemistry

Bacteria monitor population density through a mechanism termed quorum sensing (QS). In Gram-negative QS, an N-acylated L-homoserine lactone (AHL) is synthesized and leaves the cell. Once intercepted by another bacterium, the AHL is bound by a receptor protein, which activates group-behavior genes. In natural microbiomes, thousands of coexisting bacterial species make and sense signal. Due to proximity, QS signals of one species may interfere with the QS system of another species, unless the bacteria selectively recognize their own subtly different signal molecule. We observed that receptors of certain species are activated by foreign signals, whereas other species are specificity activated by their native signal. In this project, we identify residues that confer specificity of Lux-type receptors in addition to residues involved in receptor (in)activation.

## **THE EFFECT OF SEDENTARY BEHAVIOR ON MOOD IN WOMEN WITH MAJOR DEPRESSIVE DISORDER**

Lauren Schlapman, Jacob Meyer (Mentor), Kinesiology

Research validates exercise as an effective treatment for depression, but there is limited knowledge about how sedentary lifestyles influence this relationship. This study investigates the impact of sedentary behaviors on symptoms of depression in women with major depressive disorder. Accelerometer data was collected to objectively measure several characteristics of sedentary behavior. Symptoms of depression were recorded via self-report questionnaires both before and after an exercise bout. This analysis examines how sedentary lifestyles relate to depressive symptoms and how sedentary behavior can be predictive of responsiveness to acute exercise. These findings will provide more accessible and affordable strategies for depressed patients to manage their symptoms at home. Additionally, this information will provide pilot data for future interventions targeting the most salient aspects of sedentary behavior.

## **DOMESTICATION OF BRASSICA RAPA IN LATIN AMERICA**

Elena Schmelzer, Noah Bevers, Alex Mcalvay (Mentor), Botany

Brassica rapa is a widely utilized research and food crop with many varieties around the world, but the paramount of its importance is as a “quelite,” centralized in Latin America. Quelites function in Latin American agriculture as tolerated weeds harvested for greens, seed, fruit, or root stalk. Introduced Brassica rapa in Latin America is a potential candidate for ongoing domestication as various ethnic groups implement differing cultivation and management practices to select for specific morphologies. A standardized greenhouse grow-out was conducted and plant measurements and DNA extraction were performed with the goal of comparing physical data sets and DNA sequencing to determine if subspecies are in fact arising. We compared the multiple usages of Brassica rapa by modern and past peoples in southwestern Europe with contemporary practices in Latin America to distinguish any specific cultivation practices that may potentially be involved in the process of domestication. In particular, Brassica rapa was found to be used to feed songbirds in both Spain and Mexico, suggesting an origin for the selection process of specific Brassica rapa plant organs. We hope to determine the evolutionary consequences of this centralized distribution and how it will continue to affect selective morphological features of Brassica rapa, especially in Latin America.

## **TYROSINE BIOSYNTHESIS PATHWAY IN TOMATO: IDENTIFICATION AND ANALYSIS OF THE SOLYC06G05630.2 GENE**

Un Shin Schmidt, Hiroshi Maeda (Mentor), Botany

Tyrosine (Tyr) is vital to plants and mammals for the synthesis of proteins and secondary metabolites such as pigments, morphine, and neurotransmitters. There are two routes for Tyr biosynthesis in plants, one utilizing arogenate dehydrogenase (ADH), strictly regulated by Tyr, and one utilizing prephenate dehydrogenase (PDH). The ADH pathway is more common in plants, however it was recently found that PDH is unresponsive to Tyr, and so we are investigating the possibilities of Tyr production using PDH. This study characterizes the gene Solyc06g05630.2, which we suspect to be a poor acceptor for arogenate, and may have a novel function in tomato. We will isolate the enzyme from Solyc06g05630.2, determine its substrate specificity for arogenate and similar substrates, and study its influence on Tyr synthesis.

## **BIOSPHERE RESERVES: A COMPARISON OF GOALS, STRATEGIES, AND EFFECTIVENESS**

Owen Schneider, Patricia Kuntz, Aidan Mazur, James Berkelman (Mentor), Forest & Wildlife Ecology

The Man and the Biosphere Reserve Programme was established in 1971 by UNESCO (United Nations Education Scientific and Cultural Organization) in order to foster the integration of people and nature for sustainable development. The Program intends to ensure environmental sustainability while also promoting economic and social growth and stability. This study examines the differences in implementation, goals, and effectiveness of la Sierra de Manantlan, the Cape West Coast, the Everglades National Park, and other biosphere reserves throughout the world. Specifically, this study will focus on the treatment of various stakeholders at these sites regarding the integration of knowledge from various sources, the network of municipalities, educational institutions, and public and private entities, and the building of global capacity for management.

## **THE RELATIONSHIP BETWEEN LEXICAL-PHONETIC AND SOCIO-PHONETIC LANGUAGE DEVELOPMENT**

Bianca Schroeder, Jan Edwards (Mentor), Communication Sciences and Disorders

Child speech development is typically divided into two categories: lexical-phonetic and socio-phonetic. While current research has explored both of these areas separately, there is little research that examines the two areas together. This study examines both aspects of development and the relationship between them using acoustic and perceptual measures. Lexical-phonetic development will be measured using acoustic and perceptual measures of “s” and “sh” productions; socio-phonetic development will be measured using perceptual measures of gender-likeness. I hypothesize that there will be a positive correlation between lexical-phonetic and socio-phonetic measures. A better understanding of the relationship between lexical-phonetic and socio-phonetic development is needed in order to develop appropriate evidence-based interventions for children with delays in one or both areas of development.

## **HEARING A NEW ACCENT: CHANGING PERCEPTIONS OF WISCONSIN ENGLISH OVER TIME**

Danielle Schuld, Joseph Salmons (Mentor), German

Distinctive regional varieties of English have only recently emerged in parts of North America, including Wisconsin, where differences appear to be increasing today. In a situation of new and still-emerging regional varieties, we expect speakers to be able to more accurately identify recent speech samples versus old samples from their region. We present an experiment in which listeners heard two short samples each from three Wisconsin regions and three other dialect areas. For each area, one sample was recorded pre-1970 and another recorded post-2010. Regional stereotypes were excluded. Listeners proved better at recognizing speakers from Wisconsin in newer over older recordings.

## **GENDER DIFFERENCES IN SELF-REPORTED TRAUMATIC BRAIN INJURIES AMONG WRAP PARTICIPANTS**

Danielle Schuld, Sterling Johnson (Mentor), Geriatrics

This study investigated differences in self-reported traumatic brain injury (TBI) history between genders among 363 Wisconsin Registry for Alzheimer's Prevention participants (WRAP; mean(sd) baseline age = 53.7(6.6); 72% parental history of AD; 61.4% women). Men reported earlier age of first TBI (17.2(11.8) vs 20.3(16.5),  $p=.04$ ). Women had more TBIs due to falls (43.1% vs 31.4%,  $p=.03$ ) and fewer sports-related TBIs (14.4% vs 29.3%,  $p=.0005$ ). The genders did not differ significantly on other TBI causes (vehicle-related and other). Men had more TBIs with loss of consciousness (Chi-square (2 df)=7.1,  $p=.03$ ), indicating more severe injury. These differences in TBI between men and women can possibly be explained by lifestyle. Whether these histories impact cognitive course later in life is an ongoing topic of research.

## **PREDICTORS OF POSTTRAUMATIC GROWTH AMONG STEM CELL TRANSPLANT RECIPIENTS**

Jessica Schwartz, Erin Costanzo (Mentor), Psychiatry

We examined predictors of post-traumatic growth (PTG) in hematopoietic stem cell transplant recipients. PTG is the positive psychological change associated with stressful or challenging life circumstances. Participants (N=430) completed assessments of PTG, social support, and coping style pre-transplant. PTG was also assessed at 1, 3, 6, and 12 months post-transplant. Social support significantly predicted PTG ( $z=2.55$ ,  $p=.011$ ). Coping styles associated with emotional engagement including active coping, positive reframing, acceptance, and emotional processing strongly predicted PTG ( $z=4.31-8.55$ , all  $ps<.001$ ); conversely, coping styles characterized by emotional avoidance did not predict PTG. Treatment regimen, comorbid conditions, and post-transplant complications were not associated with PTG. Findings indicate that social support and emotional engagement could be targeted in interventions to facilitate well-being after stem cell transplantation.

## **STUDIES OF OMEGA-3 FATTY ACIDS AS A TREATMENT FOR TRAUMATIC BRAIN INJURY**

Jocelyn Seppala, David Wassarman (Mentor), Cell & Regenerative Biology

Traumatic brain injury (TBI) affects millions of people every day and is the leading cause of death and disability for people under the age of forty-five. Currently, there are no therapies for TBI patients. Several studies indicate that diet, specifically omega-3 fatty acids, can affect TBI outcomes. I aim to use our *Drosophila melanogaster* model of TBI to test whether omega-3 fatty acids, specifically DHA and EPA, will reduce the percent mortality and inhibit activation of the inflammatory response. These studies will not only provide insights into the use of omega-3 fatty acids for treating TBI, but also lay the groundwork for testing other diets as TBI therapies.

## **CONSONANT PRODUCTION IN HERITAGE SPEAKERS OF SPANISH**

Noemy Serrano, Andy Diaz, Rajiv Rao (Mentor), Spanish & Portuguese

Our research study focuses on the acoustic analysis of heritage Spanish speakers with different experiences with English and Spanish. Its purpose is to gain a better understanding of the potential influence of English on their Spanish sound system. While several types of data were collected, this current study focuses on the consonant /b/ due to its differences in Spanish and English. In Spanish, while it is just one phoneme it can be spelled with <b> or <v>, while in English /b/ and /v/ are different phonemes all together. Through the analysis of /b/'s intensity relative to a following vowel, we examine the presence or absence of English influence in the production of a set of pairs of words that only differ through /b/ or /v/.

## **THE HISTORICAL PERCEPTION OF THE 1157 EARTHQUAKE OF SHAIZAR**

Alli Shaadie, Elizabeth Lapina (Mentor), History

The research analyzes how earthquakes during the Middle Ages impacted regional politics, and the popular attitudes toward those earthquakes. Since there are more sources for earthquakes during the Crusades than the rest of the Middle Ages, the research uses chronicles of the Crusades as a window into the beliefs of medieval societies. The goal of the research is to analyze how the biases of authors influence the ways in which they perceive the earthquake of 1157, its devastation of the city of Shaizar, and Shaizar's subsequent political changes. The research includes historical accounts written by Syrian and Egyptian Muslims, Andalusian Jews, and Syriac Christians. Preliminary results suggest that when the author sympathized with the victims of the earthquake, they saw the event as random or senseless. In contrast, enemies of the victims constructed narratives in which the earthquake was a form of justice for previous wrongdoing by those victims.

## **EVALUATING THE ACID STRESS RESPONSE OF E. COLI IN CFT073**

Minaliza Shahlapour, Rodney Welch (Mentor), Medical Microbiology & Immunology

In *Escherichia coli* CFT073, the invertible gene element, *ipuS*, is hypothesized to contribute to the up-regulation of the acid stress response (ASR) genes when *ipuS* is in the 'ON' position. *ipuR*, a gene next to *ipuS* that is expressed when *ipuS* is in the 'ON' position, is hypothesized to be a positive effector of *gadE*, which is a positive effector of an acid stress protein, *GadA*. The *ipuS* promoter is up-regulated by *RpoE*, a sigma factor that is active in conditions of extra-cytoplasmic stresses, such as ethanol shock or growth at elevated temperatures. In this study, the expression of *GadA* is measured to better understand the genetic regulation of the ASR in various stress growth conditions.

## **LONG-TERM CHANGES IN DISSOLVED OXYGEN CONCENTRATIONS OF LAKE MENDOTA**

Thomas Shannon, Mark Vander Zanden (Mentor), Zoology

The purpose of this research is to investigate if there have been any long-term changes in the oxygen concentrations of Lake Mendota and, if so, if those changes are due to human influence. By analyzing historical data, both from University archives and through biological indicators in lake sediments, historical oxygen concentrations may be compared to present-day concentrations and, based on when these changes take place, give insight into the causes of their change. We hypothesize that the volume of anoxic (oxygen-less) water at the bottom of the lake has increased since the lake has been settled on due to an increased influx of other chemicals introduced to the waters. Results may provide further information on how human settlement has affected inland lakes.

## **SIGNIFICANCE AND CAUSATION OF DISTURBANCE RINGS IN FRESHWATER MUSSELS**

Hailey Shanovich, Vincent Butitta (Mentor), Center for Limnology, Natural Sciences

Freshwater mussels exhibiting disturbance rings in their shells have shown to have permanently retarded growth, never reaching the same potential as equivalent undisturbed individuals. These rings are proposed to be an indicator of a period of stress in the mussel's life history as a response to abiotic and/or biotic sources. We collected *Lampsilis siliquoidea* from 10 lakes in northern Wisconsin to examine potential drivers of stress which range from lake specific to regional macroclimate indices. This research will provide us with more information on freshwater mussel physiology and insight into the degree of sensitivity between benthic organisms and their regional macroclimate.

## **IMPACT/BEHAVIORAL ANALYSIS OF WISCONSERVATION**

Kyle Sherman, Jill Sakai (Mentor), Office of Sustainability

Wisconservation is a new initiative launched by the Office of Sustainability to foster resource conservation at UW-Madison both on and off campus. The Residence Hall Challenge, a component of the Wisconservation initiative run in conjunction with University Housing, encourages halls to compete for the largest reduction in energy use and largest increase in recycling to their baseline rates. This study evaluates whether efforts to improve conservation behaviors on campus generate a measurable change in residence hall energy use and recycling during and after the competition. We also surveyed residents living in Elizabeth Waters Hall pre- and post- competition to obtain engagement and behavioral metrics related to conservation behaviors.

## **THE EFFECTS OF PEPTIDYL ARGININE DEIMINASE II IN NEUTROPHIL EXTRACELLULAR TRAPS (NETS)**

Daeun Shim, Miriam Shelef (Mentor), Medicine

Neutrophil Extracellular Traps (NETs) allow neutrophils to capture the body's pathogens by excreting its genetic material along with various antimicrobial substances. To decondense the DNA in order for NETosis to occur, PAD4 enzyme must citrullinate histones. We propose to determine if PAD2, an isotype of PAD family, is required for NET formation in mouse neutrophils. We hypothesized that the PAD2 deficiency will not have a significant impact in NET formation. To explore the effect of PAD2 in NETs, we immunostained PAD2<sup>+/+</sup> and PAD2<sup>-/-</sup> murine blood sample. As a result, the immunofluorescent staining of PAD2<sup>-/-</sup> mice showed production of NETs. We concluded that the PAD2 expression is not required for the formation of NETs.

## **QUANTITATIVE MRI-DERIVED MICROSTRUCTURAL FEATURES OF THE CENTRAL VISUAL PATHWAYS IN GLAUCOMA**

Alex Shimony, Gillian Mclellan (Mentor), Ophthalmology & Visual Sciences

Glaucoma is a major clinical problem in humans and animals. Our goal is to establish a non-invasive method for quantifying structural damage to the visual pathways in glaucomatous cats. We attempted to quantify the damage to both the optic nerve (ON) and optic tract (OT) using two magnetic resonance imaging (MRI) techniques in cats with primary congenital glaucoma (PCG), which is analogous to the human disease. Our initial findings indicated that our methods can detect significant damage to the ON, but not the OT, caused by glaucoma in cats. Refinement of our analysis in order to increase the sensitivity of detection of optic tract damage is in process. Results will be presented.

## **MARITAL INTIMACY AND PARENT-CHILD CLOSENESS IN FAMILIES WITH CHILDREN WITH AUTISM SPECTRUM DISORDER**

Chloe Shmays, Shari Blumenstock, Sigan Hartley (Mentor), Human Ecology

Autism spectrum disorder (ASD) is the fastest growing developmental disability, now estimated to occur in 1 in 68 children in the U.S. Having a child with ASD presents unique parenting challenges and is associated with an increased risk of negative marital outcomes. Little is known about how the quality of the marital relationship is related to the parent-child relationship within these families. In the present study, we examined one aspect of marital quality, sexual intimacy, and its association with closeness in the parent-child relationship in a sample of 190 married couples who have a child with ASD (aged 5-12 years). Satisfaction of intimacy predicted closeness in the parent-child relationship for mothers, but not for fathers. Results have important implications for potential family services.

## **SILENCES IN CONVERSATIONAL SPEECH: EMBODIED ACTIONS DURING SILENCES**

Brennyn Sibley, Joshua Raclaw (Mentor), Public Health

This research examines silences in conversational English speech. Using Conversation Analysis (Heritage & Atkinson, 1984), I transcribed and analyzed 10 minutes of natural, video recorded conversation between college-aged females. The analysis focuses on embodied actions used to mark upcoming gaps (silences where the speaker could be finished talking, but another does not immediately respond) or pauses (silences where the turn is not finished). I focus on embodied actions (uses of the body and objects during interaction) including the use of smartphones, shifting position, and eye gaze during silences greater than one second. These silences were considered a ‘standard maximum’ before speakers engaged in other activities (Jefferson, 1984). This research expands what we know about long silences, and focuses on actions more common among young females.

## **THE LOCALIZATION AND IMPACT OF CD11c+ DENDRITIC CELLS AND ENCEPHALITOGENIC T-CELLS IN THE CNS DURING THE PROGRESSION OF EAE, THE MURINE MODEL OF MS**

Eric Silignavong, Aditya Rayasam (Mentor), Pathology

Previous studies on neuronal/axonal health have presented us with information about dendritic cell and T-cell accumulation in the brain and CNS. In an autoimmune disease, such as multiple sclerosis (MS), areas of the brain and spinal cord become inflamed and cause various dysfunctions. Dendritic cell and T-cell activation restimulates other immune cells to attack the foreign antigen, thus mediating the rate of pathogenesis. In this study, we will apply our knowledge of the localization of immune cells and use various techniques of immunohistochemistry, statistical analyses, and more to examine the impact of CD11c+ dendritic cells and T cells during the progression of experimental autoimmune encephalomyelitis (EAE), the mouse model of MS. This research will further contribute to the study of the pathology of MS and provide a greater understanding of immune cell interaction in an autoimmune disease.

## **ISCHEMIA INDUCED EXPRESSION CHANGES OF GLUCAGON FAMILY PEPTIDES IN MACROPHAGE AND NEURONAL CELLS**

Nausheen Singh, Umadevi Wesley (Mentor), Neurosurgery

Ischemic stroke is a worldwide health problem. The Glucagon Family Peptides (GLP), Glucagon-Like-Peptide-1 (GLP-1), Vasoactive Intestinal Peptide (VIP), and Pituitary Adenylate Cyclase-Activating Peptide (PACAP), affect post stroke recovery. In this study, we determined whether GLP-1, VIP, and PACAP expression changed in macrophage (RAW 264) and neuronal cells (Neuro-2a) after exposing to in vitro ischemic conditions (Oxygen Glucose Deprivation - OGD), followed by re-oxygenation. RT-PCR analysis and immuno-fluorescence staining indicated increased expression of GLP-1 and PACAP in both Raw 264 and Neuro-2a cells after exposure to ischemic conditions. VIP did not show significant change. Understanding the differential expression of these GLP peptides after ischemic stroke may increase our understanding of the post-ischemic stroke recovery processes.

## **THE SOAP PROJECT: MATERIALS AND METHODS OF MAKING SOAP IN KENYA**

Kayla Sippl, Susan Paskewitz (Mentor), Entomology

The Soap Project, funded by the WIF, works to spread the knowledge of soap-making as a conduit to economic and personal empowerment for women and communities. Workshops were facilitated in Kenya with the support of multiple community partners including Indigenous People in Action and Living Positive Kenya. Both organizations are historically involved with teaching women potential income-generating skills. In addition, research was conducted to identify unique ingredients and potential markets for the finished soap product. Community partners provided a wealth of information to improve the process and procedures. These mutually beneficial relations and the balance between workshops, research, and reflection has allowed The Soap Project to become an economic empowerment tool for the women, as well as a way to improve health and personal hygiene.

## **EXAMINING DISCORDANT ANTIBIOTIC THERAPY FOR UTI IN NURSING HOMES**

Talia Sirkis, Rebecca Muehrer (Mentor), Nursing

Urinary tract infections (UTIs) are “the most commonly treated infection among nursing home residents” (Phillips et al., 2012). While antibiotic therapy is undoubtedly beneficial in many residents, studies have shown that a substantial number of residents treated for UTI do not have fever or localizing symptoms of infection. Consequently, it is believed that much of the antibiotic prescribing for UTI in nursing homes is inappropriate (Nace et al., 2014). Nevertheless, the factors that contribute to antibiotic use in this setting remain poorly understood. The goal of this project was to enumerate the frequency of and factors associated with antibiotic deferral (i.e., delaying antibiotic treatment of UTI until urine culture results became available). Data on antibiotic prescribing events for UTI was collected in five Wisconsin nursing homes between January 2013 and October 2014. A final sample of 287 events were analyzed. The objectives of the data analysis were to: 1) estimate the number of prescribing events initiated immediately versus those in which therapy was deferred until culture results became available; 2) determine if antibiotic deferral differed by provider type (physician versus non-physician); and 3) determine if antibiotic deferral differed by whether the resident met explicit criteria of infection (Stone et al., 2012; Loeb et al., 2001).

## **CHARACTERIZING THE FUNCTION AND EVOLUTION OF FATTY ACID REDUCTASES IN DROSOPHILA**

Kailey Slavik, Hock Chung (Mentor), Genetics

Cuticular hydrocarbons (CHCs) form a waxy layer on the cuticle of most insects. CHC profiles produced in *Drosophila* fruitflies act as species specific pheromones, and help prevent cuticular water loss. As CHC profiles diverge in response to diverse ecological conditions and selective mate choice, reproductive isolation occurs. By investigating fatty acid reductases (FARs), one family of genes implicated in CHC production, we may elucidate the genetic basis for this divergence. We characterize the function of FARs in the CHC pathway through determining their expression at the site of CHC synthesis and analyzing the CHC profiles resulting from a knockdown of their expression. An examination of FAR gain/loss in *Drosophila* may further elucidate the relationship between the evolution of CHC genes and reproductive isolation.

## **INVESTIGATING DAILY SOURCES OF RELATIONSHIP CONFLICT AMONG YOUNG ADULT DATING COUPLES**

Amber Smits, Lauren Papp (Mentor), Human Development & Family Studies

The purpose of this study is to determine the most frequent and distressing sources of romantic disagreements experienced by young adult dating couples. The second purpose is to investigate whether male and female partners reported analogous topics as particularly frequent and difficult across lab-based surveys and daily diary approaches. Results from daily diaries analyzed by a linguistic text analysis program reveal communication and recreation to be major conflict topics for both male and female partners while communication and jealousy emerged as significant disagreement topics based on lab data. Our findings will highlight the need to continue investigating young adult intimate relationships as they provide an important context for adjustment in young adulthood and beyond.

## **JAZ HANDS: CREATING A HORMONE IMAGING SYSTEM**

Dirk Spencer, Simon Gilroy (Mentor), Botany

The plant hormone jasmonate-isoleucine (JA-Ile) is known to trigger defense responses when plants are subjected to wounding, such as by herbivory. Understanding the dynamics of JA-Ile in plants is thus necessary to improve our understanding of plant immunity. The Coronatine-insensitive protein 1 (COI1) is a receptor that binds JA-Ile initiating the ubiquitin-dependent degradation of the jasmonate ZIM-DOMAIN proteins. Therefore, we created a JA-Ile biosensor using the COI1 receptor and JAZ degron to observe jasmonate dynamics in plants with high spatial-temporal resolution. We fused the COI1 receptor, and its target, the JAZ degron, to fluorescent proteins and expressed it in bacteria. We are currently testing the characteristics of this biosensor using biochemical techniques.

## **LONGEVITY OF HDPE GEOMEMBRANE EXPOSED TO LOW-LEVEL RADIOACTIVE WASTE LEACHATE**

Benjamin Stark, Kuo Tian (Mentor), Civil & Environmental Engineering

Disposal facilities of low-level radioactive waste (LLW) and mixed waste (MW) are designed to prevent groundwater contamination on site. High-density polyethylene (HDPE) geomembrane are installed in the composite liner system as an impermeable barrier to prevent contaminant flux. The design standard for LLW and MW disposal facilities requires the longevity of the liner system working effectively for 1,000 years. Thus, evaluation of the service life of HDPE geomembrane is important for long-term concern. In this study, degradation of the geomembrane was simulated by immersing pieces of 2-mm thick HDPE in radioactive synthetic leachate (RSL) at four temperatures (25, 50, 70, and 90 °C). To simulate a disposal facility scenario, the RSL had chemical composition to represent the leachate at LLW disposal facilities operated by the US Department of Energy's environmental restoration program. Tests were also conducted with non-radioactive synthetic leachate (NSL), which has identical chemical composition to RSL except radionuclides are absent. The effect of radiation on HDPE geomembrane degradation can be studied by comparing experimental results between RSL and NSL. Control tests were conducted with deionized water. Samples were removed at a regular interval. Mechanical properties were tested for with standard tension tests on the HDPE sample (ASTM D638). Degradation of the HDPE caused yield stress to increase at a smaller strain than original HDPE sample. Molecular weight of the sample was indirectly measured by a Melt Flow Index Test (MFI) (ASTM D1238). The MFI of HDPE geomembrane immersed in RSL decreased after 20-month immersion test at 90 °C, which indicated crosslinking occurs in the geomembrane polymer.

## **ESTABLISHING THE FUNCTION OF COQ9: A PUTATIVE LIPID CHAPERONE ESSENTIAL FOR COENZYME Q BIOSYNTHESIS**

Matthew Stefely, David Pagliarini (Mentor), Biochemistry

Coenzyme Q (CoQ) is a vital part of the electron transport chain and is synthesized de novo in mitochondria. COQ9 is a crucial protein in this pathway but has no known function. Recently, our lab published important clues to the function of COQ9: COQ9 co-crystallized with a lipid and associates physically and functionally with COQ7, a protein in the CoQ pathway that binds the CoQ precursor, demethoxy-CoQ (DMQ). These results led me to hypothesize that COQ9 is a DMQ chaperone. Here, we present recent progress including the isolation of DMQ and optimization of an assay for examining lipid-binding activity. This research is an important step toward elucidating COQ9's endogenous ligand, understanding CoQ biosynthesis, and ultimately treating CoQ deficiency, which has serious human health implications.

## **SIMULATING MAGNETICALLY DRIVEN ASTROPHYSICAL JETS WITH THE PERMANENT MAGNET PULSED JET SOURCE**

Aaron Stemo, Matthew Brookhart, Cary Forest (Mentor), Physics

Astrophysical jets are commonly associated with accreting bodies such as active galactic nuclei, binary systems, and proto-stars. Models state that these plasma jets are formed due to interactions between the magnetic field near the accretion disk and the conducting disk material. It is further theorized that the presence of interstellar plasma stabilizes the propagation of these astrophysical jets over vast distances. The purpose of the Permanent Magnet Pulsed Jet Source is to simulate magnetically driven astrophysical jets. Over the last year, the plasma source has been designed and constructed. Initial studies include creating jet-like plasmas in a vacuum. Future work with the Madison Plasma Dynamo Experiment (MPDX) will attempt to create astrophysical jet-like plasmas and propagate them through an unmagnetized background plasma.

## **FUNCTION OF FMRP IN NEURAL STEM CELL MAINTENANCE AND ITS ROLE IN AGE DEPENDENT COGNITIVE DECLINE**

Michael Stockton, Yue Li (Mentor), Waisman Center

Fragile X Syndrome (FXS) is the most common form of mental retardation and occurs due to mutation in the fragile X mental retardation 1 (FMR1) gene. The mutation of FMR1 leads to lower production of the Fragile X Mental Retardation Protein (FMRP). Our lab has shown that FMRP deficiency leads to decreased neurogenesis and impaired learning and memory. The maintenance of quiescent populations of adult neural stem cells (aNSCs) is very important, its loss leads to fewer aNSCs and subsequent deficit in neurogenesis. I aim to test the hypothesis that FMRP plays a crucial role in maintaining the neural stem cell pool, reducing stem cell depletion in the dentate gyrus (DG), and that conditional FMRP deletion will impair learning and memory tasks in adult mice.

## **COBALT PHOSPHOSULFIDE (COPS) AS AN EFFICIENT ELECTROCATALYST FOR THE HYDROGEN EVOLUTION REACTION**

Michael Stone, Song Jin (Mentor), Chemistry

Hydrogen is an energy carrier that may be the future of clean energy for the global economy. High performance earth-abundant catalyst materials to replace platinum for electrochemical hydrogen production are key for the viability of a hydrogen economy. We have discovered that pyrite-type cobalt phosphosulfide (CoPS) is a novel, high performance material that may be able to fill this role. I have synthesized and structurally characterized thin films, nanowires and nanoplates of CoPS. The electrocatalytic performance of this material was optimized through the synthesis of highly dense nanowires directly on graphite substrates and high surface area nanoplates directly on carbon fiber paper. These electrodes achieved some of the top reported catalytic performances of any earth-abundant materials, nearly reaching the levels of platinum.

## **CHARACTERIZATION OF CO-CULTURE SIGNALING BETWEEN OVARIAN CANCER CELLS & TUMOR ASSOCIATED MACROPHAGES**

Lauren Stopfer, Molly Carroll, Madalyn Pechmann, Olivia Velazquez,  
Pamela Kreeger (Mentor), Biomedical Engineering

The presence of tumor associated macrophages (TAMs) in ovarian cancer (OvCa) has been previously associated with increased tumor growth and poor clinical prognosis. While the signaling pathways between these cell types have been previously investigated, current methods have several limitations. A novel in-vitro co-culture device was developed and used to more accurately examine the relationship between OvCa and TAMs by allowing dynamic interactions to take place. Using this device, proliferation and cytokine concentration profiles were generated between four OvCa cell lines and one TAM line. The results provide a greater understanding of which cytokines may be involved in tumor growth in vivo, and may ultimately suggest new therapeutic targets for ovarian cancer patients.

## **ROLE OF TRANSCRIPTION FACTOR BACH2 IN REGULATORY T CELL FUNCTION DURING A BACTERIAL INFECTION**

Brady Strittmatter, Suresh Marulasiddappa (Mentor), Pathobiological Sciences

Foxp3+ regulatory T cells (TReg) are a subset of T cells that play crucial roles in mitigation of autoimmunity and restraining inflammatory responses to infections. Genome-wide association studies have linked the transcription factor Bach2 to several immune-mediated diseases including asthma, vitiligo, type 1 diabetes, Crohn's disease and multiple sclerosis. Here, we investigated the effect of Bach2 deficiency on the responses of TReg cells during infection of mice with an intracellular bacteria, *Listeria monocytogenes*. During listeriosis, Bach2 deficiency resulted in TReg that displayed exaggerated activation (elevated expressions of CD44, KLRG-1 and CXCR3) and produced the proinflammatory cytokine, tumor necrosis factor. These findings suggested that Bach2 restrains the differentiation of effector Tregs and also limits Treg cells' ability to produce proinflammatory cytokines during infections.

## **EFFECTS OF DENTATE GYRUS PATHOLOGY ON PATTERN SEPARATION**

Mohammad Suleiman, Mathew Jones (Mentor), Neuroscience

The dentate gyrus is located in the hippocampus and functions to discriminate between relatively similar inputs in the brain, a process known as pattern separation. Such functions may be severely impaired during epilepsy, which engenders our goal of understanding the fundamental processes that constitute pattern separation. Overall, we wish to better understand the effects of epilepsy on pattern separation and memory. To accomplish this, a group of mice will perform the cheeseboard maze task, an activity that entails spatial pattern separation, during which the performance of normal and epileptic subjects will be observed. We wish to demonstrate that pattern separation occurs in the dentate gyrus and observe behavioral deficits in epileptic mice. Our results will ultimately induce plausible treatments for patients expressing dentate gyrus pathology.

## **THE EFFECTS OF INCREASING DISRUPTIVE FORCE ON AGGREGATE STABILITY IN PRAIRIE AND AGRICULTURAL SOILS**

Joe Sullivan, Nicholas Balster (Mentor), Soil Science

A soil's aggregate stability influences its resistance to erosion, and soil organic carbon (SOC) content affects soil aggregate stability. I hypothesized that soils with higher SOC would be more resistant to the disruptive forces encountered in a wet-aggregate stability (WAS) test. Soil samples from adjacent prairie and agricultural fields were subjected to a rotary WAS test at 35 and 140 rotations per minute. SOC content was determined by loss on ignition. Increasing the test speed resulted in greater losses of aggregate stability in the agricultural soil than occurred in the prairie soil, and SOC contents were greater in the prairie soil than in the agricultural soil. These results indicate that adjusting the speed of WAS tests may provide greater resolution when comparing treatments.

## **SEX DIFFERENCES IN RESPONSE TO GROWTH FACTOR AGONIST IN HIPPOCAMPAL NEURONS AFTER IN VITRO ISCHEMIA**

Wendy Sun, Pelin Cengiz (Mentor), Pediatrics

Hypoxia-ischemia (HI) related brain injury after perinatal asphyxia is a major cause of disability. Female newborns are more resistant to the effects of HI, suggesting a sex-specific neuroprotective mechanism. Administration of 7,8-dihydroxyflavone (7,8-DHF; TrkB agonist) increases TrkB phosphorylation, hippocampal neuronal survival and improves long-term functional outcome post-HI in females, but not in males. Females exhibit increased expression of estrogen receptor  $\alpha$  (ER $\alpha$ ) compared to males post-HI. Sexually differentiated TrkB phosphorylation becomes ablated in ER $\alpha$  knockout mice. To study the mechanisms underlying sex differences post-HI, my project established an in-vitro model of HI using hippocampal neuronal cultures. We demonstrated that neuronal survival decreased after in-vitro ischemia and rescued after 7,8-DHF administration only in females. We will investigate the role of ER $\alpha$  further after in-vitro ischemia.

## **PLASMA P-SELECTIN CONCENTRATION IN ADULT OR PEDIATRIC PATIENTS WITH SEVERE OR NON-SEVERE ASTHMA**

Calvin Swanson, Mats Johansson (Mentor), Biomolecular Chemistry

The protein P-selectin is released into plasma from endothelial cells and platelets upon cell activation. We analyzed P-selectin in plasma from participants in the Severe Asthma Research Program (SARP) phase III. We found a trend to higher P-selectin in severe (mean=36.4 ng/mL) than in non-severe asthma (mean=27.4 ng/mL). There was a trend toward lower P-selectin in children than in adults, especially in severe asthma (severe children mean=19.2 ng/mL, severe adults mean=37.1 ng/mL). We will also present results of analyses of possible correlations between P-selectin and clinical data, including lung function. The study is ongoing and more samples will be tested from different dates, including after a corticosteroid injection and after an acute exacerbation.

## **EFFECTS OF EARLY LIFE STRESS ON NEUROCOGNITIVE FUNCTION**

Joanna Swinarska, Seth Pollak (Mentor), Psychology

Recent research has indicated that early life stress (ELS) can contribute to developmental alterations of the pituitary-adrenal stress response pathway and development of certain brain regions, suggesting the possibility of effects on neurocognitive function later on in life. In the following study we assessed the neurocognitive performance of 53 18-25yo participants via the Cambridge Neuropsychological Test Automated Battery (CANTAB). Participants were classified into two groups, either high stress or low stress, by a life stress interview (LSI) performed during previous assessments in the lab. Results indicated significantly higher neurocognitive abilities in participants with a low LSI score, specifically in relation to impulse control, difficulty in identifying emotions from facial expressions and positive or negative verbal stimuli, deficits in attention shifting, and impaired reason-based decision-making.

## **TEB, A THERMOELECTRIC BRACELET TO IMPROVE PERSONAL THERMAL COMFORT**

Jason Sylvestre, Kevin Ponto (Mentor), Human Ecology

Creating environments that are thermally comfortable for all individuals can be a difficult endeavor. Research has shown that the application of a temperature change to a local part of the body causes the brain to perceive the change over the entire body. The proposed project leverages this effect by utilizing thermoelectrics to send pulses of thermal stimuli through the wrist to induce a perceptual change in body temperature in order to improve personal thermal comfort. If this device proves to be successful in human testing, then the implications stretch to every person who experiences thermal discomfort on a regular basis and provide new opportunities for the methods in which environments are heated and cooled.

## **GLASS IN CLASS**

Xiang Zhi Tan, Bilge Mutlu (Mentor), Computer Sciences

The rising popularity of lightweight head-mounted displays (HMDs) presents unique opportunities to develop applications that support classroom-based learning. Lightweight HMDs are design to act as a supplementary display outside of the users' primary field of view, thus less likely to obstruct the users' focus on their primary task. To better understand the design space in classroom settings, we designed a Google Glass application called "What Was That?". The application provided students the opportunity to temporarily record and then replay short clips of lecture audio using simple interaction techniques known as microinteractions. To evaluate our system, a field study was conducted with students in various types of real university classrooms. The insight gathered provided important design implications for designers of such technologies for classroom usage.

## **DOES DNMT3B EXPRESSION CORRELATE WITH AXONAL REGENERATION IN THE PERIPHERAL VS. CENTRAL NERVOUS SYSTEMS?**

Angelito Tenorio, Bermans Iskandar (Mentor), Neurological Surgery

Studies from our laboratory have shown that folic acid promotes axon regeneration in multiple rodent models via DNA methylation. The levels of DNA methyltransferase enzymes, including DNMT3b, have correlated tightly with the extent of axonal regeneration. We have subsequently shown that in a culture model of dorsal root ganglion axon growth, in which the same cell body extends a central axon into the spinal cord and a peripheral axon into the sciatic nerve, spinal cord injury suppresses axon extension, whereas sciatic nerve injury enhances it. In turn, folic acid treatment restores the ability of spinal cord-injured neurons to extend axons. In this study, we examine the role of DNMT3b in this differential effect of injury and folic acid on CNS vs. PNS axon regeneration.

## **IMMIGRANT FAMILIES: LITERACY AND IDENTITY DEVELOPMENT OVER TIME AND SPACE**

Shannon Thao, Caroline Gasao, Catherine Lilly (Mentor), Curriculum & Instruction

This project is a longitudinal study that follows 10 children from immigrant families. They are being followed through their 6th grade year in school and we hope to eventually follow them into their high school career as well. We are taking a look at how the child's immigrant background affects their learning experiences within the classroom, especially their literacy/language development and identity construction over time and space. Data is collected through interviews with the child, their family members, and teachers, as well as through observations within the child's home and school, and through artifacts created by the student. This study will help to bridge gaps within the education field and give insight that will lead to a more engaging and effective teaching curriculum for students, especially those coming from immigrant backgrounds.

## **NONPROFIT ORGANIZATIONS AND BIRTH OUTCOMES (NOBO)**

Angela Thao, Amy Hilgendorf (Mentor), Center for Community & Nonprofit Studies

The Nonprofit Organizations and Birth Outcomes (NOBO) project seeks to understand the improvement in birth outcomes for African American babies in the early to mid-2000s in Madison through examining inter-organizational relationships around that time. A survey was sent out to organizational representatives in Madison and Dane County to gather data about shared philosophy and collaborative relationships over time to conduct a social network analysis (SNA). This poster presents this analysis in four SNA maps which describes the relational differences in the network across the time periods. The results are considered in relation to birth outcomes at these times and possible reasons for the observed improvement.

## **DEVELOPMENTAL EXPECTATIONS & CHALLENGES OF PARENTS OF INFANTS WITH A COMPLEX CONGENITAL HEART DEFECT**

Taylor Thompson, Danielle Keller, Karen Pridham (Mentor), Nursing

Parents of a baby with a complex congenital heart defect (CCHD) encounter unique obstacles in addition to typical parenting responsibilities. Our aim was to identify parents' developmental expectations of their babies and specific challenges faced. We analyzed interviews, previously conducted by Karen Pridham, of 10 families done at three times during the first year of infants born with a CCHD requiring surgery. Most parents expressed hope that their child would develop at the expected rate of a child without a heart defect. Several families experienced issues with their child's amount and pace of feeding, and worried that this would hinder growth and development. Results will provide insights for parents, providers, and researchers into the developmental expectations and experiences of parents of babies with CCHD.

## **CROSSTALK BETWEEN RNA BINDING PROTEIN HUND AND TRANSCRIPTION FACTOR SATB1 REGULATES NEUROGENESIS**

Joey Tidei, Xinyu Zhao (Mentor), Neuroscience

HuD/ELAV4 is a neuronal RNA-binding protein implicated in multiple aspects of neuronal functions and several neurological diseases, such as paraneuroplastic encephalomyelitis and spinal muscular atrophy, etc. However, the function of HuD in neural differentiation is largely unknown. Here, using HuD knockout (KO) mice, we show that HuD deficiency leads to decreased neuronal differentiation of adult neural stem/progenitor cells (aNSCs). We discovered that HuD promotes neuronal differentiation by enhancing the stability of special AT-rich DNA binding protein 1 (SATB1) mRNA through binding to the AU-rich elements located within its 3' untranslated region. On the other hand, SATB1, known to be critical for cortical development, binds to the proximal promoter of HuD and promotes HuD expression during aNSC neuronal differentiation. SATB1 knock down decreased the SVZ aNSCs differentiation, while overexpression of SATB1 rescued the phenotypes associated with HuD deficiency. Additionally, SATB1 knockdown can decrease HuD mRNA level. We further discovered that neuronal master regulator NeuroD1 is a direct downstream target of SATB1. Therefore HuD and SATB1 form a positive regulatory loop in aNSCs that enhances NeuroD1 transcription and neuronal differentiation. Our results demonstrated that a novel positive feedback loop between mRNA binding protein and transcription factor that plays critical regulatory roles in neurogenesis.

## **DIFFERENTIAL IMMUNE RESPONSES OF M1 AND M2 MACROPHAGES TO VIRUS-INDUCED AIRWAY INFLAMMATION IN RATS**

Alyssa Tidemann, Ronald Sorkness (Mentor), Pharmacy

Macrophages are key mediators of inflammation in the body. They regulate the balance between the ‘fight’ (M1) and ‘settle down’ (M2) responses that, when inappropriately regulated, result in fibrosis and disease. This experiment quantifies M1 and M2 macrophages at various time points (post viral inoculation) using flow cytometry to compare differential immune responses in two strains of rat—one vulnerable to post viral airway dysfunction and one resistant to it. It is hypothesized that susceptibility to viral airway inflammation is correlated with unregulated response patterns of M1 and M2 macrophages, possibly by overproduction of both types of macrophages or inappropriately timed M1 and M2 response patterns. These findings will provide insight into the mechanisms surrounding airway injury and disease.

## **IMMIGRANT FAMILIES: LITERACY AND IDENTITY DEVELOPMENT OVER TIME AND SPACE**

Gabrielle Tielman-Fenelus, Catherine Lilly (Mentor), Curriculum & Instruction

The large influx of immigrant students in the United States and the lack of knowledge and administrative support in incorporating these children into the classroom have led to the creation of various research projects that seek to make the classroom as supportive and inclusive as possible for all students. This project follows 10 children from immigrant families through their journey in grade school (grades 1 to 12) with the purpose of examining how these children and their families adjust to their relocation to the United States. The study also serves to study the experiences and relationships that these children have while in school while primarily focusing on the issues of literacy and language development and identity construction. The researchers collect interviews and artifacts made by the children, and all of these materials are later studied and analyzed in order to measure the child’s development. The goal of the project is to help teachers and school administrators better understand immigrant students and make their learning experience an enjoyable one.

## **OSMAN HAMDI BEY’S ORIENTALISM AND THE RE-HISTORICIZING OF THE OTTOMAN ORIENT**

Samantha Timm, Jennifer Pruitt (Mentor), Art History

Osman Hamdi Bey was an Ottoman painter in the late nineteenth century who took on a directorial position in the Imperial Museum and founded the Ottoman School of Applied Arts. My project seeks to examine the ways in which Hamdi’s role as Director as well as his own brand of Orientalist painting positions him to relocate the Ottoman past and reclaim Ottoman national identity for the current empire. Hamdi depicts not only Ottoman places and Mamluk artifacts, but also scenes similar in subject matter to the French Orientalist painter, Jean-Léon Gérôme.

## **NEW APPLICATION OF MUSCLE TISSUE ENGINEERING TO UNDERSTAND AMYOTROPHIC LATERAL SCLEROSIS**

Michelle Tong, Masatoshi Suzuki (Mentor), Comparative Biosciences

Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease characterized by specific loss of motor neurons in the spinal cord and brainstem. Ten percent of cases are familial, with copper-zinc superoxide dismutase 1 (SOD1) gene mutation accounting for 10% and hexanucleotide GGGGCC repeat expansions in the chromosome 9 open reading frame 72 (C9ORF72) accounting for 25-40%. While most research has focused on motor neuron cell death, recent studies demonstrate that degenerative processes begin in the skeletal muscle. The main objective of my research project is to develop and test novel culture models to further understand muscle pathology in ALS. Specifically, I will generate human skeletal muscle progenitor cells (hSMPCs) using patient-derived induced pluripotent stem cells with SOD1 or C9ORF72 mutations, and ask whether these mutations influence cell proliferation, muscle differentiation, and viability of muscle cells. I will also develop an in vitro model for muscle tissue engineering and test its ability to show skeletal muscle properties. My research will provide important information for further application of hSMPC transplantation and in vitro disease modeling for ALS.

## **OPTIMIZING FILTRATION AND PRESERVATION OF EPITHELIAL CELLS FROM URINE**

Michelle Tong, Nathan Bressler, Kiersten Haffey, Joseph Vecchi, Jesse Wang,  
Krishanu Saha (Mentor), Biomedical Engineering

Collection of patient specific cells is a task that often involves painful blood draw, skin puncture, or other clinical techniques. In order to streamline the process of cell collection from patient to laboratories, it is necessary to create a method for easy collection of epithelial cells. The goal for this project is to fabricate an easy-to-use, at home urine collection device that serves to separate renal epithelial cells from urine. The device must capture as many renal epithelial cells as possible and maintain sterility, while being user friendly. In addition to filtering epithelial cells from urine, they must be kept viable for at least 24 hours for the return shipment to the lab. The cells will then be used for reprogramming to create embryonic-like stem cells, called induced pluripotent stem cells (iPSCs). Patient-specific iPSCs are thought to hold unlimited potential in regenerative medicine and disease modeling applications.

## **THE ENGLISH LANGUAGE'S INFLUENCE ON THE SPANISH PRONUNCIATION OF HERITAGE SPEAKERS**

Alejandra Torres Diaz, Ricardo Zuniga, Rajiv Rao (Mentor), Spanish & Portuguese

Heritage speakers of Spanish (HSS) in the United States are individuals who were exposed to the Spanish language in their homes as children. Many such speakers are, to varying degrees, bilingual in both English and Spanish. However, these individuals tend to exhibit English influence in their Spanish pronunciation. This project focuses on the phonology of HSS, more specifically, realizations of the phoneme /b/, which is characterized differently in Spanish and English. Previous research has shown that HSS who feel more comfortable with the Spanish language have increased success at maintaining distinctions between their Spanish and English sound systems. However, few studies have used acoustic analysis to prove the validity of a correlation between competency in the Spanish language and pronunciation.

## **EFFECT OF VISUAL BENCHMARKS ON AMBULATION OF HOSPITALIZED OLDER ADULTS**

Eric Tourbier, Barbara King (Mentor), Nursing

Loss of independent ambulation, identified as hospital-associated disability, occurs in 17-65% of hospitalized older adults and is caused by limited ambulation during hospital stay. Patients are rarely engaged in setting goals for walking. A walking pathway on an inpatient unit called "Walk Around Wisconsin" incorporates strategically hung pictures of Wisconsin locations for the purpose of engaging patients in focused attention during ambulation. We hypothesize that a focused attention on "Walk Around Wisconsin" will increase the frequency of patient ambulation. One-on-one interviews were conducted to identify patient's perception of using artwork as targets for walking distance. Measured walking pathways quantify distance patients walk. Content analysis was used to analyze data. Results may help design hospital environments that promote ambulation and reduce hospital-associated disability.

## **A SYSTEMATIC LITERATURE REVIEW: PHYSICAL ACTIVITY'S EFFECT ON THE HIPPOCAMPUS**

Hao Tran, Elisa Torres (Mentor), Nursing

The hippocampus is a structure in the brain related to memory and emotions that shrinks with age. Decreased hippocampal sizes are associated with higher risks of developing Alzheimer's disease and depression. It is possible that physical activity can increase hippocampal size, thereby mitigating the risk for the progression of associated diseases. A systematic literature review was conducted using the PubMed database (2004–14) to determine the effects of physical activity on the hippocampus. Of the four articles selected, two concluded physical activity increases hippocampal volume. This suggests more research is needed to further define physical activity's effects on the hippocampus. If future findings support the positive impact of physical activity, perhaps it can be an intervention to inhibit the development of Alzheimer's disease and depression.

## **NUTRITION AND COGNITION AMONG INDIVIDUALS WITH HEART FAILURE**

Abigail Traylor, Mara Stewart, Lisa Bratzke (Mentor), Nursing

Cognitive impairment is commonly observed in older adults with heart failure (HF); nutrition is a possible contributing factor. The purpose of this study is to explore the relationship between nutritional factors, cognition, and specified brain MRI regions. Thirty-nine NYHA Class 1-3 community-dwelling adults completed the DETERMINE checklist and a nutritional survey, and underwent comprehensive neuropsychological testing and a brain MRI. Participants were 54% male, the mean age was 68, and average left ventricular ejection fraction was 47%. Additional data will be analyzed using descriptive statistics, chi-square tests, and Spearman correlations. These findings will inform future research projects designed to expand our understanding of the effects of nutrition on cognition and brain changes among older adults with chronic illness, including HF.

## **YOUNG CHILDREN OF INCARCERATED PARENTS: CHILD DISTRESS LEVELS AFTER WITNESSING CRIME AND ARREST**

Carly Tucker, Luke Muentner, Julie Poehlmann-Tynan (Mentor), Human Development and Family Studies

This presentation explores the distress levels that children experience after witnessing their parent's criminal activity and/or arrest. The data is extracted from a set of qualitative interviews performed during Dr. Poehlmann's ongoing research. During the interviews, the child's jailed-parent and caregiver are asked whether or not the child witnessed their parent's criminal activity and/or arrest. If answered yes, the distress is rated on a scale from 1 to 5 depending on how upsetting those experiences were for the child. Results were collected for 79 children from the perspective of their caregivers and jailed parents. This research seeks to understand the impact that witnessing crime and arrest can have on children. Beyond this, it shows a greater need for caution when arresting adults with children present.

## **A STUDY ON TRICHOME EXPRESSION IN BRASSICA RAPA AND FUTURE EDUCATIONAL OPPORTUNITIES**

Natalie Tupper, Sophie Carr, Kimberli Ward, Scott Woody (Mentor), Biochemistry

Our research will use a QTL analysis to identify the location and nature of genes in the Brassica rapa genome that condition the expression of trichomes, hair-like tissues that form on leaves of seedlings. The results of this analysis will be valuable for enriching education about quantitative genetics at both the high school and undergraduate level. There are many more instructional tools currently available to teach Mendelian genetics, but very few that address quantitative genetics. The current research will provide students a hands-on educational experience in a very important, but underrepresented, area of science.

## **MECHANISM OF THE ANTIMICROBIAL PEPTIDE INDOLICIDIN ON THE CYTOPLASMIC MEMBRANE OF E. COLI**

Meghan Turner, James Weisshaar (Mentor), Chemistry

The current antibiotic-resistance epidemic has led to increased focus on antimicrobial peptides (AMPs), short, host-defense peptides multi-cellular organisms, as potential prototypes for the design of novel antibacterial drugs. Bulk biochemical assays have helped elucidate possible mechanisms by which these AMPs attack, but make it difficult to separate the sequence of events due to limited spatial and temporal resolution. Single cell, time-lapse fluorescence microscopy was used to determine the importance of mechanosensitive channels on membrane permeabilization, cell growth, and cell survival from the attack of the AMP indolicidin on Escherichia coli. We hope to provide a detailed mechanistic explanation of indolicidin's attack on the membrane system of E. coli to further improve designs of synthetic AMPs for use as alternatives to antibiotics.

## **ADSORPTION OF AMMONIA TO DIVALENT TRANSITION METAL ATOMS IN ZEOLITES**

Pajeau Uchupalanun, Florian Goeltl (Mentor), Chemistry

Zeolites are the most important industrial catalyst today. In these systems, cations act as active sites and their activity is affected by its position and chemical environment. In this project we develop a computational, design-based approach for such zeolite catalysts. We study the adsorption of ammonia to divalent Cu, Ni, Co and Fe sites in the zeolites SSZ-13 and Mordenite. We modeled eight different sites and 26 different local, chemical environments for all four metals using van der Waals corrected Density Functional Theory (DFT). In the end, we were able to describe the adsorption strength using a multi-parameter approach. In the future, this will allow the prediction of catalytic activity of such active sites, and with it realistic zeolite catalyst for various chemical reactions.

## **METABOTROPIC GLUTAMATE RECEPTOR-HOMER1 INTERACTION AND ITS ROLE IN ACQUISITION OR CONSOLIDATION OF MEMORIES**

Jeanet Ugalde, Corinna Burger (Mentor), Neurology

Gene delivery of Homer 1c has been shown to improve memory and long-term potentiation (LTP), a form of synaptic plasticity. However the importance of Homer is due in part to the interactions with metabotropic glutamate receptors (mGluR) located in the post synaptic density of neuronal cells that also play an important role in synaptic plasticity. The significance of these interactions in memory has not been studied. Our main focus is to see whether or not Homer-mGluR interactions have a significant effect in memory. This will be achieved by using a tetracycline-regulated system in order to control the transcription of a peptide that interferes with Homer-mGluR interactions in neuronal cells. This control will allow us to investigate the time at which Homer-mGluR interactions are necessary for memory formation.

## **SYNTHESIS AND QUANTIFICATION OF THE SECONDARY ORGANOSULFATE DERIVED FROM 2-METHYL-3-BUTEN-2-OL (MBO)**

Steven Underwood, Frank Keutsch (Mentor), Chemistry

Understanding the reactivity of organic compounds in the atmosphere is an important step in understanding the climate of the Earth. Two distinct processes are the oxidation of volatile organic compounds (VOCs) and aqueous photooxidation once the oxidized species enter secondary organic aerosol in the troposphere. Organosulfates formed from the reaction of VOCs and aerosol have been identified and characterized in field data. Standards have been synthesized for several of these compounds, allowing researchers to measure concentrations of these compounds in the atmosphere, increasing our knowledge of atmospheric and aerosol chemistry, and helping us better understand the climate changes of the Earth. This presentation documents the attempts to synthesize one organosulfate derived from 2-methyl-3-buten-2-ol (MBO), 2-MBS.

## **TRANSPLANTATION OF HESC-DERIVED NEURAL PROGENITOR CELLS TO IMPROVE FUNCTIONAL MOTOR PERFORMANCE IN A RAT MODEL OF TBI**

Ryan Valk, Ronald Kalil (Mentor), Ophthalmology & Visual Sciences

TBI affects an estimated 1.7 million people in the United States annually, leading to neurobehavioral impairments and increased risks of neurodegeneration. Thus, TBI calls for more effective treatment methods, preventative strategies and early acute rehabilitation. We hypothesize that transplanting immature hNPCs to the injured region of the brain will lead to the repairing of the damaged environment, resulting in improved behavioral outcomes. We will test behavioral outcomes in terms of motor performance on the rotarod both before and after inducing a TBI to the hind limb region of the motor cortex. To aid in the functional recovery of the animal, immature hNPCs will be transplanted to the impacted cortex with the hope that these cells will integrate and restore the neural connections lost due to injury.

## **INVESTIGATING FLUID FLOW WITHIN THE VOCAL FOLD USING FINITE ELEMENT ANALYSIS**

Andrew Vamos, Jack Jiang (Mentor), Surgery

Vocal fold edema is commonly coupled with benign lesions, including nodules, polyps, and cysts. Despite the frequent occurrence of VF lesions, their exact etiology is not fully understood. This motivates research into the complex biomechanics of the vocal fold in order to better understand the mechanisms leading to edema. Recent advancements in modern computing allow computational modeling of the vocal fold in order to gain insight into this pathology. Here, a biphasic finite element model is proposed in order to study the movement of fluid within the vibrating vocal fold. By monitoring stress and flow, we hope to improve our understanding of edema and related trauma. Preliminary results indicate that significant fluid accumulation towards the midline of the vocal fold occurs due to vibration.

## **USING MICRO SATELLITE MARKERS TO DETERMINE GENETIC DIVERSITY IN HYLES LINEATA FROM ARIZONA AND WISCONSIN**

Patrick Van House, Jillian Henss (Mentor), Entomology

Understanding the amount of genetic diversity within and between populations of a pollinator species is an important aspect in understanding how populations interact with each other and can potentially provide insights into how pollinators move pollen through the landscape. Microsatellites are short segments of DNA consisting of repeating nucleotide sequences that can be used as genetic markers to tell us how closely related individuals are to one another, as well as quantify the genetic diversity within and between populations. In this study we identified microsatellites for *Hyles lineata* from populations in Arizona and Wisconsin. These markers will be used to determine how genetically distinct populations from these two states are, and in future studies to examine finer scale patterns of genetic diversity within *H. lineata*.

## **LEARNING THROUGH DESIGN: ARIS**

Rachelle Vang, David Gagnon (Mentor), Academic Technology

This project represents four case studies conducted across two distinctly different undergraduate courses where learners used media as a tool to build their own location-based mobile narrative experience. Our goal is to better understand how to facilitate a learning through design process using ARIS, an open source tool for creating mobile, locative games, narratives, and field research activities (Holden, Gagnon, Litts, & Smith, 2013). Using a Design Based Research (Brown, 1992; DBRC, 2003) methodology we altered the instructional approach across four iterations in order to explore the relationships between the design tools, design process, and content. We hope to use our findings to inform the development of future design projects.

## **MEDICAL DEVICE AWARENESS IN A HOSPITAL SETTING**

Priya Varghese, Peter Van Beek, Christopher Crnich (Mentor), Medicine

Hospitalized patients with central venous catheters (CVCs) and urinary catheters are at substantial risk of developing device-related infections. Failure to review the need for these devices during medical round meetings may contribute to their delayed removal and increase risk of infection. The purpose of this research project was to determine the frequency of discussion on presence and necessity of medical devices. Members of our research team shadowed teams of doctors in round meetings, and entered the frequency and extent of device discussion in patients into a structured database. Results will be analyzed alongside duration of patient device use. Significance of results and their correlation with prolonged device use may prompt Medical Device Awareness programs and decrease unnecessary device use, yielding lower infection rates in patients.

## **TERRITORIAL CONFLICT AND THE ROLE OF ETHNICITY**

Leo Vartorella, Alli Abolarin, Chet Edelman, AJ Minucci, Andrea Quade, Nadav Shelef (Mentor), Political Science

The research I have done for Professor Nadav Shelef examines how border conflicts between nations relate to the ethnic demographics of disputed territories. To determine this relationship, our research team is in the process of tracking the demographic trends of every region involved in a border dispute since 1945. Once all this information is collected, the relationship between changes in ethnic demography and inter-state conflict can be evaluated. With over 300 hundred cases to be examined, there is much work to still be done, but hopefully this research will help us better understand why nations go to war.

## **ACHIEVING A VERSATILE MOUSE MODEL FOR SCREENING NEURONAL DEVELOPMENT**

Dimitar Vassilev, Yina Xing (Mentor), Waisman Center

Transgenic mice (tg) models for screening adult neurogenesis have been successfully used in short-term studies; however, there is still a lack of a comprehensive and versatile method that allows testing neuronal fate over extended periods of time. To overcome this hurdle, we aim to create transgenic DCX-CreAi14 homozygous mouse line containing tdTomato, a fluorescent protein especially effective in marking and tracking the development of immature neurons. The core of this transgenic model lies in the expression of the DCX (doublecortin) neuronal progenitor marker, a protein expressed by immature neurons in the central nervous system (CNS), making it a powerful tool for monitoring the fate of adult neural stem cells. Moreover, it increases the potential for deliberate manipulation of gene expression.

## **ENGINEERING RIBONUCLEASE INHIBITOR VARIANTS TO RESIST OXIDATION AND MAINTAIN FUNCTION**

Quinn Vatland, Ronald Raines (Mentor), Biochemistry

Ribonuclease inhibitor (RI) is a cytosolic protein that protects cells against ribonucleases (RNases), a class of enzymes that degrade cellular RNA. RI is commonly used in the laboratory to protect RNA from degradation by RNases. Human RI is composed of 32 cysteine residues that are highly susceptible to oxidation in a cooperative manner, which inactivates RI. Creation of a RI hybrid that is resistant to oxidative damage, yet maintains avidity to RNases will be valuable for RNA research and understanding cellular protection. To test our hypothesis, we combined different segments of wild-type and cysteine-free RI to produce four hybrid RI. The hybrids have biotin tag which can be purified by biotin-streptavidin system. Purified hybrid RI will be examined for their oxidative resistance and binding properties.

## **DETERMINING THE MECHANISM OF COLOCALIZATION OF RIBOSOMAL RNA OPERONS IN E. COLI**

Andrew Vogel, Richard Gourse (Mentor), Bacteriology

The Gourse laboratory discovered that E. coli ribosomal RNA operons come together in space within the bacterial nucleoid. This colocalization was quantified by inserting DNA fragments into the chromosome that bind to fluorescently labeled proteins and measuring the distances between the fluorescent foci using microscopy. I have been helping to determine the mechanism responsible for colocalization by testing effects of various chromosomal mutations. I found that certain deletions in the promoter region of ribosomal RNA operons resulted in loss of colocalization, although eliminating transcription does not affect colocalization. Current research is being conducted to determine which segment of the promoter region is responsible for the lack of colocalization in order to help understand the organization of DNA within the nucleoid.

## **DETERMINING THE ROLE OF TRANSLATION DURING THE CELL CYCLE IN C. ELEGANS EMBRYOS**

Alex Villarreal, Megan Gnazzo, Ahna Skop (Mentor), Genetics

Cell division is one of the most basic events required by all living organisms to accomplish growth, repair, and reproduction. Because this process is so vital, the smallest defects in cell division can lead to complications in cells such as becoming multinucleated, which is a driving factor behind tumor formation and conditions like cancer. It has been thought that translation within cells is temporarily inhibited during cellular division and rapidly resumes within each daughter cell immediately upon entering the G1 phase of the cell cycle (Sivan, 2008). However, several RNA-binding proteins have been identified, such as CAR-1, that function during cytokinesis (Squirrell, 2005). How CAR-1 is functioning during the cell cycle is unclear, although we suspect that CAR-1 could mediate the translation of localized mRNAs during cell division. The goal of this project is to determine if translation is necessary during the cell cycle in early *C. elegans* embryos. We plan to determine the critical concentrations of translation inhibiting drugs (puromycin and cyclohexamide) on permeable *C. elegans* embryos. We will then visualize the treated embryos using in vivo video microscopy to determine the cellular consequences of these drugs. We are particularly interested in observing cell division and cell cycle defects. This research may provide evidence that translation plays a role during the cell cycle. Sivan, G., & Elroy-Stein, O. (2008). Regulation of mRNA Translation during cellular division. *Cell Cycle*, 7(6), 741-744. Squirrell, J. M. (2005). CAR-1, a Protein That Localizes with the mRNA Decapping Component DCAP-1, Is Required for Cytokinesis and ER Organization in *Caenorhabditis elegans* Embryos. *Molecular Biology of the Cell*, 17(1), 336-344.

## **GREAT LAKES STORIES: USING STORY MAPS TO COMMUNICATE THE IMPACT OF WISCONSIN SEA GRANT**

Joel Villarreal, David Hart (Mentor), Aquatic Sciences Center

In order to help conserve the Great Lakes, our research is seeking to bridge a connection of familiarity between people and the resource. The Wisconsin Sea Grant Institute has many outreach programs and research across the state. My project involved researching innovative methods to communicate the impact of Sea Grant's efforts through a more interactive way with the user. Story maps are interactive web maps that are intertwined with multimedia to tell a story. With the Wisconsin Sea Grant Story Map Shortlist, we hope to provide new and interesting information to promote stewardship of the Great Lakes.

## **CHARACTERIZING DOPAMINERGIC NEURON LOSS IN DROSOPHILA SCARLET MUTANTS**

Katherine Waldeck, Daniel Babcock (Mentor), Genetics

Parkinson's Disease is a debilitating disease that causes a progressive loss of motor coordination due to the degeneration of dopaminergic neurons in the brain. A significant amount of progress investigating Parkinson's has been made, but much is still not known about what occurs at the cellular and molecular level. *Drosophila* models mimicking Parkinson's Disease in humans have provided much insight into this disease and the subsequent dopaminergic neuron loss that the disease produces. In order to further investigate the genetic basis behind this dopaminergic neuron loss in Parkinson's, I performed a screen last semester on various mutant flies for loss of dopaminergic neurons. The screen revealed a gene, scarlet, previously known only to be responsible for eye pigmentation in flies. This year, I propose to characterize this scarlet gene and identify its unknown effects on the fly. The characterization of this gene involves the testing of scarlet mutants' lifespan, behavior, and other functions. I also plan on investigating whether other populations of neurons are lost in scarlet and other eye pigment mutants. The characterization of this gene will provide more insight into dopaminergic neuron loss in Parkinson's and the genetic basis behind it.

## **PSYCHOLOGICAL SCIENCE APPLIED TO ANIMAL WELFARE**

Aubrey Waldron, Mackenzie Dutton, Allyson Bennett (Mentor), Psychology

The refinement of animal husbandry, care, and enrichment practices continues to promote better animal welfare across many settings where nonhuman animals are housed. Scientific study of care practices is important to provide empirical evidence to inform decisions and best practices to promote the health and well-being of animals in captivity. There is currently a lack of data comparing common best practices across facilities. Therefore, we evaluated the content of federally-mandated environmental enrichment plans at facilities housing nonhuman primates in order to provide initial data and identify community standards. Of the 77 facilities surveyed, 13 have returned plans thus far: three from zoos, four from sanctuaries, and six from research facilities. Initial comparison has shown a wide variation of content and practices of enrichment between facilities.

## **BRIDGING THE GAP**

Leah Walker, Eric Bahr, Emily Baranek, Shannon Behling, Rebecca Breitlow, Jeri Jo Cassidy, Victoria Enriquez, Hannah Hayes, Sarah Hinde, Jordan Hollenbeck, Katja Kane-Foempe, Allyson Kowaleski, Lauren Lawson, Alejandra Lira, Bryanne Sekeres, Megan Van Boxtel, Yvette Egan (Mentor), Nursing

Bridging The Gap is a community-based project where student nurses at University of Wisconsin-Madison were paired with an elder in Madison. This partnership facilitated a client-focused therapeutic relationship. Students developed communication and assessment skills while combating biases related to the elderly. Assessments were performed to evaluate mobility, nutrition, cognitive ability, and spirituality. The assessments provided the opportunity to discuss difficult subjects in a safe environment. A survey about attitudes towards the elderly was taken by the students before and after the project that revealed a change in beliefs about memory loss, pain related to aging, and confidence caring for older adults. Meaningful relationships were formed in which the elder and student learned from each other, bridging the age and societal divide between these diverse groups.

## **INBREEDING, LOW GENETIC DIVERSITY AND LOW SPATIAL GENETIC STRUCTURE IN TWO HAWAIIAN LOBELIADS**

Kelly Wallin, John Brennan, Antonio Del Valle, Aidee Guzman, Heather Jennings, Stephaney Olson, Thomas Givnish (Mentor), Botany

The endemic lobeliad genera *Cyanea* and *Clermontia* (Campanulaceae) are among the largest in the native Hawaiian flora, and contain large numbers of endangered taxa. We used RAD markers to estimate genetic variation and spatial genetic structure in single populations of two common species, *Cyanea pilosa* and *Clermontia fauriei*. We found low levels of heterozygosity, consistent with studies of other island plant species, and high levels of inbreeding. Spatial genetic structure was limited for both species. The relative dearth of genetic diversity and high levels of inbreeding in these common lobeliads may reflect selfing in response to a decline in native avian pollinators, raising concerns that inbreeding and loss of genetic variation may be even more severe in rare species of this diverse but endangered group.

## **CHARACTERIZATION OF NON-PLASTIDIC AROGENATE/PREPHENATE DEHYDROGENASE ACTIVITY IN THREE PLANT SPECIES**

Kelly Wallin, Hiroshi Maeda (Mentor), Botany

Tyrosine and the natural products derived from it are essential to both plants and animals. Two pathways for tyrosine synthesis are known, via arogenate dehydrogenase (ADH) or prephenate dehydrogenase (PDH). Canonically, plants utilize tyrosine-inhibited ADH enzymes located in the chloroplasts. Phylogenetic analysis of putative plant ADH/PDH enzymes revealed genes from leguminous and non-leguminous species that form a clade predicted to be localized to the cytosol and separate from canonical ADH sequences. Although some legume enzymes have been shown to be bona fide PDHs, the function of non-legume homologs is unknown. Thus, this study accessed the activity of purified proteins coded by putative non-canonical ADH/PDH genes from three plant species. These enzymes could represent novel enzymes responsible for the production of secondary metabolites derived from the tyrosine pathway.

## **COOPERATIVITY OF N TO PI-STAR INTERACTIONS**

Kelly Wallin, Ronald Raines (Mentor), Biochemistry

A variety of noncovalent interactions drive protein folding. Among these are attractive  $n \rightarrow \pi^*$  interactions between consecutive carbonyl groups in the amide backbone of proteins and polypeptides. Carbonyl groups participating in such interactions have a unique orientation similar to that seen in nucleophilic attack, and can be assayed using NMR spectroscopy and X-ray crystallography. Although  $n \rightarrow \pi^*$  interactions are relatively weak ( $\sim 0.27$  kcal/mol), their high prevalence could mean a significant contribution to protein stability. Additionally, a carbonyl accepting an  $n \rightarrow \pi^*$  interaction should be more likely to act as an  $n \rightarrow \pi^*$  donor (“cooperativity”). This study sought to assess the potential for cooperativity between  $n \rightarrow \pi^*$  interactions in diproline-based model systems using NMR and X-ray crystallography.

## **PATTERN AND CORRELATES OF HUMAN-WILDLIFE CONFLICT INVOLVING MESOPREDATORS IN RURAL NORTHERN TANZANIA**

Eric Walsh, Lisa Naughton (Mentor), Geography

In rural Northern Tanzania, the involvement of small carnivores, crows, and raptors in human-wildlife conflict is not well understood. Our research sought to bridge the existing information gap of mesopredator conflict by surveying community members about the amount of conflict they have and what they do to prevent it. We surveyed 368 households about 9 different animal species in an area that spans two unique ecosystems. We found that the number of poultry per household was the variable most likely to increase perceived conflict and the subject having some level of secondary education was the variable most likely to decrease perceived conflict. Most interestingly, we found that dogs, the second most commonly used method to prevent conflict, actually increased perceived conflict in 6 of 11 models.

## **METABOLIC ENGINEERING OF LACTOBACILLUS CASEI 12A FOR PRODUCTION OF PURE LACTIC ACID**

Di Wang, Jessie Heidenreich (Mentor), Food Science

Lactobacillus casei 12A is a strain of heterofermentative lactic acid bacteria that produce a mixture of D- and L-lactic acid. Pure L-lactic acid is essential for the production of polymers, liquid crystal, food preservatives, emulsifiers, etc., and it is tedious to isolate pure L-lactic acid from the lactic acid mixture. This study aims to obtain pure L-lactic acid by engineering the metabolic pathway of Lactobacillus casei 12A. The wild type L. casei 12A and three mutants L. casei 12A xylABT, 12A xylABT xpk::tkl, and 12A xylABT xpk::tkl dHic will be created and grown in three different media: xylose solution, glucose solution, and xylose-glucose mixture. The metabolites will be analyzed by HPLC.

## **MECHANICAL BEHAVIOR OF POLYURETHANE STABILIZED FOULED BALLAST (PSFB)**

Liangquan Wang, James Tinjum (Mentor), Geological Engineering

According to Federal Railroad Administration, the total length of Class 1 railroads decreased 42% while the traffic increased 93% between 1980 and 2008. With increased operations, the track quality decreases from repeated loading and other mechanisms. One of these mechanisms is fouling, which is the accumulation of fine grained soil within the substructure of the railroad. Increased traffic density facilitates more fouling and deformation. The objective of this research is to reduce maintenance and the effect of fouling by rigid polyurethane injection. Different fouling materials and ballast types were explored using cyclic triaxial, unconfined compression and flexural testing. Results have shown that polyurethane injection into fouled ballast is effective for increasing the resistance to permanent deformation.

## **BRINGING LIGHT TO FORGOTTEN REPERTOIRES OF THE GERMAN BAROQUE**

Duangkamon Wattanasak, Jeanne Swack (Mentor), Musicology

This research project investigates the nature and the process of critical editing of early music and its relationships to textual criticism and philology. The research also examines the influences of different editions (e.g. critical vs. performance) on performers' perception and interpretation of a musical work. Through an integration of both of the above studies, I will prepare a critical edition of music from manuscript sources. The chosen manuscripts are works by German composers written between 1600-1800 that have never been edited or published in modern notation. This project results in a well-researched and practical text suited for both performance and study. Performances of the works will be given to introduce the public to these repertoires.

## **INNOVATIVE WASTEWATER TREATMENT WITH ANAEROBIC AMMONIUM OXIDIZING BACTERIA**

Coty Weathersby, Christopher Lawson (Mentor), Environmental Engineering

This research applies anaerobic ammonium oxidizing (anammox) bacteria to remove nitrogen from municipal wastewater. Anammox bacteria are of biotechnological interest because they shortcut the nitrogen cycle, converting ammonium and nitrite to nitrogen gas without oxygen. Current practice employs anammox bacteria to treat digester supernatant at high temperatures (35°C) and ammonium concentrations (900 mg/L); however, anammox application for mainstream treatment has been limited because of these organisms slow growth rate. Here, sequencing batch reactors were operated at 15 °C with low ammonium concentrations (30 mg/L) to adapt anammox bacteria to mainstream wastewater treatment conditions. Process chemical measurements were used to monitor anammox process performance. Resulting experiments will demonstrate the feasibility of using anammox bacteria for mainstream wastewater treatment, creating more sustainable and energy efficient environmental biotechnologies.

## **ABCG2 LINEAGE TRACING TO IDENTIFY VOCAL FOLD-SPECIFIC PROGENITOR CELLS IN A MOUSE PROGENY MODEL**

Alice Wei, Nathan Welham (Mentor), Surgery

Tissue-specific progenitor cells can self-renew and differentiate and may contribute to tissue regeneration and repair in the vocal fold. These cells can be identified via their nuclear efflux phenotype, which is conferred by ATP-binding cassette transporters including *Abcg2*. The purpose of this study was to better characterize *Abcg2*-expressing progenitor cells in the vocal fold by identifying: (i) possible lineage patterns over time and (ii) regional localization to a micro-anatomic niche. Using genetic lineage tracing, *Abcg2*<sup>+</sup> cells and their progeny were traced over time in mouse vocal folds. The transgenic model had a DNA rearrangement in the *Abcg2* gene, allowing activation of LacZ following tamoxifen-induced Cre-lox recombination. Larynges were harvested 0.5, 1, 3 and 6 months post tamoxifen administration and *Abcg2* lineage cells were labeled using X-gal staining. The quantity and location of *Abcg2* lineage cells in sub-sites of the epithelium, lamina propria, and thyroarytenoid muscle were recorded and mapped with stereology. No significant *Abcg2* expression was found in the epithelium. In the lamina propria, expression was highest at 0.5 months but increased from 1 to 3 to 6 months. In the thyroarytenoid muscle, expression decreased from 0.5 to 1 month and increased from 1 to 3 months. Similar regions of micro-anatomic localization were observed within the lamina propria across all time points. Vocal fold *Abcg2* lineage cells may exist within micro-anatomic niches, particularly in the lamina propria, and exhibit particular lineage patterns over time.

## **SYNTHESIS AND SUPPORT EFFECTS ON PTMO ACTIVITY FOR WATER-GAS SHIFT**

Thejas Wesley, James Dumesic (Mentor), Chemical Engineering

The Water-Gas Shift (WGS) reaction is industrially ubiquitous and vital in producing hydrogen. While traditional WGS catalysts are prone to deactivation, platinum nanoparticles are highly active and stable when supported on a reducible metal oxide. We have applied a novel, highly controlled bimetallic catalyst synthesis to study molybdenum promotion of platinum for WGS. Molybdenum increases platinum reactivity by three orders of magnitude, although this promotion is highly dependent on Mo:Pt ratio. A silica support also promotes the reaction. Additionally, similar reactivities between controlled synthesis and traditional impregnation catalysts suggest molybdenum is highly mobile on the catalyst support during reduction. This result is substantiated by STEM micrographs. The synthetic knowledge obtained here may have implications for developing future catalysts and elucidating WGS surface chemistry.

## **A REEL CONVERSION: HOW VIEWING LEFT BEHIND PROLONGS THE EVANGELICAL CONVERSION RITUAL**

Kurt Wieters, Corrie Norman (Mentor), Religious Studies

This research analyzes the religious dimensions of the most recent Left Behind film. For certain Evangelical Christians, viewing the Left Behind film prolongs the efficacy of the conversion/commitment ritual that is so crucial to Evangelical Christianity. This research will explore theories of film and religion in order to understand the ritual dimension of film, it will look at the use of media within Evangelical Christianity, as well as the function of apocalyptic rhetoric within the Evangelical community.

## **READING THE TRACES: USE-ALTERATION ANALYSIS OF BRONZE AGE POTTERY FROM KLAZOMENAI, TURKEY**

Tasia Williams, William Aylward (Mentor), Classics

This study examines the function and use of Bronze Age cooking pots found near the archaeological site of Klazomenai in modern-day Turkey. Use-alteration analysis is employed in order to determine if a small sample of cooking pottery found in burial contexts was used for cooking before being deposited or was made only as a grave good. Similar to the use-wear analysis employed to study traces on lithic tools, use-alteration analysis examines abrasion and other traces left behind as the result of use. This study has implications not only for chemical residue analysis of pottery, but also for the study of the rituals surrounding the burial of the dead in Bronze Age Turkey.

## **COMPLICATIONS OF COLLECTIVE MEMORY IN PERU: A HISTORY OF MARGINALIZATION, AN ATTEMPT AT INCLUSION**

Alex Wills, Ksenija Bilbija (Mentor), Spanish & Portuguese

Since the early 2000s, Peru has seen numerous memorials dedicated to the lives lost in the Peruvian internal conflict (1980s–2000s) between the Maoist Guerrilla group Shining Path and the government. Two sites — one amidst where the atrocities took place and the other in an upper scale neighborhood of Lima — highlight a lingering tension. Complications of collective memory are evident in issues such as whether or not to repress memory, how exactly to remember, and if we are remembering something that is truly in the past. Social injustice remains amongst the Peruvian people and threatens an inclusive collective memory. It is evident that the memory sites address this problem differently — one being an academic arena and the other set to directly serve victims.

## **QTL ANALYSIS OF ANTHOCYANIN EXPRESSION IN B. RAPA**

Max Wilson, Jaffna Mathiapparanam, John Riley, Scott Woody (Mentor), Biochemistry

Anthocyanin pigmentation is used as a quantitative trait to study genetics in educational settings. We are conducting a Quantitative Trait Locus (QTL) analysis to identify the genes involved in expression of anthocyanin pigments in hypocotyls of rapid-cycling *Brassica rapa*. Relative pigment intensities will be assessed using a colorimetric swatch that pilot experiments suggest will span the range of values observed among two *B. rapa* recombinant inbred populations. Candidate loci identified through QTL analysis will be evaluated by sequence comparisons of *B. rapa* and *Arabidopsis thaliana* gene models and functional annotations in anticipation that we will discover loci that are likely responsible for the heritable response to selection imposed by students in the course of widely-used laboratory exercises.

## **IDENTIFYING ACTIVE BLACK HOLES IN NEARBY GALAXIES**

Jennifer Witt, Andrew Hauser, Christina Tremonti (Mentor), Astronomy

Astronomers identify black holes by looking for high energy radiation emitted by infalling matter. We are using data from the MaNGA (Mapping Nearby Galaxies at APO) project to look for active black holes in the centers of nearby galaxies. We have developed numerous emission line diagnostics to enable us to identify galaxies with active black holes. A unique feature of MaNGA is its spatial resolution which has allowed us to better separate gas that is ionized by a black hole from gas ionized by other processes such as shocks associated with galaxy mergers. Surprisingly, we find that a large portion of galaxies that were thought to host accreting black holes may be powered by other mechanisms.

## **TRIGGERING CELL FATE CHANGES WITH ARTIFICIAL TRANSCRIPTION FACTORS (ATF)**

Matthew Wleklinski, Asuka Eguchi (Mentor), Biochemistry

Transcription factors play vital roles regulating cell fate and function. Identification of master regulators that determine cell fate can be useful for therapeutic and research purposes. However, the discovery of these master regulators can be difficult and cost-prohibitive if candidate genes are tested by trial and error. The purpose of this project was to develop a method for discovering novel regulators that determine cell fate using an artificial transcription factor (ATF) library capable of activating thousands of genes. This library was tested in the context of reprogramming mouse embryonic fibroblasts to induced pluripotent stem cells. Identified ATFs capable of turning on Oct4, a marker of pluripotency, were validated. The targets of the ATFs will provide insight on the transcriptional networks that guide cells towards pluripotency.

## **NEUROBLASTOMA TUMOR CELL CLEARANCE AFTER CLR1404 TREATMENT**

Matthew Wolf, Dana Baiu (Mentor), Pediatrics

Among pediatric cancer patients, neuroblastoma is the most common extracranial solid tumor and is responsible for one in every eight pediatric cancer deaths. With aggressive therapies lasting up to one year for most patients, still less than one third of children are likely to achieve long-term cure. Furthermore, patients remain at risk for developing long-term complications and second malignancies as a result of their initial treatment. Thus, less invasive, more targeted treatments are necessary to minimize the impact on overall health. CLR1404, an alkylphospholipid, is a promising anti-cancer agent that selectively localizes and possibly interferes with signaling in neuroblastoma tumors. The effect of CLR1404 on tumor growth rate *in vivo* has been studied in the lab of my mentor, Dr. Otto, with encouraging results. To further this investigation, this project aims to determine if CLR1404 induces transcription of genes coding for tumor clearance signals (aim 1). Additionally, expression of clearance signal proteins after CLR1404 treatment in tumor cells will be tested (aim 2). The results of this study will build upon past knowledge of alkylphospholipids, current ongoing studies, and clinical trials, with the intention of eventually proposing CLR1404 as an alternative, less invasive, more targeted therapy.

## **A NEW METHOD FOR COPPER-CATALYZED AEROBIC OXIDATION OF BIDENTATE SUBSTRATES**

Tianyao Wu, Scott McCann (Mentor), Chemistry

Copper-catalyzed methods for aerobic oxidation of C-H bonds have been the focus of growing attention. (bpy)Cu/TEMPO/NMI catalyst system has been proved to promote efficient aerobic oxidation of sterically unhindered alcohols. However, substrates with phenol substituents and bidentates were proved to be less reactive and have low conversion rate of the starting material. We tried to find a new Cu catalyst system with high conversion rate of alcohol bidentates and also with high economical value.

## **CHERENKOV TELESCOPE ARRAY: A NEXT-GENERATION TELESCOPE FOR VERY-HIGH-ENERGY GAMMA RAY PHOTONS**

Tianyao Wu, Colin Adams, Justin Vandenbroucke (Mentor), Physics

The Cherenkov Telescope Array (CTA) is a next-generation ground-based gamma-ray instrument. CTA builds on the technique of detecting gamma-ray induced particles in the atmosphere through Cherenkov radiation. Currently the CTA Consortium consists of over 1,000 scientists. CTA will detect gamma ray photons between 30 GeV and 300 TeV, the highest energy photons ever detected. This information can be combined with data from other telescopes like Fermi and IceCube. Since the electronic signal from Cherenkov radiation is only a few nanoseconds long, the information has to be stored in a silicon chip for a short time. We present results from the TARGET 7 chip, which we are using to build a prototype telescope for CTA.

## **CULTURAL AWARENESS IN MENTORING RELATIONSHIPS**

Jessica Wu, Patrice Leverett (Mentor), Educational Psychology

The effectiveness of mentoring relationships are often complicated by cultural diversity factors that are commonly not addressed in science disciplines. The purpose of this research is to investigate the role that cultural diversity awareness (CDA) plays in mentoring relationships in the biological sciences by using a phenomenological analysis of 60 interviews split between mentors and mentees. From the interview data, CDA will be defined in the biomedical mentoring relationship and measures for CDA will be created from the student and mentor perspective to determine the impact of current mentoring training on CDA. Ultimately, this study will allow for the creation of more effective training methods for mentors in terms of cultural awareness.

## **CHANGE IN ELASTIC MODULUS IN NONPREGNANT SHEEP UTERINE ARTERIES IN RESPONSE TO LEPTIN**

Jeannaej Rochelle Yambing, Vladimir Vargas (Mentor), Obstetrics & Gynecology

In the ovarian cycle, the follicular phase has elevated estrogen and uterine blood flow mediated by uterine artery (UA) remodeling, compared to the luteal phase. We hypothesized the modulus during the follicular phase decreases in response to ex vivo Leptin treatment vs. the luteal phase in sheep. UAs were collected from luteal and follicular phases and treated overnight with or without 1 ng/ml of Leptin. UAs were then cannulated and incrementally pressurized from 0 to 120 mmHg. Inner, outer diameter, and axial length measurements were taken to calculate longitudinal and circumferential modulus. Leptin treatment resulted in a significant decrease in longitudinal modulus for follicular UAs. Circumferential modulus was the same between phases. The results show that Leptin may play a key role in UA remodeling.

## **PATIENCE AND ALTRUISM OF PARENTS: IMPLICATIONS FOR CHILDREN'S EDUCATION INVESTMENT**

Jinghao Yang, Steven Durlauf (Mentor), Economics

Investment in education by parents is a key factor in their children's skill formation and hence lifetime outcomes. Parents' investment decisions are affected by various factors, including their levels of patience and altruism. This paper starts with a two-period version of the Becker and Tomes (1986) framework on intergenerational investment optimization. We particularly focus on households' optimal investment ratio in their children across periods using the technology of skill formation developed in Cunha and Heckman (2007). This paper estimates the skill formation technologies and investigates the effects of parents' patience and altruism levels on their investment decision by simulation. We find that, conditional on family income level, the ratio of parents' optimal investment level between two childhood periods decreases as either their patience or altruism increases; however, the decrease caused by patience is larger than that triggered by altruism.

## **PROTECTIVE EFFECTS OF SIGMA RECEPTOR LIGANDS IN ARPE19 CELLS**

Annie Yao, Lianwang Guo (Mentor), Surgery

Age-Related Macular Degeneration (AMD), a common cause of central vision loss, is primarily caused by the death of retinal pigment epithelial (RPE) cells. This study investigates the protective effects of sigma receptor agonists against oxidative stress in RPE cells. Sigma-1 receptor is known to promote cell survival but has not been studied in RPE cells. By photobleaching, we confirmed the presence of the sigma-1 receptor as well as the less studied sigma-2 receptor in RPE cells. We found that among sigma-1 agonists PRE-084 produced the best protective effect. PB28, a sigma-2 ligand, was also found to be protective. Our preliminary results suggest that sigma receptors may provide potential new targets for treating AMD.

## **THE PERCEPTIONS OF ENVIRONMENTAL SERVICES STAFF REGARDING ULTRAVIOLET LIGHT DISINFECTION**

Brianna Young, Nasia Safdar (Mentor), Medicine

As hospital acquired infections become increasingly common in the healthcare setting, many institutions are implementing hands-free disinfection technology such as ultraviolet light machines. However, studies neglect to collect data on the perceptions and procedures of environmental services staff with this new technology. We conducted a survey amongst Xenex-users at UW-Madison Hospital and Clinics to examine the perceptions and self reported practices regarding the ultraviolet disinfection system (Xenex®). Our study focused on the perceptions of the front-line workers. In conclusion, we found that the Xenex UV-light disinfectant machine poses a number of barriers for the environmental services staff that operate the machine. The frontline workers at UW Hospital and Clinics noted that the biggest barrier of the Xenex machine is the frequency of breakdowns.

## **OXYGEN UPTAKE EFFICIENCY SLOPE MEASURES CARDIORESPIRATORY FITNESS AND PREDICTS ALZHEIMER BIOMARKERS**

Sherman Yu, Ozioma Okonkwo (Mentor), Medicine

Peak oxygen uptake (peakVO<sub>2</sub>) is the gold standard measurement of cardiorespiratory fitness (CRF). However, peakVO<sub>2</sub> is seldom attained in older populations during graded exercise testing (GXT) due to motivational factors and other limitations. Therefore, the objective of this study is to determine the effectiveness of Oxygen Uptake Efficiency Slope (OUES) as a submaximal measurement of CRF and its capacity to predict Alzheimer's disease (AD) biomarkers. This study will obtain data regarding OUES and peakVO<sub>2</sub> using GXT. The association between OUES and peakVO<sub>2</sub> will be examined to determine the efficacy of OUES as a measurement of CRF. Lastly, both OUES and peakVO<sub>2</sub> will be correlated with AD biomarkers, such as cerebrospinal fluid  $\beta$ -amyloid<sub>42</sub>, to determine their relative potential for tracking AD pathophysiology.

## **EVALUATION OF NRAS Q61R AND MAPKX AS CANDIDATES FOR INDUCING LYMPHOMA**

Grant Yun, Zhi Wen (Mentor), Oncology

Establishing gene-modification based mouse models of lymphoma have significantly improved the treatment and care of patients. This study takes advantage of oncogene NRas Q61R expression and the deletion of a specific Mitogen-activated Protein Kinase (MAPKx) which has been hypothesized to induce and accelerate growth of lymphoma/leukemia. 100% of mice with both Q61R and MAPKx modification have shown signs of b-cell lymphoma including splenomegaly and enlarged lymph nodes while mice only with Q61R have shown decelerated tumor growth and mice with only MAPKx deletion have shown no tumor growth at all. This study will provide a fast and stable mouse model of lymphoma, favoring new drug development and test of new treatment.

## **RECOVERY OF FUNCTIONING FOLLOWING HEMATOPOIETIC STEM CELL TRANSPLANT**

Cassandra Zahn, Erin Costanzo (Mentor), Psychiatry

We investigated the recovery of cancer patients' functioning following hematopoietic stem cell transplantation (HSCT). Allogeneic and autologous HSCT recipients (N=483) completed measures of physical functioning and fatigue and pain interference with activities at 1, 3, 6, and 12 months post-HSCT. Among allogeneic recipients, physical functioning decreased from pre-HSCT to 1 month ( $p > .001$ ) and increased from 1 to 3 months post-HSCT ( $p > .001$ ). Fatigue and pain interference increased from pre-HSCT to 1 month ( $p > .001$ ;  $p = .027$ ) and fatigue decreased from 1 to 6 months post-HSCT ( $p > .01$ ). Autologous recipients showed similar patterns. 13.3% and 31.9% of patients returned to work by 6 and 12 months, respectively. Results indicate that functioning improves between 1 and 6 months but deficits in functioning and ability to work persist for the first year.

## **IMPACT OF FLANKING RESIDUE MODIFICATIONS ON BINDING SPECIFICITY OF H3K9 METHYLATION READERS**

Michael Zaiken, Rupa Sridharan (Mentor), Cell & Regenerative Biology

Somatic cells can be converted to an embryonic stem cell (ESC)-like state by transcription factor-mediated reprogramming. Chromatin modification plays a role in maintaining the plasticity of pluripotency. Histone modifications are recognized by reader proteins for downstream function. The recognition and binding by the reader protein to a specific site can be influenced by modifications on flanking amino acid residues. High levels of Histone H3 lysine 9 methylation (H3K9me) is a barrier to the late stage of reprogramming. We are interested in the impact of flanking residues on the binding of Dppa3 and HP1 isoforms, proteins important to reprogramming, to the H3K9 methylation site. To this end, we have determined the impact of flanking residue modifications to these proteins binding specificities using a histone peptide array.

## **THE EFFECT OF CUMULATIVE DISEASE ON POST-WEANING WEIGHT OF PURE-BRED HOLSTEIN DAIRY HEIFERS**

Gabriela Zaldumbide, Melissa Cornett (Mentor), Dairy Science

Robotic feeding systems (RFS) increase disease risk for dairy calves. This study examined the impact of cumulative disease on post-weaning wt (66D, FW) in RFS calves (n=96). Data derived from calves on a 2X2 factorial direct-fed microbial (DFM), milk nutrition study (slow/fast). Health (Diarrhea, Navel, Fever, and Respiratory) and weight parameters were collected bi-weekly. Data was analyzed using PROC MIXED in SAS. FW was Mean $\pm$ SD (95.47 $\pm$ 13.85 kg, 90.48 $\pm$ 11.18 kg, 93.67 $\pm$ 11.64 kg, 96.39 $\pm$ 12.52 kg) for slow/fast placebo and slow/fast DFM, respectively. Diarrhea, fever, initial weight (IW) and final age significantly impacted FW. Respiratory\*fever interaction and navel tended for significance. For each additional event, calves were Mean $\pm$ SD (-1.37 $\pm$ 0.62 kg), (-3.59 $\pm$ 1.30 kg), and (-6.74 $\pm$ 2.79 kg) lighter for diarrhea, fever, and Respiratory\*fever, respectively. Results suggest cumulative disease impacts calf FW.

## **BEHAVIORAL AND NEURAL INVESTIGATIONS OF THE LINKS BETWEEN SYMBOLIC NUMBER REPRESENTATIONS**

Abigail Zellner, Edward Hubbard (Mentor), Educational Psychology

Previous studies have indicated that numerous animal species and human infants have the ability to discriminate the numerosity of various non-symbolic representations. However, the neural mechanisms that link symbols to magnitudes are still unclear. In an fMRI study, participants were repeatedly presented with non-symbolic stimuli that habituated neurons to either quantities of six or eight. Deviant stimuli depicted as either dots or digits ranging from five to nine were displayed and neuronal response was measured. We hypothesized that neurons in the intraparietal sulcus (IPS) would respond more strongly to deviant rather than habituating stimuli, independent of notation. We compared the precision of this representation as measured behaviorally with neural responses to determine whether individual differences in acuity assessed behaviorally relate to neural differences in acuity.

## **IMPROVING THE SENSORY CHARACTER OF SOYMILK BY DECREASING LEVELS OF VOLATILE CARBONYL COMPOUNDS**

Bingxin Zhang, Michael Maranan, Davin Marta, Scott Rankin (Mentor), Food Science

The purpose of this experiment is to improve the sensory character of soymilk through the reduction of volatile carbonyl compounds such as hexanal. In this experiment, we remove various levels of hexanal through chemical reactions with  $\beta$ -cyclodextrin and whey protein hydrolysates. The  $\beta$ -cyclodextrin molecule can bind with hexanal through hydrophobic interactions, thus hexanal loses its volatility. Under the right circumstances, amino groups from whey protein hydrolysate can react with the carbonyl group from hexanal and form a non-volatile imine, thus reducing the ability of hexanal to influence aroma. The reduction of volatile hexanal concentrations is measured by GC-MS. Both of these methods have shown to be effective to remove hexanal compounds. In conclusion, our research provides insights for improving the sensory character of soymilk.