



**2020 VIRTUAL**

**Undergraduate Research  
SYMPOSIUM**

**MAY 1, 2020**

**Celebrating the contributions  
of undergraduate students to  
UWM's research mission**

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Dear Students, Colleagues, and Friends,

Welcome to the 12th Annual UWM Undergraduate Research Symposium!

UWM's annual undergraduate research symposium celebrates the collaborations of UWM undergraduate students with our larger research community. For the last eleven years, this celebration has taken place in the Union as students have filled the building with oral presentations, performances, and epic poster events. We have looked forward to this annual showcase as an opportunity to thank the research mentors who have guided the efforts of their students over the year, to congratulate the students on their hard work, and to celebrate the fact that UWM, over the course of decades, has built an exceptional environment of shared inquiry. Student success, research excellence, and community engagement are pillars of UWM's mission, and all of these are at the heart of the Annual Research Symposium.

When it became clear that we would not be having an on-campus event this year, we decided to create a Virtual Symposium in its place. We encourage you to visit the new website we have launched: <https://sites.uwm.edu/undergrad-research-symposium/>. There you will find abstracts submitted by 277 students who were mentored by over 200 of UWM's faculty and research staff. Along with the abstracts, students have developed PowerPoint presentations, videos, and other artifacts of their research. There is also a commenting feature on the site and we would be grateful if you could provide some encouragement to the students through leaving some thoughts about their work.

We urge you to take this opportunity to learn more about the extraordinary research collaborations happening across our campus and hope that you will continue to advocate for the participation of undergraduates in research at UWM. In many ways, the Annual Symposium highlights UWM at its very best. If you need some encouragement in these difficult days, we hope you will visit the Virtual Symposium and learn more about how our faculty and students are building new knowledge and new futures together.

Sincerely,

A handwritten signature in black ink, appearing to read "Nigel".

Nigel Rothfels  
Director, Office of Undergraduate Research  
University of Wisconsin-Milwaukee

## 2019-20 Senior Excellence in Research Awardees

The Office of Undergraduate Research congratulates this year's Senior Excellence in Research Awardees, listed below, on an impressive year of research productivity, conference presentations, and work as undergraduate research ambassadors. You have truly been an inspiring group. We congratulate you on your graduation, wish you luck on the growth that lies ahead, and look forward to seeing the impact of your hard work and vision in the years to come.

### **Robert Aloisi**

Radio Bright Supernovae Observed by Australian  
SKA Pathfinder

Mentor: David Kaplan, Physics

Transient radio flux density from supernovae are caused by synchrotron radiation related to supernova shock waves interacting with circumstellar material. These observations can constrain physical supernova models as well as the mass loss history of progenitor stars over thousands of years prior to the supernova. The Variables and Slow Transients (VAST) survey is using the Australian Square Kilometer Array Pathfinder (ASKAP) radio telescope array to explore the transient radio sky. ASKAP is an array of 36 12-meter dishes located in Western Australia, which covers 30 square degrees per field pointing, allowing sensitive, rapid sky surveys. The Rapid ASKAP Continuum Survey (RACS) included the first full set of ASKAP observations, which were taken at 888 MHz frequency and at all declinations  $< +40^\circ$ . RACS images were searched for matches to known supernovae sky locations compiled from optical transient catalogs. Flux densities from matches were compared to those from prior radio surveys to identify candidates for which flux changed over a 20-year time period as well as additional ASKAP observations at multiple epochs from the Pilot VAST survey spanning several months for some of the matches. Several radio bright supernova candidates with transient flux densities were identified for follow up observations.

### **Bella Biwer**

Urban Safety and Resistance: Sherman Park, MKE

Mentor: Arijit Sen, Architecture

The purpose of this project is to evaluate the multiple ways in which different groups of people talk about safety and to document alternative forms of grassroots social action deployed by community residents to address this issue. Disjuncture between top-down and bottom-up knowledge is well known in academic literature. With this in mind, I began by looking at safety and policing in Sherman Park, Milwaukee, which is located in the North Side of the city. In order to understand the grassroots perspective, I participated in six community-led Jane Jacobs walks through Sherman Park, and created an interactive 'countermap' of the community based off of the community members' comments. Using this knowledge as a resource, as well as information drawn from extensive primary knowledge provided by years of interviews and partnerships with Sherman Park's leaders, widespread first-hand physical experience within the community, and exhaustive analysis of safety scholarship and data as it pertains to the community, this project examines the broader social and spatial context of such community action — that, at the core of the disjuncture between these two point of views and the resultant actions people take to ensure community safety, there are two different perceptions of space and place.

### **Bailey Flannery**

Animal Transformations: Medieval Commentary on Consent and Sexual Violence

Mentor: Jacqueline Stuhmiller, Honors College

In tales across the Celtic tradition, men transform into animals after mastering women through sexual violence. The fourth branch of the Mabinogi, a collection of ancient Welsh myths, offers a prime example through Gwydion and Gilfaethwy, who abuse their statuses and magical abilities in order to rape a woman named Goewin. Once she describes her experience and accuses them of raping her, Gwydion and Gilfaethwy turn into creatures of the hunt. This is not simply a punishment, but also an oblique reference to the love-hunt: an

age-old, inherently violent metaphor of erotic pursuit in which men chase and forcefully overtake their female prey. Through their transformations into animals, this tale indicts not just Gwydion and Gilfaethwy, but also the love-hunt's model of gender relations and masculinity—a toxic masculinity based in violence. Unlike their male counterparts, the women of these tales turn into animals when they use their powers of speech and wisdom to reject the love-hunt and master themselves instead. Examples include the Mabinogi's Rhiannon and Irish mythology's Macha, both of whom transform into horses. Notably, horses are physically powerful and impressive, yet they are also non-predatory creatures, suggesting Rhiannon and Macha's non-violent mastery. Furthermore, horses often serve as the tools of men without granting their consent; their bodily autonomy is similarly violated. Thus, when Rhiannon and Macha turn into horses, this symbolizes a reversal in which woman and animal alike rebel against their would-be masters, opening the possibility of alternative gender relations that undermine the love-hunt and assert women's bodily autonomy. By examining the Mabinogi and other Celtic tales, such as "The Weakness of the Ulstermen" and "The Dream of Oenghus," I will demonstrate that the animal transformation is ultimately sympathetic to women, elevating their voices and experiences in the face of sexual violence.

### **Ryan Majinski**

Asymmetric Synthesis of the Anticancer Agent (+)-Elacomine

Mentor: M Mahmud Hossain, Chemistry & Biochemistry

(+)-Elacomine is a natural anticancer agent found in certain shrubs of the *Elaeagnus* genus. It has been found to be toxic to melanoma cells while also having almost no effect on normal human cell lines. This allows for a uniquely targeted treatment to melanoma, and therefore elacomine has been the subject of recent synthetic research. Modeled after a recent synthetic route for (-)-coeruleosine, a structurally similar analgesic agent, we devised an efficient method of creating elacomine in only six successive reactions. The first step consists of the formation of a 3-hydroxyacrylic acid ester, which has already been optimized. The second step involves the asymmetric alkylation of the acrylate product, and it is currently being optimized. After optimization of all steps using model compounds, we can apply these reaction parameters to the synthesis of the anticancer agent elacomine.

### **Tessa Miskimen**

Effects of Physical Salience and Learned Aversive Value on the Deployment of Attention

Mentors: Deborah Hannula & Fred Helmstetter, Psychology

Recent work from our lab indicates that attention capture can be observed for learned fearful stimuli. However, aversive items in our original work were onsets, distinctive not only based on learned value, but also by their sudden appearance in the search display. In this experiment, we eliminate this potential confound and examine whether capture effects persist. Participants in these experiments search for a target stimulus defined by color during a training phase. They are told to make a single eye movement to the target location as quickly and accurately as possible. Shock delivery was dictated by the color of the target stimulus so that one target becomes a conditional stimulus (CS+) and the other a predictor of relative safety (CS-). Next, participants search for a shape target and occasionally, one of the distractors is either the CS+/-, but no shock administered. Results from Experiment 1 indicate that eye movements during test are made in error more often to the CS+ than the CS- and that this occurs even in the absence of explicit knowledge about shock-color contingencies. However, contingency awareness was assessed using an insufficiently sensitive post-experimental questionnaire. In Experiment 2, we attempt to replicate these results with participants making button responses to indicate how likely they are to be shocked. This approach will permit us to make more definitive claims about capture with and without awareness. Finally, this study will provide context for future studies to investigate the effects of fear conditioning on those with anxiety disorders or PTSD.

### **Nikolaus Prusinski**

Star Formation and Galactic Outflows in the Early Universe

Mentor: Dawn Erb, Physics

Intense star formation in galaxies results in powerful, galactic-scale outflows of gas. Because stars form from gas, these outflows have a strong effect on the evolution of galaxies, but the primary driving mechanisms are still uncertain. We investigate the connection between galactic outflows and the morphology of star formation using two independent data sets covering a sample of galaxies in the early universe. The Hubble Space Telescope (HST) provides high spatial resolution emission line spectra yielding maps of the extent and strength of star formation, while absorption line spectra from the Keck Observatory at Mauna Kea provide the intensity and velocity of the outflows. The joint HST/Keck dataset enables direct comparisons between star forming regions and the outflows they drive. Future facilities such as the James Webb Space Telescope (JWST) and the upcoming extremely large telescopes (ELTs) will extend these studies to lower masses and star formation rates, probing galactic feedback across orders of magnitude in galaxy properties.

### **Nicole Vigon**

Evaluation of Joint Dynamics During Gait in Children with Hypermobile

Ehlers-Danlos Syndrome

Mentor: Brooke Slavens, Occupational Science & Technology

Hypermobile Ehlers-Danlos Syndrome (hEDS) is an inherited connective tissue disorder caused by a defect in the protein collagen. This disorder affects as many as 1 in 5000 people worldwide. Symptoms include excessive range of motion, dislocation, and instability in joints, which leads to early-onset osteoarthritis. There is currently a lack of knowledge on the functional effects of these symptoms on gait in children with hEDS. This study aims to quantify gait, in an effort to contribute to defining the biomedical phenotype of hEDS. Eight children with hEDS (mean age of 14 years) were recruited from the Genetics Center at Children's Hospital of Wisconsin. The subjects underwent three-dimensional motion analysis using a 15-camera Vicon T Series system with 14 retro-reflective markers. The subjects completed multiple walking trials at a self-selected speed along a 30-ft walkway. Data was labeled, filtered, and modeled using Vicon Nexus software and the lower extremity Plug-in Gait model for five gait cycles per subject. The group mean for stride length, walking speed, stance duration, and cadence were  $1.27 \pm 0.156$  m,  $1.24 \pm 0.067$  m/s,  $37.78 \pm 1.94\%$  and  $59.46 \pm 7.19$  strides/min, respectively. For the ankle, the group mean for sagittal plane range of motion and peak dorsiflexion moment were 38 degrees and 1.41 Nm/kg, respectively. While the temporal spatial parameters were within normal ranges, as reported in the literature, inspection of subject specific metrics were found to be different. Identification of differences between those with hEDS and healthy individuals may provide insight to determine the underlying mechanisms of pain and injury, to mitigate the risk for early-onset osteoarthritis. Quantitative gait analysis findings will provide rehabilitation engineers, therapists, and physicians with a better understanding of pathological human movement. This work will lead to improved diagnosis and rehabilitation for children with hE

# Abstracts

## Maysam Abdeljaber

Challenging Housing Injustice in Milwaukee

Mentor: Arijit Sen, Architecture

This research is a part of a bigger project called “Climates of Inequality.” Organized by the Humanities Action Lab, a coalition of universities led by Rutgers University-Newark working with issue organizations and public spaces, this participatory public memory research project engaged students, educators, and community leaders from over 20 cities across the US and around the world in order to expose the roots of current environmental injustice, and share generations of frontline communities’ strategies for resistance, resilience, and mitigation. The Milwaukee community’s story is critical in this global vision and action around climate and environmental justice. The proposed paper situates the history of housing injustice in Milwaukee’s Northside neighborhoods within a timeline documenting explicit national housing policies starting with the 1862 Homestead Act up to present-day proposals. The purpose of this macro-scale policy-timeline is to comprehend the unjust consequences of national governmental decisions on housing conditions in Milwaukee. The timeline illuminates how national housing policies impact local (Milwaukee) housing trends around three distinct areas: (1) equitable housing, (2) homeownership, and (3) housing finance. In addition, this paper examines the granular everyday consequences of housing injustice by analyzing data collected from 7 local foreclosed homes in Sherman Park and Washington Park neighborhoods of Milwaukee. This includes a detailed study of the physical conditions, ownership history, and oral histories of residents of the neighborhoods. Despite the difficulties, the ethnographic research demonstrates community resilience, identifying ways in which residents resist injustice. This paper discusses specific local responses to ensure equitable housing, homeownership, and housing finance.

## Adriana Abud

Analyzing Obsessive Compulsive Disorder with the Three Impulsivity Factors

Mentors: Han Joo Lee & Abel S. Mathew, Psychology

The current study is based on analyses conducted from a previous study looking at the correlation between response inhibition (RI) and impulsivity with obsessive compulsive disorder (OCD). OCD is characterized by recurring and/or unwanted thoughts or sensations that may lead to compulsive behavior (American Psychiatric Association (APA), 2013). Although compulsive behaviors are premeditated while impulsive behaviors are not, literature has shown that impulsivity may predict OCD symptoms (Potenzia et al., 2009). The goal of our study was to evaluate which features of impulsivity (i.e., motor, non-planning, attention) were associated with OCD, after controlling for emotional symptoms like depression, anxiety, and stress (Carter et al., 2005). We hypothesized that individuals with OCD would have significantly elevated impulsivity symptoms across all three domains (i.e., attention, motor, and non-planning) after controlling for emotional symptoms. The sample included 701 individuals from the University of Wisconsin-Milwaukee. To evaluate emotional and impulsivity symptoms, participants completed the Depression, Anxiety, and Stress Scale (DASS-

21) and the Barratt Impulsiveness Scale (BIS), respectively. To determine the influence of impulsivity on OC-severity the Obsessive-Compulsive Inventory Revised (OCIR) was used, a two-step hierarchical linear regression was run, where Step 1 included DASS-21, and Step 2 included BIS factors. The findings revealed that the non-planning factor was a significant predictor of OCIR symptoms over emotional symptoms ( $R^2 \Delta = 34.1, p=0.004$ ). In contrast, neither the attention nor motor factor significantly predicted influence emotional symptoms ( $R^2 \Delta=0.000, p=0.974, p=0.981$ ). The findings suggest that the individuals who are higher in symptoms of non-planning such as finding enjoyment of challenging tasks, demonstrate higher OC-symptoms.

## Nour Abuomar

Social Experience & Reproductive Isolation in a Vibrational Insect

Mentors: Rafael Rodríguez Sevilla, Camille Desjonqueres & Jak Maliszewski, Biological Sciences

*Enchenopa binotata* treehoppers are host plant-feeding insects that communicate through plant-borne vibrational signals. Typically, each species has a distinctive host plant species and male mating signal frequency (with the females of each species preferring the signal frequency of their males). At some sites, however, more than one species may be found on the same host plant. We chose to investigate whether developing in mixed- or single-species aggregations will affect an individual’s communicational behavior. Does developing in a mixed aggregation make communication systems more similar or more distinct? The consequences may weaken or strengthen reproductive isolation between the species. We raised two species of *Enchenopa* in treatments or either mixed or single-species aggregations from nymphs to adulthood. Once they reached adulthood, we assessed female preference with vibrational playbacks of male signals that ranged from high to low frequencies. When females heard an attractive call, they responded with their own mating call in return. By comparing the responses to the playbacks, we were able to determine which of the playback frequencies were preferred. We discuss our findings in terms of species reproductive isolation and the consequences for insect behavior in the wild.

## Hannah Adams

What is the Stroop Interference Effect?

Mentor: David Osmon, Psychology

The construct validity of the DKEFS-Stroop CW trial has not been examined using reaction time and Miyake executive function timed measures. The present study did so using simple, choice, and cognitive control measures of reaction time as well as timed measures of Miyake factors of inhibition (SSRT, Stroop-negatively primed trials), flexibility (Local-Global-RT, Flanker-RT), and updating/monitoring (Keep Track-4, 2-back). One hundred one UWM students were given the DKEFS-Stroop CW Inhibition task (CW-I), Simple RT, 2-Choice RT, Complex 2-Choice RT, Cognitive Control RT, Stroop negative priming RT, Local-Global RT & correct, a timed 2-back Correct, a timed Keep Track-4, Flanker RT & correct, Stop Signal RT tasks. An adaptive elastic net General Regression with Weibull model analyzed which variables predicted the DKEFS-Stroop CW task. Generalized regression predicted CW-I well

(Generalized  $R^2=0.46$ ) using only two of the 13 variables, including Choice IIV and Stroop negative priming ). These results indicated that better CW-I performance was associated with less Choice IIV and faster Stroop negative priming RT. The present results demonstrate that CW-I performance on the popular DKEFS executive function battery is associated with less intraindividual variability on choice RT tasks and with a faster ability to overcome Stroop interference when negatively primed trials increase the interference. CW-I is not related to other executive abilities, including being able to be cognitively flexible or holding a lot of information in mind and not related to the second type of interference either, which is the ability to stop an already programmed action but is related to inhibiting a prepotent response in favor of a less preferred and less automatic response. That indicates that CW-I requires executive control and is most related to having little variability between reaction time trials, and strongly related to overcoming negative priming interference.

#### **Adedamola Adeniyi**

Simulating The Blood Flow in Human Vasculature  
Mentor: Mahsa Debagh, Biomedical Engineering

Advances in computing technology have allowed the field and research of Computational Fluid Dynamics (CFD) to evolve and find solutions to an ever-expanding array of complex real-world problems. One of the most sought out scenarios simulated by CFD is the flow of blood throughout the body. Since many diseases that affect the body are related to blood flow, this line of research has great potential to aid the progress of medical intervention and treatment. However, since the body has many vascular structures, each having their own complex shapes and sizes, this often makes developing accurate models for blood flow difficult. Fortunately, there are many available CFD libraries and resources to aid in the understanding and application of accurate CFD simulations. One such library called Palabos has found popular use as an open source CFD library that provides highly customizable functionality for those who need flexibility and multithreading capabilities. The objective of my research is to apply the Palabos CFD library to simulate blood flow in patient-specific vascular geometries. The focus will be to examine the association between hemodynamic features and areas of aneurysm growth to present the key hemodynamic parameters essential for an accurate prediction of the growth and to gain a deeper understanding of the underlying mechanisms. Patient-specific images of a growing cerebral aneurysm in 2 different growth stages are segmented and reconstructed. Our study will introduce an accurate criterion to explain the hemodynamic conditions predisposing the aneurysm to growth. Our findings will assist clinicians in differentiating stable and growing aneurysms during pre-interventional planning.

#### **Eisa Mohammed Y Alyaqoub**

Converting Medical Imaging to Pre-Processing  
Computational Grids  
Mentor: Mahsa Dabagh, Biomedical Engineering

One of the essential medical technologies that are used these days to study different diseases is medical imaging. To take a critical advantage from medical imaging in studying a

specific disease, image segmentation is the first step that must be done as preprocessing. Image segmentation is considered the most essential medical imaging process as it extracts the region of interest (ROI) through a semiautomatic or automatic process. It divides an image into areas based on a specified description, such as segmenting body organs/tissues in the medical applications for border detection, tumor detection/segmentation, and mass detection. Conversion of medical images to pre-processed computational grids will dramatically increase the size of future retrospective studies while widening the scope of computational fluid models to both larger data sets and organs with complex anatomy including small capillaries. In this study, patient-specific images of growing cerebral aneurysms at different growth stages are segmented and reconstructed. Computational meshes representing 3D topology are created from CT-scan datasets corresponding to the pre- and post-stenting stages of 4 patients using the image processing software Materialise Mimics (Materialise, Leuven, Belgium). Blood flow in these computational models will be then simulated using the Palabos an open source Computational Fluid Dynamics (CFD) library. We will examine the impact of stent deployment on blood flow distribution, flow structure, wall shear stress (WSS), and oscillatory shear index (OSI) in pre and post-stent deployment stages. Our findings will lead to better understand how hemodynamics is linked the growth of aneurysm and how stenting may help slow down/prevent the growth of aneurysm.

#### **Alexis Alexander**

Strategic Use of Social Media by Commercial Brands  
Mentor: Taisik Hwang, Journalism, Advertising, & Media Studies

This research project attempts to discover how leading commercial brands utilize social media to effectively reach and build relationships with their audiences. Specifically, it employs a content analysis to examine how five big companies take advantage of Twitter to engage with their consumers. These companies include Coca-Cola, General Motors, Samsung, Sony, and Nestle which represents different types of industries. A total of 1,644 tweets sent by these businesses for a one-year period from August 1, 2017 to July 31, 2018 are used for quantitative analysis. This study focuses on three research questions: (1) How do they utilize the basic Twitter features such as retweet, hashtag, and hyperlinks; (2) To what extent do they differ in their use of branding strategies and message appeals; (3) Which branding strategy leads to increased engagement on the part of users. The expected outcomes include that there will be differences in use of basic features, strategies, and appeals both by companies and by industry type, and that emotional appeals will generate more engagement. The current study will benefit not only other private enterprises but also government and non-profit organizations by revealing ways in which these brands purposefully use social media to fulfill their goals.

**Maricruz Almanza**

Lack of Interlimb Transfer Following Visuomotor Adaptation in a Person with CMG  
Mentor: Jinsung Wang, Kinesiology

Congenital mirror movements (CMMs) have been conventionally thought to occur due to the corticospinal tracts that project irregularly to both sides of the body. More recently, it has been suggested that both brain hemispheres are activated during anticipated unilateral movements due to deficient transcallosal inhibition, leading to mirror movements on the unintended side as well. To further understand the mechanisms underlying CMMs, we examined the pattern of interlimb transfer following visuomotor adaptation in 'DB', an individual with CMMs. DB's CMMs were established by detecting EMG signals in both arms during intended unilateral movements, and also when transcranial magnetic stimulation (TMS) was applied to the motor cortex. Following that, DB performed reaching movements with the left arm under a visuomotor condition in which the visual display was rotated 30 counterclockwise about the start circle, and then with the right arm under the same (experiment 1) or opposing (experiment 2) rotation condition. DB's performances were compared with the data from control subjects. In both experiments, DB was able to adapt to the rotation with either arm; however, movement errors at the beginning of right-arm adaptation did not differ from those at the beginning of left-arm adaptation, indicating no transfer. These transfer patterns differ from those observed in controls, who demonstrated substantial transfer when the rotation directions were the same between the arms, but no transfer when they were opposite. These findings suggest that in DB, both hemispheres are activated during unilateral movements, but interhemispheric communication is compromised, resulting in mirror movements on the involuntary side.

**Robert Aloisi**

Radio Bright Supernovae Observed by Australian SKA Pathfinder  
Mentor: David Kaplan, Physics

Transient radio flux density from supernovae are caused by synchrotron radiation related to supernova shock waves interacting with circumstellar material. These observations can constrain physical supernova models as well as the mass loss history of progenitor stars over thousands of years prior to the supernova. The Variables and Slow Transients (VAST) survey is using the Australian Square Kilometer Array Pathfinder (ASKAP) radio telescope array to explore the transient radio sky. ASKAP is an array of 36 12-meter dishes located in Western Australia, which covers 30 square degrees per field pointing, allowing sensitive, rapid sky surveys. The Rapid ASKAP Continuum Survey (RACS) included the first full set of ASKAP observations, which were taken at 888 MHz frequency and at all declinations  $< +40^\circ$ . RACS images were searched for matches to known supernovae sky locations compiled from optical transient catalogs. Flux densities from matches were compared to those from prior radio surveys to identify candidates for which flux changed over a 20-year time period as well as additional ASKAP observations at multiple epochs from the Pilot VAST survey spanning several months for some of the matches. Several radio bright supernova candidates with transient flux densities were identified for follow up observations.

**Tiffany Antonopoulos**

No Place Like Home: Do Black Widow Spiders Use Path Integration to Navigate Their Webs?  
Mentors: Rafael Rodríguez Sevilla & Clinton Sergi, Biological Sciences

Animals store memories about the layout of their environment and use this stored information to navigate. One common way of storing this information is to construct a mental path integration model, which stores an animal's cumulative distance and direction from home. Black widow spiders use stored information about their webs when navigating the web, but it is not clear what information they store. We conducted an experiment to test if black widows store a path integration model. We tested the hypothesis that black widows store their cumulative distance and direction from their home as they move about the web. This hypothesis predicts that when displaced to a new location on the web, spiders will attempt to return home by following a path the same distance and direction as the most direct path from where they were originally displaced. To test this, we lured black widows to the most distant part of their webs from their homes. We then either puffed the spiders with air to get them to flee home or displaced the spiders to a different location on the web before puffing. We used videos of each trial to measure the length and direction each spider's path after being puffed. We compared these measurements to the length and direction of the most direct path home from where we initially lured each spider. I will discuss these results in terms of whether the paths black widows took when attempting to go home match the paths predicted by the path integration hypothesis.

**Brian Barber**

Connection Through Volunteerism  
Mentor: Benjamin Trager, Community-Based Learning, Leadership, and Research

Reflecting on the impact my experiences of volunteering gave me, I've noticed a serious change that has uplifted me in ways that I could only explain by posing the following question. "How does volunteering through a youth mentoring program influence sense of individual growth and my connection to the community?". The method I used during the volunteering was guided reflection and then I incorporated free reflection. Through my volunteering I see the change in my mentee's attitude and demeanor towards school and activities, demonstrating that he is more engaged than when we first began. I also personally experience the direct results of social capital growth through volunteering. I now feel more connected to the community in which I belong because I'm volunteering in it. I have personally become more enriched due to the increased sense of belonging and purpose. Importantly, my findings coincide with Yosso's idea of social capital. As I help in my community, I become more aware and present within it. This profound connection to my community develops my social growth. This growth is what I believe connects it to Yosso's idea of social capital. Through volunteering I have found a sense of belonging and purpose and seen how the volunteering affects others. This has shaped my sense of individual growth. By volunteering in the community, I feel more connected, because I'm taking an active part in it. My research focused on my experience and not so much of the mentees which was one of the limitations of the project. Yet, this research sheds light on an important issue of being able to relate to others and having a sense of belongingness.

**Taylor Beecher**

Intimate Partner Violence and Adverse Childhood Experiences in Sexual Minority Dating Relationship  
Mentor: Ryan Shorey, Psychology

Intimate partner violence (IPV), including physical, psychological, and sexual aggression, is equal to or greater in sexual minority (e.g., lesbian, gay, bisexual or another non-heterosexual identity) relationships than in heterosexual relationships (Walters, M.L., Chen J., & Breiding, M.J., 2013). IPV in sexual minority relationships can have more substantive negative outcomes compared to their heterosexual counterparts, such as increased depression, substance abuse, and health issues (Koepfel, M., & Bouffard, L., 2014). Research on heterosexual couples has shown a link between adverse childhood experiences (ACE's) and an increased risk for IPV perpetration (Widom, C. S., Czaja, S. J., & Dutton, M. A., 2014). There is a lack of research on the impact that experiencing ACE's can have on IPV perpetration in sexual minority relationships. The current study of sexual minority young adults in dating relationships (N= 104) will investigate the relationship between ACE's and IPV perpetration. This sample is part of an ongoing study that examines alcohol use, minority stress and IPV in sexual minority dating relationships. Participants completed measures related to ACE's (Finkelhor et al., 2015) and IPV (Wolfe et al., 2001). We hypothesize that there will be a significant correlation between ACE's and IPV perpetration. Findings will be presented and implications for future research will be discussed. This study will help identify risk factors for IPV perpetration in sexual minority populations.

**Lauren Below**

Healthcare as a Human Right; Findings From Ecuador  
Mentor: Anne Dressel, Nursing

The UNHCR estimates that Ecuador is home to over 1 million Colombian and Venezuelan refugees. This qualitative study explores the idea of healthcare as a human right based on data collected regarding migrants and refugees in Ecuador. In 2017, the binational study team from Ecuador and UWM conducted interviews with fifty working adults in Quito, Ecuador from five different sectors: health care, the press, the police, non-governmental organizations, and education. The interviews were conducted, audiotaped, and transcribed in Spanish. Using deductive line by line qualitative analysis, key themes were identified related to healthcare as a human right. The right to healthcare means looking past race, gender, immigration status or age. Article 32 of the new constitution of Ecuador states that health is a guaranteed right by the state and includes access to services and programs for all. However, findings of this study demonstrated that there are concerns among working professionals about health care access, mental health and other problems related to the well-being of migrants in Ecuador. Migrants and refugees struggle with many health issues because of their displacement from home. Participants also noted the importance of economic, political, and social structures related to access to healthcare for refugees.

**Peyton Bendis**

Evaluation of Overhead Throwing Angular Kinematics in Able-Bodied and Wheelchair Lacrosse Players  
Mentors: Brooke Slavens & Matthew Hanks, Occupational Science & Technology

Wheelchair lacrosse is an increasingly popular adaptive sport with little research investigating upper extremity biomechanics. Previous research has examined upper extremity angular velocities in able-bodied lacrosse players and potential implications for upper extremity overuse injury; however, no research has assessed these metrics in wheelchair lacrosse players. The purpose of this study was to characterize differences in angular kinematics between able-bodied and wheelchair lacrosse players with spinal cord injury (SCI). Three able-bodied ( $23.7 \pm 3.8$  years) and three wheelchair ( $55.3 \pm 14.01$  years) lacrosse players with SCI performed three maximal effort overhead throws using a standardized lacrosse stick. A 15-camera Vicon T-Series motion capture system collected kinematic data at 240 Hz. Able-bodied players performed the throws standing and sitting in a standardized wheelchair while the wheelchair players with SCI performed the throws sitting in their personal sport wheelchair. Angular velocity was assessed in bilateral wrist, elbow, and glenohumeral joints and thorax in the frontal, transverse, and sagittal planes. Group mean joint angular velocities were greater in able-bodied players than in wheelchair players in most joints. Dominant elbow angular velocity in the sagittal plane was greater in wheelchair players with SCI than in able-bodied players in both standing and sitting conditions. We hypothesize the angular velocity of the dominant arm elbow may be greater in wheelchair players as their elbow compensates for lack of trunk rotation that typically drives an able-bodied overhead throw. The able-bodied standing players had greater angular velocities in most joints than the able-bodied sitting players who had greater angular velocities than the wheelchair players with SCI, which indicates that the presence of the wheelchair and SCI each affect angular velocity. The results of this study may help identify potential mechanisms of overuse injury and enhance safety in wheelchair lacrosse.

**Andrew Beszhak**

Synthesis of Hydroxyarginine & Precursor Guanidinylation Agent  
Mentor: Alan Schwabacher, Chemistry & Biochemistry

Keto-hydroxyarginine is a precursor to Enduricididine, an oxidized arginine found in potent antibiotics. The Mpp family of enzymes transforms these arginines into enduricididines. Enduricididine is a non-protogenic amino acid, one that isn't encoded directly by the genetic codes of any organism, rather one generated through post-translational modifications of mRNA molecules. This is to say, if you want to study it, you have to make it. Overall, investigating these reactions involving arginine, MppP, MppQ and MppR will allow for a formal understanding of the biosynthesis, kinetics and mechanism of these molecules, possibly resulting in applications in other antibiotic syntheses. Reagents, like Ethyl nitroacetate and Di-Boc Pyrazole are needed to synthesize precursors to the Mpp pathway. Unfortunately, these compounds are either not readily available, expensive, or both. For these reasons, the independent synthesis of these compounds is paramount.

**Megan Biesmann**

The Relationship Between Severe Storms and Weather Regimes Over the US

Mentor: Paul Roebber, Mathematical Sciences

Weather regimes are wind flow patterns that cover a large region, approximately the size of the continental United States, and they change over days and weeks as the wind flow patterns change. They affect local weather in different ways depending on what the flow is. It is unknown if small-scale weather, like thunderstorms, influences these changes in weather regimes. Using a National Oceanic and Atmospheric Administration (NOAA) database, we created a gridded analysis over North America to analyze the wind flow patterns and identify weather regimes using a technique called cluster analysis. The study will continue by investigating if regimes (flow pattern clusters) or if certain transitions between regimes indicate specific types of severe weather. Bootstrap analysis, a technique used to determine if differences have a statistical significance, will be used to ensure that any differences found between clusters and transition between clusters are significant. In particular, transitions between regimes that can be associated with thunderstorm activity would suggest the aforementioned upscale effects on regimes. The conclusions to this project are unknown, but if an effect on weather regimes is found, it could help to improve long-term forecasting.

**John Biro**

The Motel and America

Mentor: Arijit Sen, Architecture

The current redesign of Interstate 41/94 has eliminated a historic connection to entering the county of Milwaukee from the south. Prior to the 1960's and the introduction of the expressway, the fastest route to Milwaukee was Highway 41. As you entered Milwaukee County, Highway 41 became 27th Street and seven historic motels were built along a four mile stretch of Highway 41 from 1946 to 1955. Then in the 1960's the expressway was built and the direct route to the motels was eliminated. Fortunately, the 27th street exit was included. The word motel was a contraction of motor and hotel and became a generic label for highway accommodations. This was a dynamic period in America and people were on the move. The motel became an element of the modern American landscape. There was a restless sense of freedom after WWII. The automobile and the motel reflected and contributed to a changing America. Now that the latest expressway expansion into Milwaukee County has eliminated the 27th Street exit we see For Sale signs at many of the 12 current motels. This visual representation of the four mile stretch shows North at the left side where Drexel Avenue crosses 27th Street. The motels are shown on a 2018 map. The other major intersections are Puetz Road, Ryan Road and Oakwood Road. The motels are enlarged to see their location and design along with signage and color. Multiple interviews with owners were conducted. When asked how they plan to survive in light of the freeway changes, many owners have decided to put their place up for sale and move on.

**Andrea Bishop**

Privacy Co-Management on Social Media in Latinx Youth

Mentors: Celeste Campos-Castillo & Katherine Craig, Sociology

The goal of this project is to conduct an exploration of privacy from the perspective of adolescent co-managers, with a focus on managing information indicative of the mental wellbeing of peers, and also to develop and disseminate guidelines for privacy co-management to Latinx adolescents, their schoolteachers, administrators, and adult caretakers. This project involved interviewing 43 Latinx teens between the ages of 14 and 18 to understand the thought processes of current youths in relation to mental health and privacy in social media. Participants were asked about how they would respond to a variety of situations, including body insecurity and signs of an eating disorder, ranking them from not worried about to worried, and if they would tell a trusted adult about the worrisome situations. Interviews were analyzed using thematic analysis, which allowed for coding and classification of participant norms and practices around privacy co-management, with themes anchored in the experiences and feelings of the participants. Common themes in responses involved normalizing issues as justification for not being worried, and an understanding of how things may escalate in cases where they expressed worry. Body insecurity had the largest gray area because the ramifications are not as clear as others, for example suicidal thoughts, and because it is considered 'normal'. Those who are worried about eating disorders do not have a full understanding of the issue because it is rarely talked about, escalating eating disorders to hospitalization, much like how people escalate drug use to overdosing. The results show the lack of literacy surrounding eating disorders and the unspoken hierarchy of posting others of different social media sites.

**Bella Biwer**

Urban Safety and Resistance: Sherman Park, MKE

Mentor: Arijit Sen, Architecture

The purpose of this project is to evaluate the multiple ways in which different groups of people talk about safety and to document alternative forms of grassroots social action deployed by community residents to address this issue. Disjuncture between top-down and bottom-up knowledge is well known in academic literature. With this in mind, I began by looking at safety and policing in Sherman Park, Milwaukee, which is located in the North Side of the city. In order to understand the grassroots perspective, I participated in six community-led Jane Jacobs walks through Sherman Park, and created an interactive 'countermap' of the community based off of the community members' comments. Using this knowledge as a resource, as well as information drawn from extensive primary knowledge provided by years of interviews and partnerships with Sherman Park's leaders, widespread first-hand physical experience within the community, and exhaustive analysis of safety scholarship and data as it pertains to the community, this project examines the broader social and spatial context of such community action — that, at the core of the disjuncture between these two point of views and the resultant actions people take to ensure community safety, there are two different perceptions of space and place.

**Sarah Bodhy**

The Role of Response Inhibition Deficits in Obsessive-Compulsive Disorder

Mentor: Han Joo Lee, Psychology

Obsessive-compulsive disorder (OCD) is a psychiatric disorder characterized by recurrent obsessions or compulsions that cause marked distress and interfere with daily functioning. Therefore, the inability to inhibit inappropriate thoughts or behaviors, known as response inhibition (RI), is the hallmark characteristic of OCD. Response inhibition can be inferred by studying performance in various cognitive tasks such as the stop-signal task, the go/no-go task, and the flanker task. Using these methods, studies have shown elevated RI deficits in OCD (Bannon et al., 2002). However, these findings are mixed in literature, as some studies have failed to find RI deficits in OCD patients (Krikorian et al., 2004). The lack of RI deficits could be due to the low symptom severity of participants in these studies. Thus, this study sought to examine whether RI deficits are associated with OCD symptoms within a clinical sample of patients with OCD who are receiving intensive treatment, such as in a partial hospitalization program (PHP). We recruited 88 patients with OCD who were treated in a PHP program in the Rogers Memorial Behavioral Health. Upon admission, treatment seeking individuals were assessed for OCD symptoms and other related symptoms using the Schizotypal Personality Scale (STA) and the Revised Obsessional Intrusion Inventory (ROII). Subjects also completed several computerized neurocognitive tests designed to measure RI. The current study sought to examine the association between the OCD symptom severity and RI deficits on these cognitive tasks in the current sample of severe OCD patients using the Pearson correlation and multiple regression analyses. A positive correlation between RI deficits and STA and ROII scores is expected. By contributing to the existing literature about the nature of RI deficits in OCD and how they are associated, these findings would improve our understanding of the psychopathology of OCD with respect to its underlying cognitive deficits.

**Braedon Brehm & Dominic Robson**

Natural Energy Decomposition Analysis for Molecular Interactions: Applications to Hydrogen Bonding

Mentor: Mohamed Ayoub, College of General Studies - Mathematics & Natural Sciences

We present a procedure for partitioning interaction energy into electrical (EL), charge transfer (CT), and core repulsion (CORE) contributions, which are evaluated for self-consistent field wave functions. Applications are presented for several representative binary and ion complexes. Our findings show that electrical interaction dominates the long-range of potential energy surface, and the charge transfer is strongly stabilizing the short-range within Van der Waals contact. The core repulsive interaction in the short-range of the potential arises from deformation as the fragment wave functions become distorted to avoid significant interpenetration.

**Jacob Brewer**

Analysis of Dynamic Muscle Length in Patients with Osteogenesis Imperfecta

Mentor: Jacob Rammer, Biomedical Engineering

Dynamic muscle length changes during activity to support clinical decision-making, especially in surgical planning. The purpose of this project is to assess muscle length changes in a population of children with Osteogenesis Imperfecta (OI, brittle bone disease). The primary objective of this work is to model and characterize muscle behavior in children with OI, using OpenSim, an open-source musculoskeletal modeling approach. Over 30 subjects with OI were measured in a motion capture and will be compared to typically developing subjects with some similar demographics in age and sex. Results from the study will show muscle length changes compared to the resting length of the subject. Analysis will reveal changes in muscle length of key groups involved in gait and an overall evaluation of the population tested. It is expected to see differences in muscle length changes between the two groups of subjects. Projections for this research expect to improve in understanding classifications of OI and aid in treatment decisions.

**Liam Brodie**

Synthesis of Polyurethane Foam with Iron Oxide Nanoparticles for Arsenic Filtration

Mentor: Krishna Pillai, Mechanical Engineering

Groundwater arsenic contamination is a global issue that affects developing countries significantly. 50 parts per billion (ppb) or greater in concentration of arsenic has been linked to adverse health effects including respiratory disease and neurological malformity. The maximum contaminant level for arsenic by the Environmental Protection Agency is 10 ppb. By synthesizing polyurethane filters with readily accessible nanoparticle additives, a low cost, efficient filter might be built for increased availability and greater understanding of arsenic removal. Based on previous studies with positive correlation of arsenic removal and polyurethane foam, this experiment will vary the ratios of constituents to determine the most effective nanoparticle distribution. Nanoparticles will be iron oxide primarily due to previous research results. By manipulating the media while it forms, the pore space might be altered to maximize surface area contact with nanoparticles responsible for removal of arsenic. To test varying arsenic removal efficiencies, aqueous arsenic will be passed through filters synthesized and run independently then attempt to replicate this formula for additive manufacturing. To simulate household flow, a pump test system must be developed. Polyurethane foam will be made using 2,4-toluene diisocyanate (TDI) and polypropylene glycol (PPG). Hydroxyl functional groups on the PPG react with TDI to create polyurethane, a process that requires time and heat. A previous study by Arundhati Pillai suggest a molar ratio of two to one of TDI to PPG, which will be replicated. The TDI must first be heated to 70 degrees Celsius for maximum reactivity, done in a vacuum furnace. Using a bath of mineral oil to ensure consistent heating, a flask will be heated with the two to one ratio of TDI to PPG and injected with nitrogen gas to ensure an inert atmosphere. Previous work suggests a four to five hour reaction time, which will be done using a hot plate and magnetic stirrer. Upon completion

of this time, a polysiloxane surfactant and metal nanoparticles will be added. The surfactant lowers surface tension to allow bubbles to form and create the filter lattice. Previously 10% by mass of nanoparticles were used. For this experiment, iron oxide with 8 nm sizes will be used, substantially smaller than the 15-20 nm used before and enhancing removal as suggested by Dr. Y.F. Shen and Dr. J. Tang. Roughly 7 mL of deionized water are added in this step, with thorough mixing. The flask is left in a stable environment to allow for the release of carbon dioxide for bubble formation to promote microstructure channels. After 24 hours of settling, the foam is rinsed gently with deionized water and the remaining product is iron oxide loaded polyurethane foam. To test the efficacy of these filters, the system will be housed in clear PVC pipe to be the size of standard market filters and run through the filtration test system. The automated system includes flow, pH, and pressure sensors to accurately measure breakthrough on this new filter set and compare breakthrough times and removal efficiency against current market filters.

#### **Dante Brown**

Mechanics of Pedaling a Bicycle While Standing  
Mentor: Andrew Dressel, Mechanical Engineering

The purpose of this analysis is to use a simple mathematical model to rationalize why cyclist rock the bicycle when pedaling while standing. To begin the research, a broad literature search was performed. The topics ranged from kinematics and the biology of sprinting to changes in aerodynamic drag. However, no papers were found that directly relate to this research. This allowed for the ease of incorporating new variables when necessary. Measurements were taken from a standard road bicycle. From these measurements and assumed values of forces, mechanical work was calculated for the forces of one leg without tilt, two arms with tilt, then both combined with tilt. This was done to graph the change in work. The first set of calculated values was the work done by one leg without bicycle tilt. This set of values is the baseline for comparison. The second set is the work done by one leg with bicycle tilt. This showed a steady decline until a minimum at 15° where it reached 97.06% of the work done with one leg without tilt. The final set was the work done by one leg with two arms and tilt. This was the set that will give the necessary conclusions. This set showed a maximum at 5° where it reached 100.2% of the work done by one leg without tilt. With the current mathematical model, the work gained by using both arms with tilt is minimal. The current mathematical model is sensitive to the measured values, as well as the relative force from the arms and legs. However, when the finish of a stage comes down to inches, every percentage that can be gained will be.

#### **Ian Buck**

High Frequency Medium Voltage Transformer for Future Electrical Grid  
Mentor: Adel Nasiri, Electrical Engineering

Transformers are a useful instrument in distributing power. Transformers can be used to convert voltage from one value to another as well as isolate the system, preventing voltage faults. A four port, high frequency transformer is even more useful, since it isolates multiple sources as well as reduce the size

of the transformer. The inductance was calculated out, then MATLAB was used to optimize the transformer parameters. The transformer was then designed, modeled, and simulated using ANSYS Maxwell-3D and Simpler. Once the modeling was complete, the transformer was constructed. Only two ports were tested reaching a maximum of 3.2kV. The original test was successful. However, a greater power source is needed to test all four ports at rated voltage.

#### **Kaley Camber**

Design of Carbon Fiber Reinforced Polymers for Use in Heavy Equipment Industry  
Mentor: Rani El Hajjar, Civil & Environmental Engineering

Composite material systems are used as efficient secondary structures across several industries in various engineering applications due to the desirable properties of high strength, high stiffness, and low density. The implementation of composite material in the heavy mobile equipment industry would allow for uses of heavy equipment to be used in new environments requiring lighter weight machinery; for example, implementation of composites in mining structures would entertain the possibility of using the structures in space to mine on asteroids and other terrestrial bodies. Testing was conducted to determine the optimal construction of Aluminum honeycomb sandwich composites to obtain various strengths and properties. Sandwich composites consisting of aluminum honeycomb core and carbon fiber reinforced plastic face sheets were created and tested to determine mechanical properties needed to numerically model limit states. A variety of combinations of honeycomb cell size and carbon fiber plie count and direction were tested to study the optimal construction for various applications. The composite structures were created in the UW-Milwaukee Composite Testing laboratory. Aluminum honeycomb samples were cut to size and cured between a specified layup of carbon fiber sheets. Samples were then tested to material failure, and the data was analyzed to create material models. Testing remains in progress; the conclusion of this project will result in models and recommendations to be used in choosing and constructing Honeycomb Aluminum sandwich composites for heavy machinery applications.

#### **Selena Cao**

Novel Porous Material for the Removal of Lead from Water  
Mentor: Marcia Silva, Global Water Center

Heavy metal contamination, including lead (Pb), is a well-known and documented issue for waste and drinking water. Despite the numerous health hazards associated with lead, many cities in the US and around the globe still use lead pipes in their water systems. External pollution also contributes to such lead contamination. According to the World Health Organization, no known level of lead exposure is safe for humans, and lead poisoning is considered irreversible. Lead is known to affect the bones, blood, and organs such as the kidneys, liver, and brain. An experimental method of removing lead from a water supply is using functionalized natural porous material. Lead has such a high affinity to this adsorbent that the release is undetectable, a very useful property should the material ever be used on a large-scale operation. The purpose

of this research is to understand how varying the times in the fabrication process affect the Lead adsorption capacity and percent removal properties of the material. It can be concluded that the functionalized material is a highly effective adsorbent for the removal of lead from water. In some trials, adsorption capacities of 999.49 mg/g, and removal percentages of 98.8 % were observed. Future research with this material will focus on regeneration study so the adsorbent may be reused.

#### Nicole Carlson

Racial and Socioeconomic Disparities in Self-Reported Childhood Body Size

Mentors: Ellen Velie, Elizabeth Duthie & Darek Lucas, Public Health

The prevalence of obesity has increased in the United States in recent decades and is associated with negative health outcomes, including breast cancer. The association between childhood body size and breast cancer, however, is not well understood. Childhood body size is difficult to assess. The objective of this project is to evaluate the validity of self-reported relative childhood body size at age 12. We also evaluate factors associated with self-reported childhood body size, e.g., race/ethnicity, household percent poverty, pubertal status, adult BMI, and childhood food insecurity and physical activity. Participants in the Young Women's Health History Study rated their body size at age 12 on the Stunkard scale, which consists of nine body figures ranging from underweight (1) to overweight (9) and is commonly used to assess recalled body size. Participants also provided the study team with childhood photographs. A total of 62 participant photos at age 12 were independently assessed by two study staff evaluators who assigned each image a Stunkard body size. The two evaluators' assessments were compared to one another to assess reliability. The evaluators' assessments were then averaged and compared to the participants' self-report of relative childhood body size. Factors associated with recall, such as race/ethnicity, household percent poverty, pubertal status, adult BMI, and childhood food insecurity and physical activity were also evaluated. Comparisons were analyzed using Cohen's Kappa statistic. The two independent evaluators' ratings have fair agreement with one another (Kappa = 0.40), while the averaged evaluators' assessments have low agreement with the participants' self-assessments (Kappa = 0.21). Additional analyses are in progress. This study develops a method to evaluate childhood body size that can be used in future studies to examine the impact of childhood body size on adult health and exposes limitations affecting this method.

#### Jessica Carpenter

Information Security in Virtual Reality

Mentor: Christopher Willey, Film, Video, Animation, & New Genres

This project aims to explore how virtual reality is shaping the digital security field with special attention to scamming and hacking. Virtual reality is a relatively new field and comes with its own challenges for keeping people safe. How a person interacts with someone through a voiced avatar is different from that same person interacting over text, and both of those situations differ from talking face-to-face. This project will present the most common problems facing the community of VRChat, the popular virtual reality massively multiplayer game.

#### Courtney Cazzola

Optimizing the Penetration of Nanoparticles into Platelet-Rich Plasma and Whole Blood Clots

Mentor: Julie Oliver, Biological Sciences

Ischemic stroke patients have a limited number of treatment options available. The only FDA approved drug comes with a significant risk of bleeding complications. We are investigating an alternative treatment that specifically targets activated platelets in occlusive clots using fibrinogen-conjugated gold-coated magnetic nanoparticles for hyperthermia. Previous experiments showed that using silver enhancement (SE) screening methods allows us to rapidly assess differences in clot network and the degree of penetration of fibrinogen conjugated-gold nanoparticles (FGN-cAu<sub>18</sub>) into clots under light microscopy (LM). We also found that the penetration and concentration of the nanoparticles were limited to the outside of the clot that formed at high thrombin concentrations, especially in whole blood (WB) clots. The success of disrupting the clot require a significant number of nanoparticles localized deep inside occlusive clots. Thus, we hypothesize that increasing label concentration and incubation time will increase the depth of penetration and concentration of nanoparticles into clots. We examined this using an *in vitro* model in which platelet-rich plasma (PRP) and WB were clotted using a high thrombin concentration followed by soaking in low or high FGN-cAu<sub>18</sub> concentration for 15 or 60 minutes. Frozen cross-sections were treated with SE and analyzed by LM. As expected, both short time incubation and low concentration of FGN-cAu<sub>18</sub> result in low label concentration and penetration inside clots. By increasing FGN-cAu<sub>18</sub> concentration and incubation time, penetration and concentration of nanoparticles improves significantly in PRP clot, but slightly in WB clot. These results suggest that multiple applications of nanoparticles may be necessary for a targeted nanoparticle therapy for ischemic stroke.

#### Pasua Chang

Diversity in the Dietetics Profession: A Review of Obstacles and Prospects

Mentor: Lori Klos, Kinesiology

Between 2040 to 2046, America is expected to be a majority-minority country. According to Census projections from 2012, mixed/biracial groups, followed by single-race Asians and Hispanics, will experience the fastest population growth. As America experiences this expansion in diversity, the demographic makeup of healthcare practitioners should mirror this diversity to ensure the best patient care. Many health care professions are already experiencing this shift in diversity; however, the dietetics field is lagging and is predominantly white females. The purpose of this research project was to identify factors contributing to the lack of diversity in dietetics, as well as initiatives and ideas to increase diversity in the field. This study was a literature review of original research, professional interest/practice, and commentary articles published in the last 15 years. PubMed was used to identify articles using the key terms dietetics AND diversity. Inclusion criteria were articles focused on barriers that minority populations identified or encountered in regard to careers in dietetics, as well as articles about strategies and recommendations to increase diversity in the dietetics field. A total of seven articles that met these inclusion criteria were identified and reviewed. African American populations were the primary ethnic groups discussed across articles. Five articles identified that the greatest barriers for minority students studying to become

dietitians were the ability to obtain internships and the lack of support from faculty. In six of these articles, pipeline and mentorship programs are identified as strategies to support diversify the dietetics field. The barriers identified by minority students are aligned with the competitiveness of the degree, including limited internship opportunities, as well as faculty who are not prepared for or representative of diversity. To overcome these barriers, pipeline and mentorship programs must be further supported, especially as the entry level degree for dietitians becomes a masters.

#### **Louis Chapman**

Novel Porous Material for Removal of Ammonia from Water

Mentor: Marcia Silva, Global Water Center

When rivers become overloaded with nutrients, they undergo expedited eutrophication, a process which leads to the proliferation of algae and threatens the health of our ecosystem. Modern practices in agriculture and industry lead to high volumes of nutrient discharge into the rivers. Wherever possible, we use available technologies to remove the contaminants from the run-off in these locations. Current methods of ammonia filtration such as nitrification and oxidation require installation of large tanks at the point of filtration. This incurs prohibitive costs and makes these methods unfit for wide-scale application. Furthermore, these options cannot be implemented in colder climates, necessitating the development of a new filtration mechanism. Many alternative methods such as chlorination perform best in the absence of other contaminants. This project focuses on development of an engineered natural porous material designed for removal of Ammonia from water. Our engineered material can operate in colder climates where nitrification cannot. This material does require low levels of water hardness to function properly, but it can be engineered to accept ammonia over other contaminants, making it a good choice for use in waters with multiple pollutants. Preliminary data shows a 70-80% removal of ammonia from water. This study aims to optimize adsorption capacity of the material and ensure its suitability for environmental applications.

#### **Lydia Chechowitz**

Self-Selected Leisure Promotes Ambulatory Blood Pressure Dipping: A Within-Person Field Experiment

Mentor: Marcellus Merritt, Psychology

An early indicator of future cardiovascular risk is a lack of nighttime blood pressure (BP) dipping from daytime to nighttime. Identifying what behaviors may promote greater BP dipping has potential to prevent future disease, yet recent work has suggested that common health behaviors like smoking and physical activity are unrelated to dipping. One viable set of behaviors may be engagement in self-selected leisure activities (or SSLAs) that have been shown to reduce stress and improve mood and cognitions, and to relate to general daily BP control. As such, we hypothesized there would be more nighttime BP dipping on a day in which one does an SSLA, versus another day when not doing an SSLA. Healthy young adults ( $n = 38$ ; 78.9% female; 68.4% White) visited our laboratory twice within roughly one week. At each visit, participants were fitted

with an ambulatory monitor to collect BP over 24 hours. On each day participants were randomly assigned to either engage in an SSLA or to go about their day as usual except to refrain from engaging in SSLAs. Results demonstrated a higher percentage of BP dipping on SSLA versus control days for both systolic BP ( $M=16.05$ ,  $SD=1.08$  vs.  $M=13.09$ ,  $SD=1.32$ ,  $p=0.033$ ) and diastolic BP ( $M=15.71$ ,  $SD=1.19$  vs.  $M=10.73$ ,  $SD=1.50$ ,  $p=0.003$ ). Overall, SSLAs may be a protective factor against future cardiovascular disease, by way of a nighttime BP dipping effect.

#### **Dylan Childs**

Water-Rock Interactions in Sediments Below Modern Evaporites

Mentor: Lindsay McHenry, Geosciences

The use of remote sensing spectrometers allows us to determine the composition and mineralogy of surface sediment from a distance without the need to physically collect samples. One limitation of this however is that the data we collect only represents the very surface and not further in depth. Our objectives in this research are to compare mineral assemblages from the surface and shallow subsurface to assess and identify any patterns present that could allow us to better infer overall composition. If relations between surface composition and that at depth can be related, then remotely sensed mineralogical data would be more useful. This could lead to better understanding of planetary surfaces to which we don't have direct access, providing more insight into past environmental conditions and why certain regions look the way they do today. In this experiment I used a one-meter long core sample collected from a modern evaporite crust near Lake Tecopa, California. The core was then divided into 2 cm intervals and I analyzed the mineralogy and geochemistry of each sample. I used X-ray powder diffraction and X-ray fluorescence to identify the minerals present in each sample, their compositions, and how their concentrations changed over time. Prominent changes in abundance with depth were only observed for the evaporite mineral, halite. It was abundant at the surface, and rare from 1-6 cm decreasing in abundance with depth. Halite was absent from samples deeper than 6 cm. Additional analysis will help determine the elemental composition of these samples, and assess how representative the surface composition can be of the whole.

#### **Lauren Clausing**

The History of Star Wars Fans and Racial Perceptions  
Mentor: Gregory Carter, History

Dr. Greg Carter's next book brings together two phenomena prominent in the past four decades: the science fiction movie franchise, Star Wars, and the increased acceptance of interracial intimacy. Unlike most writing on the galaxy far, far away, which focuses on narratives, this project prioritizes the historical contexts of the films, which put in relief overlooked themes like interracial intimacy, whether explicit or implicit. Our objective is to uncover the link between George Lucas's creation and our real world. Just as many assume the movies lack racial issues, some have claimed that the United States has reached a "postracial" state where racial difference is irrelevant. But these conclusions come from a colorblind naivete. We plan

to show how, in both realms, prohibiting interracial (or inter-species) intimacy has maintained the differences between racial groups. Because of the centrality of the perceptions, attitudes, and activities of Star Wars fans, Lauren Clausing and Dr. Carter use methodologies drawing mostly from History—collecting and evaluating primary sources, applying critical theory, and discerning continuities and disruptions—to examine them. We pursue three inquiries: First, in what ways have minorities participated since 1977? Second, how have mainstream (white) fans engaged with issues like diversity? Third, how have various fans reacted to interracial relationships between the characters in the sequel trilogy movies (2015-2019)?

#### **Ismael Coello**

Performance of Alumina-Forming Austenitic Alloys in Decoking Environments

Mentors: Benjamin Church & Lizeth Ortiz, Materials Science & Engineering

Ethylene is one of the most used petrochemicals because it acts as a building block for many everyday plastics. The environment in the tubes where ethylene is made develops solid carbon, or coke, that deposits onto the surface of the tubes, requiring a costly decoking procedure to eliminate the buildup. Decoking takes about 48 hours with a 30-90 day frequency and is typically done with a mixture of steam and air or only steam while the furnace is shut down. The reactor tubes are typically made from alloys that form a protective chromium oxide layer or, more recently, an aluminum oxide layer due to its resistance to coke accumulation. This study aims to compare the effects of three decoking environments on alumina-forming alloys in comparison to the baseline chromia-forming alloys to determine which environment is most beneficial to the tube. Further, a secondary conclusion regarding which alloy performs better in these conditions will be described. Samples will be analyzed after being placed in an atmosphere similar to what they would experience in a petrochemical plant. The decoking environments will differ only in their oxygen partial pressure from only air, only steam, and a mixture of both. Both materials will be characterized by scanning electron microscopy, energy dispersive spectroscopy, X-ray diffraction, light microscopy, microhardness, and mass changes to understand how various procedures alter the alloys. The close inspection after every processing step will determine which alloy exhibits greater coke and carburizing resistance. Also, the decoking environments will show the effect of oxygen activity on the carbon layer and on both alloys. These results will potentially decrease the cost associated with manufacturing downtime.

#### **Michael Coey**

Analysis and Design of Plate Fin Heat Exchangers for Use in Natural Gas Liquefaction

Mentors: John Reisel & Oluwatosin Aworanti, Mechanical Engineering

Plate fin heat exchangers are commonly used in industry for applications in cryogenic and natural gas liquefaction systems. Systems utilizing these plate fin heat exchangers use thousands of repeating sections to reach the desired cooling level. Modeling these systems to achieve optimization is desired, as

it will allow for less resource utilization to achieve the same effect. Accurate modeling will also allow for the testing of several proposed designs to be compared against conventional designs for potential manufacturing. Finally, all designs will be tested and compared to the numerical models to refine model accuracy and efficiency.

#### **Lisa Collins & Haley Collins**

The Advancement into Artificial Intelligence and Advanced Robotics

Mentor: Mohammad Rahman, Mechanical Engineering

The project that has been underway is one that looks into the future of advanced robotic systems and the use of artificial intelligence, AI, for use in healthcare, biomedical sciences, industrial, and workforce settings. From Hanson Robotics' Sophia to Department of Defense's Modular Prosthetic Limb, the AI sector has continued to rapidly evolve and adapt to the needs of humanity. This research aims to gain a higher level of understanding regarding the development and use of AI and robotics, from a basic level to the most complex, and to build a model of how a single algorithm could allow AI to grow and learn beyond its present state. This project has been centered around the development of artificial intelligence, the societal perception of AI, and the research into creating the android structure to replicate the mechanisms of the human anatomy as well as the human function. The project is an extensive one which will require time and effort across disciplines to develop the algorithm for a computer to learn as well as developing the neural networks and the capacity to replicate the natural mechanisms in a robotic android form. The basic concept of developing an AI with the ability to think, reason, and learn, is possible through the institution of very minimal coding, and working further toward this research will provide answers to the questions arising from how to succeed in this. Societal and cultural aspects and prejudices are investigated, with the eventual goal of the project to collaborate with multiple disciplines across the scientific field to create an android with lifelike mechanisms and the capacity to learn, think, feel, and make decisions. This will benefit society as a whole in the healthcare and occupational setting.

#### **Ryan Conrad**

The Effect of Rumination on PTSD in Veterans Exposed to War Zones

Mentors: Han Joo Lee & Abel S. Mathew, Psychology

Research has shown a relationship between posttraumatic stress disorder (PTSD) and depression (Orsillo et al., 1996). A common depressive symptom is rumination, which is a process of negative repetitive or obsessive thinking. The purpose of this study was to evaluate whether rumination was a predictor of PTSD symptom severity for veterans in a war zone (WZVs) versus those who did not serve in a war zone (NWZVs). We predicted that ruminative symptoms would be present in those exposed to a war zone as well as those not exposed to a war zone. Thirteen WZVs and 16 NWZVs from the Milwaukee VA Medical Center were recruited for a larger study evaluating working memory training for PTSD. Participants were given the following questionnaires: the Rumination Response Scale (RRS) and the PTSD Checklist for DSM-5 (PCL-5). The RRS

is a self-report questionnaire related to the ruminative thinking processes about the presence and persistence of depressive symptoms. The PCL-5 is a self-report questionnaire that measures the severity of PTSD symptoms that are found in the DSM-5. We found that rumination scores for WZVs are significantly associated with overall PTSD symptom severity scores ( $F(1, 11)=8.43, r^2=0.434, p=0.014$ ). However, rumination scores were not associated with overall PTSD severity scores for NWZVs ( $F(1, 14)=1.01, r^2=0.067, p=0.33$ ). These findings suggest that rumination is potentially more harmful in WZVs compared to NWZVs. A potential limitation for our study was the small sample size used. Future research could look at the relationship between rumination and PTSD in individuals that are civilians rather than just people in the military.

### **Luz Areli Contreras & Julio Mejia**

Dataset of Popular Videos in the Dominican Republic to Analyze Portrayal of Relationships  
Mentor: Heidi Luft, Nursing

The Dominican Republic (DR) has consistently had one of the highest rates of intimate partner femicide in Latin America. Despite evidence that media narratives can influence social perception and response to intimate partner violence, research that examines the portrayal of and narratives about intimate relationships within the most common media platforms in the DR is extremely limited. The aims of this study are to describe the innovative methods used to create a comprehensive dataset of the most popular videos on DR YouTube and preliminary findings. Over 30 days between October and November of 2019 we recorded the top twenty videos in the “Top Trends” list on DR YouTube at 9am, 1pm, 7pm, and 11pm Atlantic Standard Time. We collected the following information about each video at each time point: title, link, # likes, # dislikes, # views, YouTube category, # comments, name of the sending channel, and # of subscribers of the sending channel. We then determined the frequency that each video appeared in each of the top twenty and top three positions of the “Top Trends” list. A total of 421 unique videos were identified, 79 of which appeared at least once among the top three positions of the “Top Trends” list. The most common genres among videos were music and comedy. Among videos within the comedy genre, most were amateur videos. Development of a comprehensive dataset of DR YouTube videos in the top twenty positions of the “Top Trends” list, and initial analysis, suggest an important role of music, comedy, and local celebrities in conveying messages to viewers. Future qualitative analysis should focus on examination and comparison of how relationships are portrayed and discussed within the most popular music and comedy videos included in this dataset.

### **Paige Cooper-Rolefson**

Phonological and Morphological Information Influences Perceptions of Rhymes  
Mentor: Anne Pycha, Linguistics

We hypothesize that morphological complexity renders words more abstract in the minds of listeners. We tested this hypothesis by focusing on rhyming, which is a natural judgment that listeners make about how similar words are to one another. We compiled American English words into

rhyming groups based on their morphology (how words are formed) and their phonology (the sounds within a language). Specifically, we compared simple words (those that cannot be further simplified, mind and kind or old and bold) and complex words (those containing multiple morphemes, banned and canned or nailed and sailed). In the lab, the participants used headphones to listen to pairs of words and rated the goodness of the rhyme on a scale of 0% (not rhyming at all) to 100% (completely rhymes). In accord with our hypothesis, we predict greater goodness scores for pairs of complex words, compared to pairs of simple words.

### **Emily Crain-Castle**

The Impact of Short-Term Study Abroad Programs  
Mentor: Anne Dressel, Nursing

In this qualitative study, we systematically analyze the impact of short-term global health study abroad programs on UWM students by utilizing Krathwohl’s Learning Taxonomy. Krathwohl’s Taxonomy has five specific levels of affective learning: (1) receiving, (2) responding, (3) valuing, (4) organizing, and (5) characterization by a value or value set. Our analysis includes 43 student reflection papers, which was a common assignment required of all students participating in the UWM College of Nursing’s study abroad programs to Ecuador (August 2017), Malawi (January 2018), and Thailand/Laos (January 2018). The students were expected to answer the following questions: a) Describe similarities and differences that you noticed between the US healthcare system and the host country; b) what was the most surprising component of the culture that you experienced and why? and c) what is one characteristic of the culture that you could integrate into your lives and why? This study seeks to address a gap in the literature regarding the impact of short-term study abroad programs on students, by applying Krathwohl’s Learning Taxonomy to our qualitative study. It also gives us a larger N for analysis, and allows us to assess potential differences in impact among various study abroad sites.

### **Emily Crain-Castle**

New Form of Colonialism on the Rise  
Mentor: Paru Shah, Political Science

Research shows that most international volunteer programs are detrimental to the host countries development. The imagery of international volunteer work promotes a simplistic, and paternalistic, set of expectations of what volunteers will observe during their experiences (Tiessen 2018). Volunteer abroad programs advertise simple solutions resulting in a misconception of communities and the set of expectations for humanitarian aid. I will utilize the Critical Race Theory (CRT) to analyze how each tier directly relates to the factors that influence the impact of international volunteer programs. I plan to design a survey that will be administered to hundreds of participants of volunteer abroad programs. The survey questions will be catered to the framework of CRT theory. I will pursue this avenue further in graduate school this upcoming fall.

**Isabel Crespo**

Comparing Measures to Capture Attention Difficulties in Young Children with Neurofibromatosis 1  
Mentor: Bonita Klein-Tasman, Psychology

Neurofibromatosis type 1 (NF1) is an autosomal dominant disorder that presents with medical symptoms and increased risks of difficulties in various areas of cognitive functioning. Previous research has shown that children with NF1 often have difficulty with attention, many meeting criteria for Attention-Deficit/Hyperactivity Disorder (ADHD). The purpose of this study was to assess the reliability of two commonly used computerized measures used to evaluate attention. This project involves two different samples of preschoolers with NF1. The first sample (N=22; Mage=4.95 (SD = 0.66)) completed the Conner's Kiddie Continuous Performance Test (KCPT). The second sample (N=18; Mage=5.44 (SD = 0.76)) completed the second edition of the measure, the KCPT-2. Both versions of the measure assess attention. Cognitive functioning and gender distribution were not significantly different across groups, however the KCPT sample had significantly younger participants. We found that the children in the KCPT group overall demonstrated better performance than the KCPT-2 group. The standard scores for the Omissions ( $p=0.015$ ), Hit Reaction Time (HRT) ( $p=0.003$ ), Hit Reaction Time Standard Error (HRT SE) ( $p=0.006$ ), and Response Styles ( $p=0.001$ ) subscales were all significantly lower in the KCPT-2 group. Our analysis of the KCPT and KCPT 2 resulted in disparate outcomes. More specifically, in this study, the newer measure yields more difficulties, suggestive of greater sensitivity to attention difficulties. Examination of the test manuals for these measures suggest that perhaps the differences between the normative group samples of the two tests (KCPT and KCPT-2) are significant enough to affect how well children with NF1 perform on each test. Based on these results, clinicians and researchers may need to be cautious in their interpretations of attention symptomatology when using these measures with children with NF1, as different versions of the measure may yield different conclusions about the presence of attention difficulties in children with NF1.

**Jose De La O Arechiga**

Antioxidant Rich Diets Are Associated with Increased Verbal Fluency in Young Adults  
Mentors: Krista Lisdahl & Ashley Stinson, Psychology

Research shows that high antioxidant (e.g., vitamin E and beta-carotene) diets are associated with superior performance on verbal fluency and verbal learning tasks. Studies have found that an antioxidant rich diet is related to some cognitive improvements in verbal cognition. However, studies have primarily focused on how nutrition relates to cognition in older adults, and little is known about whether an antioxidant rich diet is related to cognitive performance in adolescents and young adults. The current study aims to investigate how self-reported recent consumption of antioxidant rich diet (foods containing vitamin C, E and beta-carotene) relate to verbal cognitive performance in teens and young adults. The sample included 95 participants aged 16-25 (44% female, 65% white). The Automated Self-Administered 24-Hour Dietary Assessment Tool was administered to assess participant's

food intake within the last 24 hours. Separate hierarchical regressions were conducted to evaluate whether levels of vitamin C, E, and beta-carotene (Step 2) significantly predicted performance on verbal fluency and learning after accounting for age, sex, and race (Step 1). Results showed in step 1 that together sex, race, and age were significantly associated with verbal fluency,  $R^2 = .089$ ,  $F(3, 91) = 2.975$ ,  $p = .036$ . After accounting for demographic variables, vitamin C, E, and beta-carotene were significantly related to verbal fluency,  $\Delta R^2 = .067$ ,  $F_{\text{change}}(6, 88) = 2.72$ ,  $p = .018$ . Antioxidant diet was not significantly associated with initial verbal learning at step 1 ( $R^2 = .012$ ,  $F(3, 91) = .376$ ) or 2 ( $\Delta R^2 = .106$ ,  $F_{\text{change}}(6, 88) = 1.964$ ). Consistent with prior studies in older adults, higher intake of antioxidant-rich food was significantly associated with superior performance in verbal fluency in adolescents and young adults. Future studies should consider how other measures of health, such as aerobic fitness, influence the relationship between nutrition and cognitive performance.

**Ryan de la Torre**

Behavioral Activation for Elderly Latinos with Depression: UCC-UWM Collaborative  
Mentor: Sandra Millon-Underwood, Nursing

The purpose of this study is to provide Behavioral-Cognitive coaching to elderly Latinos, who exhibit the signs and symptoms of Depression, and determine the effectiveness of Group-Based Behavioral Activation (BA) on depressive symptoms, when used with this population. Latinos face significant social, environmental, economic, and cultural challenges that increases their risk for depression and depressive symptoms. Research suggests that the prevalence of depression in elderly Latinos is high, with as much as double the rates of depression compared to their White or Black counterparts. The rates of depressive symptoms are higher in elderly Latinos, than in younger Latinos. There is a significant need to address the disparities associated with the rates of depression and depressive symptoms for elderly Latinos. Research suggests that Behavioral-Cognitive interventions for depression, which include BA, may be impactful in reducing depression symptoms in elderly Latinos, when used in a group format. This study is a One-Group, Pretest-Posttest Design. Participants are recruited from a local Latino senior center. Participants are privately interviewed, screened, and enrolled. The Geriatric Depression Scale (GDS) and the Social Connectedness and QoL measure are administered during the interview and screening. To be considered for enrollment, potential participants are to register a GDS score 5-10. Participants partake in 6-8 weekly group meetings. At each meeting, they receive the Group-Based BA intervention. Data is collected, assessing effort satisfaction and satisfaction of the attempted intervention. This repeats throughout the course of intervention. Participants receive Post-Screening using the GDS and Social Connectedness and QoL measure. Data collected from intervention will be analyzed quantitatively and qualitatively. Expected outcomes include a reduction in GDS scores, an increase on Social Connectedness and QoL measures, and increased satisfaction ratings. It may be concluded that, when used in a group format, BA has an impact on elderly Latinos who demonstrate depressive symptoms.

**Benjamin Delebreau**

Mechanical Stabilization of Proteins Due to Ligand Binding Using Magnetic Tweezers

Mentors: Ionel Popa & Narayan Dahal, Physics

The mechanical unfolding of proteins is commonly measured using single molecule force spectroscopy techniques. Here, we use magnetic tweezers and hetero-covalent attachments to measure this unfolding with the ability to change the surrounding solution or solvent easily in order to assess binding of a ligand to its substrate. Protein L and the Talin rod domains, R7 and R8, are our two substrates of choice. Protein L is a bacterial protein with two binding sites for kappa-light chain antibody ligands. The R8 domain of Talin is known to bind a potential antitumor ligand, Deleted in Liver Cancer 1 (DLC1). HaloTag and Spytag were used on the ends of each molecular construct to tether the proteins. Magnetic tweezers are then able to expose the molecule to forces up to 100 pN and measure unfolding and refolding cycles. We find that ligand binding induces mechanical stabilization in both protein L and Talin R8 domains. These results open the way for screening new mechano-active drugs against bacterial infection and cancer.

**Diego Dominguez-Ramirez**

Making of Tissue-Mimicking Gelatin for Aiding in Thermoacoustic Emission Analysis from Particle Beam

Mentor: Sarah Patch, Physics

Particle therapy is used in special facilities around the world to treat cancer. This method employs accelerated charged particles to deliver efficient and controlled clinical plans to patients. With the aid of acoustic sensors, clinical plans can be analyzed via thermoacoustic emissions from the particle beam during stages of the procedure. The purpose of this project was to create gelatin models that captured anatomical features and could be put in front of the beam. As a substitute for patients, these gelatin models could be put through a variety of clinical plans, thus testing the emission-detecting equipment. In particular, mimicking fatty tissue and muscle-fat interfaces was desired. Once muscle-fat interfaces could be repeatedly fabricated, cavities were created in the interior muscle. Cavities could be left empty, filled with fluids, or filled with bone-mimicking material. The next step was to scale the process from a 500 mL sample to a 4.2 liter sample. As a final step, the stoichiometry for the sample was computed and added to a material library for Monte Carlo modeling. Through this program charged particles are modeled as they come to stop in a target. In the fall of last year, the gelatin model was put in front of a beam. During delivery of a clinical treatment plan, a 4-channel thermoacoustic system could track motion of the charged particle beam as it treated different parts of the gelatin model.

**Jonathan Doria**

A Mathematical Model of the Disruption of the Glucose Homeostasis in Cancer Patients

Mentor: Peter Hinow, Mathematical Sciences

In recent years much research has been done on how cancer can disrupt glucose homeostasis in people. Proliferating cancer cells require large amounts of energy to grow and

as such compete with healthy body tissue for glucose supply. Mathematical models have been developed to better understand the glucose-insulin-glucagon feedback system in healthy and diabetic individuals. Moreover, there is a wealth of knowledge on bodyweight regulation and energy balances. Our model focuses on how the healthy and cancerous cell populations compete for their energy source. In a first step, we have identified a steady state in a cancer-free person. Presently, we continue literature review looking to find parameters for body mass and amount of glucose available, together with rates for glucose intake and energy use. In the future we will look at the effects of cachexia in cancer patients, which is the involuntary loss of skeletal muscle. We also plan to address complications to cancer treatment in diabetic patients and the possible use of diabetes medication such as Metformin to overcome these complications.

**Jacob Duchac**

Natural Climate Change

Mentor: Phillip Owens, College of General Studies - Mathematics & Natural Sciences

The past century has shown a significant increase in the average global temperature. The source of this temperature change, however, is not fully understood. I approached this topic by looking into the different natural causes of climate change and how impactful they might be. Natural processes, such as Milankovitch cycles, solar cycles, carbon cycles, and ocean oscillations affect the global climate in different ways. Some have a short-term effect, and some have a long-term effect. For example, phytoplankton and other forms of vegetation found all around the globe greatly affect short-term climate change, whereas plate tectonic cycles have major effects on long-term climate change. Greenhouse gases, including water vapor ( $H_2O$ ), carbon dioxide ( $CO_2$ ), tropospheric ozone ( $O_3$ ), and methane ( $CH_4$ ), play a crucial role in climate change because of their effects on Earth's energy balance.

**Adane Durham**

What Does Understanding Have to Do with Measurement of Endurance During the 2MWT in Young Children?

Mentor: Victoria Moerchen, Kinesiology

The 2-Minute Walk Test (2MWT) is a measure of endurance and is used across a wide age range from young children to adults. The level of comprehension of a 3-year-old is different than that of a 69-year-old. However, the instructions of the 2MWT are standardized. The purpose of this study was to compare the errors young children make in performing this task using two different walking paths. Twelve typically developing children between ages 3-6 performed a 2MWT on two different paths. Path 1 was designated by two cones 50 feet apart. Path 2 was designated by a taped 50-foot path resembling a track. For both paths, children were instructed to walk around the path for two minutes. Each child performed both paths and the order of performance of the paths was randomized. Motor errors were coded by lap from video data. Error variables included running, noncontinuous walking, incorrect segment direction, and incorrect turns. Error scores were then turned into a standardized score to allow for comparison across children. A T-test was used for between

subject comparison of motor errors per path. Children ages 3-6 years made significantly fewer errors on Path 2 (2.30%) than on Path 1 (12.2%;  $p=0.013$ ). This result was robust, in that all but two children performed with fewer errors on Path 2 than on Path 1 (mean difference=9.9%). Children perform with fewer errors (running, noncontinuous walking, incorrect segment direction, and incorrect turns) when walking a path that includes unambiguous visual guidance. These data are part of a larger study, but start to suggest that quality of performance as well as distance walked may be important in identifying a 2MWT path that optimizes the performance of young children.

#### **Olivia Dye**

Effects of a Novel, Non-Toxic Histone Deacetylase Inhibitor on Memory Formation in Mice

Mentors: Karyn Frick & Sarah Beamish, Psychology

As researchers make strides to understand how the brain and memory function, memory formation continues to have many unknowns. Chromatin remodeling through epigenetic modifications, such as histone acetylation, promotes successful formation of long-term memories by increasing levels of gene expression. Research demonstrates that histone deacetylase inhibitors (HDACi) improve memory by preventing the deacetylation of core histone proteins and allowing transcriptional machinery to increase access to open chromatin. HDACi are a promising therapeutic target for memory decline, however, the memory enhancing effects of existing HDACi are precluded by their high toxicity and unwanted solubility. In collaboration with the Chemistry and Biology Departments at UWM, we have developed a novel brain-penetrant HDACi compound, Cpd1', that shows no evidence of toxicity. Data collected from our lab indicates that Cpd1' is capable of enhancing spatial memory in mice. However, it remains unclear the extent to which Cpd1' modifies levels of histone acetylation in the brain. The goal of this work is to determine whether Cpd1' modifies histone acetylation levels in a time-dependent manner in the dorsal hippocampus (DH). Mice received an intraperitoneal injection of negative control (100% DMSO), positive HDACi control sodium butyrate (0.6 g/kg NaBu), or one of three doses of Cpd1' (20,30,40  $\mu\text{g/g}$ ), and the DH was dissected 1 hr later. DH tissue was then homogenized so that histones were extracted, and any posttranslational modifications were kept intact. Here we present Western blot data of histone acetylation changes in the DH after 1 hr treatment. Collectively, this work represents a step forward in providing safer therapeutic treatments that can be used to treat memory decline.

#### **Rebecca Eaton**

Underfunding the Impact

Mentor: Benjamin Trager, Community-Based Learning, Leadership, and Research

I will be exploring underfunding in public schools and non-profits and the effects it has on our youth of today, by asking the question, "How does underfunding of public schools and non-profits in Milwaukee affect the Milwaukee youth?" The context of my research will be conducted through my community-based internship program and the community

engagement work I have done throughout my college career. I will dive into the public school system, the non-profit world, and the current policies on funding. My methods of conducting are dialogical reflection, guided reflection, and expressive reflection. The conclusion I have come to is funding greatly impacts kids. Schools are seeing high rates of teacher burnout. From my observations classrooms are overcrowded, and students are facing barriers they are unable to overcome. Students in Milwaukee are graduating high school with what seems like a second-grade reading level. The reading level students graduate with leaves them unable to attend higher education let alone prepare them for life after school. The non-profits that aim to support and aid these students have high turnover, overwhelmed staff, and stretch their dollar as far as it can go. As a result, both teachers and non-profit staff are suffering along with the students. My recommended solution is to rewrite the tax laws we currently have, to ensure everyone pays an equitable amount. Increasing the taxes for the heavily successful people and profitable companies would bring in more money. The influx of money would reduce class size, increase pay for teachers and school social workers, and raising the standards for the professions. The money would also bring back and fund important programs such as home economics, performing arts, and visual arts classes. Home economics teaches life skills needed in adulthood. While the performing and visual arts teaches positive self-expression and promotes creativity.

#### **Alessandra Ebben**

Role of Cancer Cells on Force Transmission in a Multicomponent, Multicell Model of the Endothelium  
Mentor: Mahsa Dabaghmeshin, Biomedical Engineering

Cancer cells (CC) alter local hemodynamics in their vicinity which will influence the function of endothelial cells (ECs). Hemodynamic forces applied at the apical surface of vascular ECs provide the mechanical signals at intracellular organelles and through the inter-connected cellular network. ECs transduce the hemodynamic forces resulting from blood flow into intracellular signals that affect gene expression and cellular functions such as proliferation, apoptosis, migration, permeability, cell alignment and mechanical properties. An understanding of how the presence of a CC influences hemodynamic forces on the endothelium is needed before we can identify potential structural components of ECs that are believed to play important roles in force transmission. The objective of this study is to investigate computationally how the cancer cell influences the forces experienced by structural components of ECs. The 3D multiscale, multi-component model of an endothelial cell monolayer was developed using COMSOL Multiphysics CAD software. The model was successfully designed to simulate a layer of endothelial cells, including their glycocalyx layer, cortical apical layer, focal adhesions, adherens junctions, stress fibers, and nuclei. By investigating the effects of arterial wall stiffnesses and high shear conditions, we can better understand how CC impact the local hemodynamics in their vicinity, how the changes in the local hemodynamics may impact the force transmission to subcellular organelles, how the stiffness of arterial wall may impact the force transmission in ECs, and identify the subcellular components (mechanosensors) which may be

activated during the adhesion of cancer cells to endothelial cells. We will validate our model by several tests of different parameters to determine that the results are sensible for each test. Our model will establish accurate criteria predisposing the cancer metastasis and identify the role of each individual mechanosensors in metastasis.

#### **Hannah Edens**

Comparing Gold Nanoparticle and Magnetite Nanoparticle Penetration into Platelet Rich Plasma Clots

Mentors: Julie Oliver & Cammy Truong, Biological Sciences

We are investigating alternative treatments for patients with ischemic stroke that are unable to receive tissue plasminogen activator (tPA) due to bleeding risk. We proposed that targeting activated platelets rather than fibrin in occlusive thrombi for magnetically induced hyperthermia could provide treatment for ischemic stroke with minimal risk of bleeding. Since synthesizing gold-coated magnetite nanoparticles (FGN-cAu-Fe<sub>3</sub>O<sub>4</sub>) is not a robust procedure, previous work used the robust fibrinogen-conjugated gold nanoparticles (FGN-cAu<sub>18</sub>) model to examine the nanoparticle penetration into clots. The goal of this research is to inspect whether FGN-cAu-Fe<sub>3</sub>O<sub>4</sub> and FGN-cAu<sub>18</sub> of approximately the same diameter show differences in their ability to penetrate and concentrate in clots during labeling. We hypothesize that FGN-cAu-Fe<sub>3</sub>O<sub>4</sub> will access the interior of platelet-rich plasma (PRP) clots to the same extent as FGN-cAu<sub>18</sub>. To test that hypothesis, PRP was clotted *in vitro* using low and high thrombin concentrations, followed by labeling with either FGN-cAu<sub>18</sub> or FGN-cAu-Fe<sub>3</sub>O<sub>4</sub>. Frozen cross-sections were treated with silver enhancement and analyzed by light microscopy. As expected, FGN-cAu<sub>18</sub> and FGN-cAu-Fe<sub>3</sub>O<sub>4</sub> produced several similar results. First, the degree of nanoparticle penetration and concentration inside PRP clots are consistent between both types of nanoparticles. Second, the extent of nanoparticle penetration was inversely related to the thrombin concentration, with high thrombin concentration resulting in reduced nanoparticle penetration. Third, more nanoparticles deposit at the clot periphery and their concentration is reduced at the center of clots. These results confirm that FGN-cAu<sub>18</sub> can be a representative model for FGN-cAu-Fe<sub>3</sub>O<sub>4</sub> in term of studying the nanoparticle penetration into clots.

#### **Marie Enderle**

Social Functioning Difficulties in Young Children with Neurofibromatosis Type 1

Mentor: Bonita Klein-Tasman, Psychology

Neurofibromatosis type 1 (NF1) is an autosomal dominant genetic disorder affecting 1 in 3,500 people and is characterized by cognitive, academic and executive difficulties, as well as common reports of social functioning deficits. No published research has analyzed the sensitivity of various social measures in relation to children with NF1. The purpose of the current study is to analyze three different measures that examine social functioning for use with young children with NF1 with a focus on the specific items on which children have difficulties. Participants are sixty-two children with NF1 (ages 3-8) and their parent as well as thirty-nine siblings without NF1 (ages 3-8) and their parent. Parents completed the Social Skills

Rating System (SSRS) questionnaire, the Behavior Assessment System for Children- 2nd Edition (BASC-2) questionnaire and participated in the Scales of Independent Behavior- Revised (SIB-R) parent interview. In our past research, we have seen that standard scores across these measures differ, suggesting that some measures are better at capturing social challenges than others. In the current investigation, we will specifically examine the frequency of difficulties on the items from each measure, to more concretely identify whether there are specific social skills that emerge as strengths and weaknesses for children with NF1 in their daily lives (using chi-square analyses). We expect that children with NF1 will show specific social deficits in comparison to the control group. Studies analyzing social functioning have the potential to help inform parents and teachers on intervention strategies specifically relating to children with NF1. Since previous research shows various negative outcomes related to social challenges, this research represents an area of study that needs to be further explored to help improve the daily lives of children with NF1 at school, with their peers, and in the home.

#### **Jacob Exline**

Assessment of Auditory and Vestibular Function in *Cabin1* Knockout Larval Zebrafish

Mentor: Ava Udvadia, Biological Sciences

The auditory and vestibular systems mediate hearing and balance, respectively, and are critical for an organism's survival. *Cabin1*, a gene encoding a calcium-dependent transcriptional repressor, is upregulated during development in neural and neural crest-derived tissues, which include the auditory and vestibular systems. Previous work in our lab suggested that reduced expression of the *Cabin1* protein leads to diminished auditory and vestibular function in developing zebrafish. In this study, we test the hypothesis that the *cabin1* gene is necessary for proper auditory and vestibular development. Four behavioral assays are performed on zebrafish strains possessing targeted gene knockout mutations in the *cabin1* gene. Application of light otic vesicle pressure, or ear touch, elicits an auditory escape response. Head and tail touches also elicit escape responses, allowing use to distinguish specific deficits in auditory response from more general deficits in the motor activity of *cabin1* mutant fish. While conducting our preliminary studies, we discovered two shortcomings in our approach: (1) the head touch control was found to be unreliable in stimulating an escape response, and (2) an oversight was made pertaining to the lateral line of the fish. The head touch frequently failed to elicit a response even in wild type fish, making it difficult to detect deficits in this behavior. The lateral line is an organ that detects particle motion in water, thus eliciting escape responses as the probe perturbs the water while approaching the fish. Here we report on the optimization of protocols that will be used to further investigate the role of *cabin1* in auditory and vestibular function.

**Grace Feucht**

Sex Differences in Hippocampal Immediate-Early Gene Expression Following Context Fear Conditioning  
Mentor: James Moyer, Psychology

Women are twice as likely to suffer from posttraumatic stress disorder (PTSD) than males (Richards & Van Neil, 2017). PTSD can be modeled in the lab using Pavlovian fear conditioning. The paradigm used for this experiment is context fear conditioning, in which rodents learn to associate an environment with an aversive stimulus (foot shock). Some studies have shown sex differences in context fear learning (e.g., Maren et al., 1994). However, other work did not observe sex differences in short-term acquisition, instead observed sex differences in molecular mechanisms that may underlie differences in later retrieval of fear learning (Gresack et al., 2009). We used context fear conditioning in male and female rats to investigate how fear learning changes immediate early gene (IEG) expression. IEGs are activity markers that are evoked by environmental stimuli. We measured IEG expression in two brain regions that are important for context fear learning, the dorsal and ventral hippocampus. Context fear conditioning involves rats being placed in a conditioning chamber where they receive footshocks. Rats learn to associate the context with the footshocks, and this can be measured by freezing behavior. A day later, rats are placed in the same chamber but without footshocks and freezing behavior is measured. An hour later, their brains are removed and processed for protein analysis. Western blots are used to quantify the amount of IEG expression in the dorsal and ventral hippocampus. Initial behavioral results indicate that there are no sex differences in retrieval of context fear memories. Any observed sex differences in IEG expression in the hippocampi following memory retrieval, would suggest that the molecular mechanisms may differ between males and females even following comparable retrieval of context fear memories. Understanding sex differences in molecular mechanisms of fear learning may explain why females are more susceptible to PTSD.

**Travis Fichtenbauer, Sparrow Roch, Claire Bolda, Natalie Meyers & Herbert De Leon**

STARS@UWM: The Search for Pulsars  
Mentors: David Kaplan, Sarah Vigeland & Joseph Swiggum, Physics

Pulsars are a type of evolved star that are extremely dense and rotate with an extremely fast and reliable period, producing an intense beam of radiation comparable to the pulse of a lighthouse. This unique pulse allows for novel ways to study the universe, the most exciting of which being the potential to detect previously undiscovered gravitational waves, giving further evidence to Einstein's theory of relativity. The Student Team of Astrophysics ResearcherS (STARS) was formed as a way for undergraduate students to be involved in the search for new pulsars and make a contribution towards the goals of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav). Students remotely observe from UWM using two of the world's largest radio telescopes, the Green Bank Telescope in West Virginia and Arecibo Observatory in Puerto Rico, then analyze resulting data to discover and

study these incredibly exotic neutron stars. Students at UWM also collaborate with other institutions around the country, including Franklin & Marshall College, University of Washington – Bothell, Kenyon College, Hillsdale College, West Virginia University, and more. Students from UWM have also participated in astronomy-related projects internationally in places such as China, Italy, India, South Africa, and Australia.

**Travis Fichtenbauer**

Analyzing Nulling Pulsars Using Gaussian Mixture Models  
Mentors: Joseph Swiggum & David Kaplan, Physics

Pulsars are rapidly rotating neutron stars that emit radiation from their magnetic poles. A small portion of the pulsar population is known to occasionally cease radio emission for periods of time; these are called nulling pulsars. The study of nulling pulsars allows us to better understand the emission mechanism of pulsars and how pulsars “die.” Observations for this project were made using the world's largest steerable radio telescope - the Green Bank Telescope. We proposed confirmation observations of 15 nulling pulsar candidates, sources originally discovered in the Green Bank North Celestial Cap (GBNCC) survey, and we have conducted observations for all of them. Until now, techniques used to estimate the nulling fraction (fraction of time pulsar spends in a null state) were biased, so we employed a new method using Gaussian mixture models to better estimate nulling fractions and characterize the nulling behavior of several recently-discovered pulsars. Our results indicate that the previous method of analysis systematically overestimated the nulling fraction by amounts that range from 10 to 57 percent.

**Patrick Finucane, Steven Rasmussen, Jon Zepeda-Martinez, Rachael Varin, Miranda Lutzke & Taylor Romanyk**

*Know Thyself*  
Mentor: Trudy Watt, Architecture

*Know Thyself* uses storytelling, architectural representation, and artificial intelligence (AI), to produce a high-fidelity reflection of spatial experience to advance human-centered design more nimbly than previously possible. This data serves as a foundation for testing novel ways of analyzing buildings and inhabitant experience, and for investigating bias in traditional architectural analysis and the emergent field of human-centered AI. This methodology addresses the paradigm shift present in the growing senior population, a large percentage of which are retiring in the next 10 to 20 years. It is crucial to foster preemptive thinking. Developing a fundamentally proactive health support system requires forethought and integrated affordances that directly improve the wellbeing of the aging community. The team is training in the TimeSlips method established by UWM's Anne Basting. Utilizing her process, we are engaging elderly patients in a narrative-driven conversation which utilizes observation, improvisation, and creativity to help redirect discussions from recollection. These narrative data, along with traditional architectural analysis methods, are the sources for synthesizing an iterative process that cultivates a fingerprint representative of the Luther Manor community. Back at UWM, the group uses these conversations to drive narrative material analysis through exploring new applications of AI that analyze data via a human-centered,

machine learning methodology. We will use new applications of unsupervised machine learning, devised by the team, to process these data. Throughout the research process, *Know Thyself* operates in parallel with the early design efforts of Plunkett Raysich Architects, who have begun the process for renovation and addition to the 19-acre Luther Manor campus in early 2020. During the 2020 spring semester, the group worked on establishing foundational working methodologies through team-oriented research development (i.e., co-design with faculty); and gaining an understanding of the current research taking place in the healthcare and AI communities.

#### **Bailey Flannery**

Animal Transformations: Medieval Commentary on Consent and Sexual Violence

Mentor: Jacqueline Stuhmiller, Honors College

In tales across the Celtic tradition, men transform into animals after mastering women through sexual violence. The fourth branch of the Mabinogi, a collection of ancient Welsh myths, offers a prime example through Gwydion and Gilfaethwy, who abuse their statuses and magical abilities in order to rape a woman named Goewin. Once she describes her experience and accuses them of raping her, Gwydion and Gilfaethwy turn into creatures of the hunt. This is not simply a punishment, but also an oblique reference to the love-hunt: an age-old, inherently violent metaphor of erotic pursuit in which men chase and forcefully overtake their female prey. Through their transformations into animals, this tale indicts not just Gwydion and Gilfaethwy, but also the love-hunt's model of gender relations and masculinity—a toxic masculinity based in violence. Unlike their male counterparts, the women of these tales turn into animals when they use their powers of speech and wisdom to reject the love-hunt and master themselves instead. Examples include the Mabinogi's Rhiannon and Irish mythology's Macha, both of whom transform into horses. Notably, horses are physically powerful and impressive, yet they are also non-predatory creatures, suggesting Rhiannon and Macha's non-violent mastery. Furthermore, horses often serve as the tools of men without granting their consent; their bodily autonomy is similarly violated. Thus, when Rhiannon and Macha turn into horses, this symbolizes a reversal in which woman and animal alike rebel against their would-be masters, opening the possibility of alternative gender relations that undermine the love-hunt and assert women's bodily autonomy. By examining the Mabinogi and other Celtic tales, such as “The Weakness of the Ulstermen” and “The Dream of Oenghus,” I will demonstrate that the animal transformation is ultimately sympathetic to women, elevating their voices and experiences in the face of sexual violence.

#### **Isabelle Flores**

The Three Kings: Applying a Contemporary Concept Onto an Old Story

Mentor: Alvaro Rios, Theatre

Theatre is a unique way to bring people together from various age groups and communities. Different types of people sit in a small space to see concepts that they enjoy, are meaningful to them, that disturb them, and where they can also walk away with a lesson learned. For the Three Kings Day study, we are researching the Three Kings holiday (also known as the Three Wise Men or the Three Magi) with the intent of writing a new theatrical script for a contemporary audience.

With the use of online sources and book sources, information about this holiday is being collected and compared. Theatrical plays relating to the Three Kings, including Christmas nativity plays, will be analyzed as well. By looking at these types of plays, we will consider plot concepts that already have been done and concepts that have not been done. The anticipated outcome for this study is to create scenes about the Three Kings themselves using the collected information. With so many ethnic communities living in a vast country like the United States, sometimes traditions such as holidays and their importance are lost with new generations. In 2017, a study was conducted showing that 60% of first-generation Latinos living in the United States are involved in their ethnicity's traditions; among second generations, only 49% are, and for the third generation, 35% are involved (Lopez). With this work, the aspiration is to have people want to learn about holidays and customs from various cultures. This work will also have people ponder about the holidays that they celebrate; why do they celebrate certain holidays and the importance it brings to their families or their cultures.

#### **Brooke Follansbee**

Classification of Covert Visuospatial Attention Direction to Assist People with No Motor Function

Mentor: Roger O. Smith, Occupational Science & Technology

People with minimal to no motor function lack the means necessary to communicate and control their environment. Our literature review revealed that Covert Visuospatial Attention (CVSA) classification, although thoroughly studied, has rarely been used in addressing the needs of these individuals (such as individuals with Locked-in Syndrome). CVSA is the process of attending to a target without overtly looking at it, which can be classified through noninvasive Electroencephalography (EEG). We collected EEG data from 4 healthy participants (all female, ages 21-27) performing a CVSA task by attending to the left or right. We then preprocessed the data and applied machine learning algorithms to classify the direction of CVSA. Due to human error, we discarded one participant's recorded data. We discovered that the classification accuracy ranged between 70%—74.07% for the remaining 3 participants. Our classification of CVSA direction met the accuracy requirements set by pioneers in the Brain-Computer Interface (BCI) field. Therefore, in this pilot study, we conclude that CVSA direction classification through EEG can be utilized and has potential to assist individuals with minimal to no motor function with communication and control tasks.

#### **Meredith Frank**

Targeting Chemosensory Array Formation for Safe Biofilm Dispersal of *Pseudomonas aeruginosa*

Mentor: Sonia Bardy, Biological Sciences

Afflicting more than 700,000 people worldwide, Cystic Fibrosis (CF) is a disorder characterized by the buildup of mucus within the airways of affected individuals. Particles such as bacteria get trapped in the airways of CF patients and increase the risk of infection, respiratory failure, and other complications. One such bacteria, *Pseudomonas aeruginosa*, forms biofilms within the lungs of CF patients. These biofilms have increased antibiotic resistance which hinders treatment of *P. aeruginosa* infection; biofilm dispersal is proposed as a critical part of treatment of *P. aeruginosa* infection. However,

biofilm dispersal of swimming bacteria can trigger satellite infections within the airways. Safe biofilm dispersion would require non-motile bacteria. Swimming motility, powered by a rotating flagellum, is controlled by a chemotaxis system of *P. aeruginosa*. Proper swimming motility relies on the formation and localization of unipolar chemosensory arrays. It was recently discovered that interrupting the stability and/or localization of these chemosensory arrays has negative effects on swimming motility. I am seeking to understand the level of interdependence between chemosensory proteins that form these arrays and are essential for swimming motility. Specifically, my results will focus on protein stability in the absence of an interacting partner. I have created fluorescent fusion proteins and will use FACS analysis to determine if protein expression is altered in the absence of an interacting partner. These results will help better model the protein interactions in array formation and signal transduction in *P. aeruginosa* and allow us to target swimming motility to limit satellite infections during biofilm dispersal.

#### **Eli Frank**

Mapping Radical Milwaukee  
Mentor: Rachel Buff, History

For nearly half a century, Milwaukee was governed by a trifecta of socialist mayors and was home to one of the most robust and accomplished socialist movements in the country. The history of municipal socialism in Milwaukee has received considerable scholarly attention, and the historical legacy of this socialist movement is ever-present in the Milwaukee landscape and built environment; one need only look to the public parks system, for example, to see the impact municipal socialism had on shaping the terrain we interact with every day. Less known, however, is that twentieth-century Milwaukee was also home to other radical movements and tendencies, like communism and anarchism. This project, then, in identifying and mapping a handful of sites representative of the social, political, and cultural worlds of Milwaukee's various radicalisms and placing those sites in their historical contexts, seeks to answer how these other radicalisms laid claim to public space and how, in thinking of the built environment as historical witness, we can read the urban landscape for traces of this disappeared past. We will end by advancing a number of conclusions that can be drawn from this research, including proposing a link between the suppression and marginalization of radical movements during the Red Scare(s) and processes of erasure in the built environment. Ultimately, by mapping the history of Milwaukee's marginalized radicalisms, we hope to raise to the surface the ways in which these submerged and subjugated histories laid claim to public space and worked to transform the social fabric of the city. In recovering and reconstructing the social, political, and cultural worlds of Milwaukee radicalisms, this project aims to uncover alternative narratives about Milwaukee's past to allow us, however fleetingly, to reinhabit those disappeared worlds in the hopes of imagining alternative futures.

#### **Armand Gamboa**

Food Justice in the Milwaukee Landscape  
Mentor: Arijit Sen, Architecture

This research is a part of a bigger project called "Climates of Inequality." Organized by the Humanities Action Lab, a coalition of universities led by Rutgers University-Newark working with issue organizations and public spaces, this

participatory public memory research project engaged students, educators, and community leaders from over 20 cities across the US and around the world in order to expose the roots of current environmental injustice, and share generations of front-line communities' strategies for resistance, resilience, and mitigation. The Milwaukee community's story is critical in this global vision and action around climate and environmental justice. Throughout its conception and development, the food landscape of Milwaukee has continually evolved to serve a diverse set of needs. This study examines the history of that development, and its impact on the larger social justice framework of the city, through the construction of a timeline analyzing national policy and local events. The purpose of this policy-event timeline is to render visible the complex relationships between larger national policies and local actions. The timeline illustrates how local actions respond to the opportunities and deficiencies afforded by the larger system of national and local policies. In analyzing the importance of food as an interconnected agent in social justice, the resiliency of community residents in the face of injustice is exposed as a model of resistance.

#### **Halie Gehling**

Resistance Isn't Futile: The Fight Against Buckthorn  
Allelopathy

Mentor: Teresa Schueller, College of General Studies –  
Mathematics & Natural Sciences

Common buckthorn (*Rhamnus cathartica*) is a highly invasive plant that is quickly overtaking Wisconsin and much of the Northern Midwest. Buckthorn is an aggressive pioneer species that takes advantage of disturbed ecosystems and edge habitats. One reason why buckthorn is particularly difficult for land managers to control is because of its allelopathy (the ability to create and spread toxins to other plants to negatively influence germination). The top priority for land managers dealing with invasive plants is to keep uninvaded areas clean. To accomplish this, land managers could plant a native, easily controlled crop to occupy the space until the spread of invasives has been diminished. In order to compete with the buckthorn to slow or stop resprouting, we tested three native species' resistance to the *R. cathartica*'s drupe allelopathy: mustard (*Guillemia flavescens*), big bluestem (*Andropogon gerardi*), and Canada wild rye (*Elymus canadensis*). Unripe drupes were collected in mid-August and ripe drupes were collected in mid-September, 2019. Drupes were placed in the center of petri dishes that were 15 cm in diameter. Each dish contained six rings of six seeds from one native species. The plants were left to germinate for 19 days under continuous light and daily watering. For both tests, *E. canadensis* germinated more than the others, and consistently closer to the drupe. Although this suggests *E. canadensis* may have some resistance to *R. cathartica*'s allelopathy, it is still uncertain if the native species would be able to out-compete common buckthorn outside of a lab setting, as many variables, like soil composition, microbiomes, and surface substrates, were not tested for. The results of this preliminary experiment show that there is variation in allelopathic resistance between native species of plants, making some more suited to use in remediation or as a cover crop when managing a buckthorn invasion.

**Stephan Girard**

Going with the Flow: Silicate Influxes from Soil and Grasses to the Milwaukee River

Mentor: Erica Young, Biological Sciences

Silicate is a common mineral compound of silicon and oxygen and is an important nutrient for some algae in aquatic ecosystems. One algal group, the diatoms, have strict silicate requirements for growth as they form protective silicified cell walls called frustules using biogenic (biologically transformed) silicate. Though silicates are common minerals, in aquatic ecosystems the dissolved bio-available silicic acid ( $H_4SiO_4$ ) is often limiting for diatoms. Inputs of Si to lakes include from rivers. Preliminary data from 2018 and 2019 suggests that biogenic silicate inputs to the Milwaukee river increases with river discharge ( $P < 0.01$ ,  $R^2 = 0.53$ ). Some higher plants have biogenic silicate deposits, called phytoliths, which can break down and dissolve into silicic acid, contributing to riverine Si inputs. This project aimed to determine silicate content of river grasses and nearby soil, and the significance of phytoliths and plant Si released into the Milwaukee river during snowmelt or rainfall. Samples of grass, soil, and river water were collected from alongside the Milwaukee River during winter. Samples were analyzed for dissolved Si and for total biogenic silicate content using a hot, alkaline extraction. The methodology for extraction of Si from soil was tested using a range of extraction intensities to ensure extractions were representing total biogenic silicate with minimal contribution from mineral Si. To examine conversion of biogenic silicate in grasses to dissolved silicate under natural conditions, samples were incubated in river water and silicic acid content of the water measured over time. This work contributes to ongoing research on the Lake Michigan Si budget, characterizing riverine sources of Si to the lake, especially in the productive nearshore zones.

**Stephan Girard**

A Bioinformatics Analysis of Plant Aspartic Protease Nepenthesin I

Mentor: Madhusudan Dey, Biological Sciences

The carnivorous pitcher plant *Nepenthes alata* produces digestive enzymes including proteases which degrade proteins in captured insect prey. Nepenthesin I (NEP1) is an aspartic protease similar to pepsin that is found in human stomachs. Nepenthesin is unique in that it cleaves on either side of an aspartate residue and is extremely stable in an acidic pH. This protein is important because the plant depends on prey digestion to get vital nutrients such as nitrogen. The National Center for Biotechnology Information (NCBI) database shows that the *nep1* gene is mapped at gene locus AB266803 on the nuclear genome. This gene contains one exon, and codes for a protein of 437 amino acids (46.33 kDa). Using the NCBI BLAST tool, I retrieved the gene/protein sequences of 8 paralogs, homologs, and orthologs. I chose these similar genes based on the percent similarity to *nep1* with a  $< 30\%$  cutoff. Using the sequence of those genes, I used the program Molecular Evolutionary Genetic Analysis (MEGA) to perform a multiple sequence alignment. This showed which nitrogenous bases are critical to creating the proper amino acid and which might be substituted without having an impact on function. The multiple sequence alignment also showed sequence homology

between *nep1* and these homologs. Using the same program and the gene alignment, I constructed a phylogenetic tree to visualize gene sequence relatedness. A published 3-dimensional structure of this protein is not available on RCSB Protein Data Base. A SWISS-MODEL was made of Nepenthesin 1 and a homology model of Nepenthesin 2 both using the 3vla.1.A model. Aligning these 2 proteins in PyMOL gives a root mean squared deviation (RMSD) of 2.228 Å. This is the average distance between the atoms of the two superimposed proteins.

**Sanjna Girdhar**

Engineering of a Polyprotein Construct to Test its Binding Activity

Mentors: Ionel Popa & Annie Eis, Physics

Protein A, a surface protein, found in the cell wall of bacteria *Staphylococcus aureus* is encoded by the *spa* gene. Its ability to bind to antibodies with high affinity employs its heavy use in biomedical research. The folding of five homologous protein binding domains leads to the structure of this three-helix bundle protein and each domain is capable of binding to many mammalian proteins, essentially IgG. IgG is a type of immunoglobulins (antibodies) circulating in the blood that aid in the phagocytic destruction of antigens. The objective of this project was to create octamers of the two subunits of this protein: B4 and B5. Starting from the monomeric unit, we employed cloning techniques and engineered a poly protein A made from eight repeats. The entire project can broadly be classified into three major steps: monomer to dimer, dimer to tetramer, and tetramer to octamer. The sub steps under each step include digestion of the fragment and vector followed by their ligation. The octameric unit was sequenced at the end to double check the obtained product. We have finally expressed this protein and tested its antibody activity using SDS-PAGE gels and other binding assays.

**Daniel Gomez Cazares**

Nanoporous Adsorbents Based on Zeolitic Imidazolate Frameworks for the Removal of Heavy Metals

Mentors: Xiaoli Ma & Junwei Wang, Materials Science & Engineering

There are growing concerns regarding the water pollution caused by the toxic heavy metal contaminants such as lead. Currently, adsorption-based physical separation process is the most practical and economic approach to remove heavy metals from water. However, the conventional adsorbents such as activated carbons are shown to have low effectiveness towards heavy metals; and this challenge has motivated the development of new materials with improved sorption efficiency. This presentation will discuss the synthesis, structure and adsorption properties of new adsorbents based on ZIF-8, a type of metal-organic framework nanoporous materials. ZIF-8 powders with two different crystal sizes were synthesized by a solvothermal method. Their phase structure and morphology were characterized by X-ray powder diffraction (XRD) and scanning electron microscope (SEM), respectively. In batch adsorption experiments, these ZIF-8 adsorbents showed excellent removal efficiency towards lead ions. The effect of crystal size on the lead adsorption properties will also be discussed in this presentation. Our findings have demonstrated the great potential of ZIF-8 as an effective adsorbent for the capture of heavy metals from water.

**Abraham Gonzalez**

Fecal Indicator and Sediment in the Milwaukee River Watershed  
Mentor: Ryan Newton & Jill McClary, Freshwater Sciences

The Milwaukee River watershed is impaired by fecal bacteria and sediment pollutants, which can be hazardous to human and ecosystem health. New regulations will require local municipalities to control the levels of both fecal bacteria and sediment in their storm water discharge. To mitigate these pollutants, it is important to know if sediment and fecal bacteria are connected and how they are transported through the watershed. Our goal was to quantify the abundance of common sewer bacteria and determine the extent to which they are particle-associated versus free-floating (planktonic) in discharge released to the Milwaukee River and Estuary. Samples were collected weekly for 6 months from three sites: the Milwaukee River, Milwaukee inner harbor, and nearshore Lake Michigan. Each sample was divided into two subsamples: one subsample was filtered through a 3- $\mu\text{m}$  filter to remove particles and particle-attached bacteria and the other subsample was left unaltered. Each subsample was then processed to quantify fecal indicator bacteria (fecal coliform, enterococci, and *Escherichia coli*) using standard membrane filtration on appropriate differential media. After the plates were incubated, colony-forming units were recorded and used to quantify the fraction of each fecal indicator that was particle-associated. On average, the majority of fecal bacteria were not particle-attached, and the fraction of particle-attached fecal bacteria was slightly higher in Lake Michigan (51%) than the river or harbor (32%). The fraction of particle-attached bacteria also varied widely, from 0% to 93% for *E. coli*. This variation was not driven by precipitation, as there was no relationship ( $R^2 = 0.0005$ ,  $p > 0.05$ ) between rainfall and the percent of planktonic bacteria. Our work suggests that FIB in the Milwaukee river watershed are largely planktonic and expected to have different transport than sediment in the system.

**Noah Graff**

Generative Adversarial Networks: Ultrasound Image Translation  
Mentors: Istvan Lauko & Adam Honts, Mathematical Sciences

Low cost and highly portable ultrasound devices under development are designed to be equipped with low frequency ultrasound transducers that provide relatively low imaging quality after reconstruction. There is strong interest to develop software technology to improve such images and to approximate the image quality of high-end devices with high frequency transducers. With this research, we aim at using deep learning technology to translate images, produced using a low frequency transducers, to the higher frequency image domain to counter the hardware limitations. The type of deep learning we are experimenting with is referred to as Generative Adversarial Network (GAN), based on convolutional neural nets. This type of network structure is commonly used in image translation tasks. Specifically, based on unpaired ultrasound images from high and low frequency domain, collected from volunteers by the staff of UW's sonography program, we aim at helping to better identify cephalic veins using GAN enhanced imaging. We present our results, that could readily translate to use on other anatomies, and which show substantial, structurally stable enhancement of image quality over low-frequency imaging results, compensating for the lack of high-end hardware components.

**Jacob Grudnowski**

Patterns of Female Mate Choice in Sympatric Cichlid fishes of the Genus *Labeotropheus*  
Mentor: Michael Pauers, College of General Studies – Mathematics & Natural Sciences

Sexual selection, especially female mate choice, has been an important force in the rapid speciation of the cichlid fishes of Lake Malawi; the need to quickly and accurately identify and choose appropriate mates is paramount in developing and maintaining reproductive isolation among species. In order to test the hypothesis that females should exhibit strong preferences for conspecific males, we examined how the females of two closely-related, sympatric species, *Labeotropheus fuelleborni* and *L. trewavasae*, selected their mates. We offered a gravid female a choice between two males, one conspecific and one heterospecific, and counted the numbers of interactions between the female and both males, and also measured the amount of time a female spent with each male. These results will give further credence to the hypothesis that sexual selection was an important force in the rapid speciation of cichlids in Lake Malawi, and will additionally explore how reproductive isolation is maintained among closely-related, sympatric species.

**Basil Hable**

Monitoring Canal Water: A Case Study  
Mentor: Marcia Silva & Thomas Hansen  
Global Water Center and Freshwater Sciences

Canal systems are integral to certain parts of the world in order to give people access to water. In the town of Gilbert, Arizona, this water was primarily so farmers could water their crops despite the normally dry climate. However, recent changes have shifted the customer base of the irrigation water. Gilbert has extensively developed former farmland into suburban neighborhoods. The canal water has never had extensive testing before since it's not drinking water and it doesn't get in contact with people. Since suburban neighborhoods have become adjacent to the canal, direct and indirect human contact with the water has become a higher probability. A team at UWM has developed a low-cost fast-data particle sensor, that has demonstrated ability to count particles in environmental water and has also shown the ability to count microorganisms in pure water. Water samples have been collected at different points of the canal in order to analyze the full length using the sensor and other lab tests. Preliminary results show rises in conductivity and dips in particle counts downstream of canal and highway intersections. These results could show possibility of monitoring runoff pollution from roads into water systems.

**Even Hackett, Samia El-Meanawy & Tyler Betker**

Addition of Cerium to a Base 390 Aluminum Alloy  
Mentors: Pradeep Rohatgi & Kaustubh Rane, Materials Science & Engineering

A base 390 alloy is a composite containing a matrix of aluminum and silicon. This alloy has added benefits of increased hardness, fluidity, and specific strength. Cerium is added to this alloy to increase the mechanical properties at elevated temperatures. The addition of Cerium improves the ultimate strength and yield strength of the alloy due to an improved microstructure. A series of tests such as X-Ray diffraction, Scanning Electron

Microscopy, and Nano-Indentation have been conducted to analyze the microstructure and composition of the phases present in the casting. This research will have great value for products produced utilizing aluminum casting due to an increase in fluidity, mechanical properties, and thermal capabilities, compared to a base aluminum alloy.

#### **Ava Hager**

Bottle Tree

Mentor: Glenn Williams, Art & Design

The proposed project for the Lynden Sculpture Garden is a metal tree with bottles attached to the branches. This will be a re-examination of the bottle tree as a reference to African American cultural identity, stemming from the Democratic Republic of the Congo and Angola traditions. These traditions were carried forth by Africans during the transatlantic slave trade. The life-size sculptural tree will be a physical manifestation of the collective stories and parallel histories surrounding the various folklore traditions that have fueled modern interpretation of the bottle tree. In creating this work we are examining the power of tradition as a psychological mechanism to sustain one's cultural distinctiveness.

#### **Nikia Handy**

The Importance of Integrating Cultural Competence Into Higher Education

Mentor: Benjamin Trager, Community-Based Learning, Leadership, and Research

How could cultural competence be more integrated into the culture of higher education? “Diversity and inclusion” are promoted by major industries such as the public sector, higher education, and social and economic institutions. The concept has permeated major industries and the political climate has been diversified. According to Huffpost, “A new report on the 2018 midterm elections found that women and people of color won their races at similar rates to white men – challenging the prevailing notions of what types of candidates are more “electable.” (HuffPost, 2019). However, higher education institutions continue to lag in understanding the importance of integrating cultural competency practices on their campuses. Diversity and inclusion are no longer just the right thing to do. A wide variety of industries have stated that diversity and inclusion are the paths forward to ensuring your bottom line is great. These concepts are merely inviting a seat at the table, whereas cultural competency acknowledges cultural differences. To explore my question, I have chosen to engage in free reflection. In my research, a free reflection would apply because it focuses on students providing their unanticipated domains for their reflection that can be valuable in processing their experience. I will be clear about sharing my experience but without revealing the institution. Through sharing my personal experience at my university, developing student success initiatives, and starting the conversation with my peers as they share their own individual experiences. Cultural competence pushes the initiative of diversity and inclusion by securing a seat at the table, as it demands equity and inclusivity. Cultural competence is a key component in working with others, facilitating communication, and group interaction: with acknowledgment of cultural differences and backgrounds while still accepting others.

#### **Megan Harris, Samantha Borden & Camryn Ryan**

Vowel Production of Mandarin-Speaking Children with Cochlear Implants

Mentor: Jing Yang, Communication Sciences & Disorders

Spoken language is acquired through the use of language in one's environment and the auditory awareness of one's own speech in the early years of life. This process of learning is hindered by hearing impairments. The cochlear implant (CI) is an auditory prosthesis that provides electrical hearing to listeners with severe to profound sensorineural hearing loss, caused by damage to the inner ear or acoustic nerve, and facilitates the speech development in prelingually deafened children. The purpose of our research is to examine the production of vowel sounds by Mandarin-speaking children with CIs. A total of 10-20 children (5-10 children with normal hearing and the 5-10 children with CI) aged between 3 and 10 were recruited. The speech materials included a list of Mandarin disyllabic or trisyllabic words containing 20 Mandarin vowels. A visual-auditory repetition task was used to elicit speech samples from the participants. Each child was shown a picture on a computer screen followed by an audio prompt produced by a Mandarin-speaking adult. Each child was then asked to repeat the target word. A time-frequency analysis program, TF32, was used to track formants of the target vowel located in the first syllable of each word. Formants are a collection of acoustic energy around a specific frequency in a speech wave. The frequency of the formant determines which vowel is perceived. The vowels' acoustic features including the vowel frequency values of the first two formants and vowel duration will be compared between the children with CI and NH. The findings from this study will help researchers and clinicians better understand the true deficits and difficulty of speech production in children with CIs and design a more targeted plan for oral rehabilitation.

#### **Erica Haven, Autumn Jensen, Sanya Kathuria & Matthew Sanville**

Physiological Effects of Mindful, Deep Breathing on Patients with Rotator Cuff Disorders

Mentors: Bhagwant Sindhu & Elizabeth Liedhegner, Occupational Science & Technology

Mindfulness practices have become increasingly relevant since societal expectations can readily detach people from maintaining awareness in the moment, allowing the mind and body to heal together. Preliminary findings suggest that engaging in deep breathing exercises within the practice of mindfulness may effectively expedite the process of rehabilitating rotator cuff disorders post-surgical repair. To date, there are no studies addressing how quickly one can resume independent activities of daily living from rotator cuff injuries utilizing mindfulness techniques. Expert Jon Kabat Zinn defines mindfulness as, “the awareness that arises from paying attention, on purpose, in the present moment and non-judgmentally”. Our collaborative team is proposing that practicing mindfulness in addition to usual care, may speed up healing post-surgical repair of the rotator cuff. The purpose of this study is to conduct a literature review to examine the effect of mindfulness through deep breathing exercises on healing post-surgery. Because one of the major barriers to

healing is inflammation, our search terms included breathing and inflammatory markers. Research from literature reviews show several physiological effects can be achieved through practicing deep breathing, modifying inhalation/exhalation from the average of 12-15 breaths per minute to an extended six breaths per minute. Six breaths per minute optimizes the sympathetic/parasympathetic nervous system output, mitigating systemic inflammation. In this state there is an improvement in cardiovascular functioning, reduction of stress responses, inflammation, and increased functioning of the immune system. With the use of breathing classes, videos and wearable technology, an optimal modification of breath may be achieved. Together, this research has shown the potential of mindful breathing to enhance healing and facilitate recovery of rotator cuff disorders post-surgical repair. This study has critical importance for further extensive research.

#### **Gabriel Heller de Messer & Chantel Jenrette**

Kelp Gametophyte Culturing and Genetic Analysis  
Techniques for Conservation and Breeding

Mentors: Filipe Alberto, Gabriel Montecinos & Rachael Wade, Biological Sciences

Bull Kelp (*Nereocystis luetkeana*) is experiencing decreases in population size and local extinction events in the Puget Sound (PS) area of Washington state due to environmental and anthropogenic stressors. This decrease in resistance and abundance is concerning in PS where Bull Kelp is the primary canopy-forming species in the coastal environment; *N. luetkeana* provides vital habitat to marine fishes and invertebrates, cycles nutrients, and is an important carbon sink. Puget Sound Restoration Fund (PSRF) works on a multitude of restoration projects, including Bull Kelp. Because of this potential loss of an ecological engineer, PSRF is interested in incorporating both classic phenotype and genotype information in their restoration efforts, particularly in terms of both intra- and interspecific hybrids; hybridization is desirable because it may result in heterosis, or increased fitness and performance afforded by introduction of novel alleles. PSRF sent UWM Alberto Lab 7-20 sporophylls from 20 populations from within PS, providing the source material to create a long-term germplasm bank of 1,600 Bull Kelp gametophytes. Gametophytes from three insular PS populations were cultured using standard protocols developed for Giant Kelp (*Macrocystis pyrifera*), pooled, and used to inoculate seed string that will ultimately be outplanted in PS in spring 2020. Low survival and sporophyte production suggested that ideal conditions for maintenance, culture, and crossing of Bull Kelp gametophytes are unique from Giant Kelp and warrants additional study. Bull and Giant Kelp gametophytes were reciprocally crossed, produced what appeared to be hybrids, but further work is needed to molecularly confirm the sporophytes were not parthenogenic. Continued efforts to test the viability of hybridization for conservation and restoration of Bull Kelp will protect the integrity coastal environments in PS, including aquaculture, fisheries, and the survival of native marine mammals.

#### **Dulce Hernandez-Blanchard**

Microstructural Observations Across the Southern Iberian Shear Zone

Mentor: Dyanna Czeck, Geosciences

The interactions of tectonic plates cause deformation in rocks that result in a shear zone. A shear zone is a tabular zone of rocks that has measurable thickness in which strain is localized when two sections of rock smear against each other. Water and other fluids can change the deformation style of shear zones, strongly influencing the heterogeneity of deformation in the Earth's crust. For this study, I am contributing to ongoing research on the interactions of fluids and deformation in the Southern Iberian Shear Zone (SISZ) located in Southern Spain. To analyze the Acebuches Metabasites, seven thin section samples that spanned the Calabazares transect were observed using a petrographic microscope, and observations of mineralogy were made which concluded that amphibole, plagioclase, and pyroxene were abundant within the samples. After observing the mineralogy, two different types of microstructures were considered; solution seams and veins and their relationship with the mineral content and angle against foliation. Microstructures such as solution seams occur when a liquid or gas diffuses down the concentration gradient which causes diffusional mass transfer (DMT) which is the dominant deformation mechanism in the upper and middle crust. We found that the veins composed of plagioclase and amphibole minerals were nearly all perpendicular to the foliation; however, there was no correlation between the orientation of solution seams and microfractures, but the presence of solution seams and microfractures provides evidence of fluid interaction during deformation. Researching the mineralogy and microstructures more at depth will help future research in determining how fluids play a major role in controlling the metamorphic reactions and deformation style of this shear zone.

#### **Kevin Hicks**

Electrochemical Sensor for Detection of Phosphorus in Stormwater

Mentor: Marcia Silva, Global Water Center

The process of trying to stop fertilizers, that farms use in their field, from ending up in our water ways and bodies of water is a very difficult task that has plagued our society over the past few decades. Whenever there is a storm fertilizer that was in the field usually gets washed away into a body of water and because the main element of most industrial fertilizers is phosphorus, the process of eutrophication occurs. Eutrophication is not good for that ecosystem because the extra nutrients in the water encourage plant growth and when plants grow at an accelerated rate, they kill the marine life due to lack of oxygen. Stormwater usually has many different elements inside of it besides Phosphorus and it is hard to detect those elements. As of right now the only means of knowing how much of each element is in each sample of stormwater is to bring it back to a lab and use a spectrometer. Transporting samples back to the lab and analyzing them is very effective, but takes time and spectrometers are not cheap. So, while it's a very fine way of detecting the elements present in stormwater it is not efficient and can't be done in the field. Our goal of this project is to use our electrochemical sensor to see if it can detect Phosphorus in storm water so that we do not have to bring samples back

to the lab for analysis. The experiment has two main stages that we test our sensor with, the first stage is testing the sensor ability to detect phosphate in stock solutions. Next, we will collect environmental stormwater samples and perform the same test as we did with the stock solutions. From our preliminary results the sensor works for detecting phosphates in the stock solutions.

#### **Dylan Hoffman**

Synthesis of Glucuronic Acid Conjugate of MIDD0301

Mentor: Alexander Arnold, Chemistry & Biochemistry

The testing of phase I and phase II metabolite of new drug candidates is warranted by the FDA for approval of first in man studies. One possible phase II metabolites of acid compounds are glucuronic acid conjugates. These metabolites that are formed in the liver by uridine 5'-diphospho-glucuronosyltransferases to increase the solubility of compounds and enable secretion. The Arnold group is currently developing an oral drug named MIDD0301 to treat asthma, which has an acid functionality. To explore how much of the glucuronic acid conjugate of MIDD0301 is formed in vivo, we are synthesizing this compound as analytical standard to enable quantification by LC-MS/MS. The synthesis of this conjugate requires two synthesis steps. This study describes the synthesis of one of the starting materials, which include the reaction of allyl bromide and glucuronic acid. The purification of this product has been challenging but is expected to give a yield of 60%.

#### **Ashley Hohnstein**

Networking: Lighting the Way to a Brighter Future in Entertainment Lighting

Mentor: Steve White, Theatre

A network provides the capability to maintain control over hundreds of lights and multiple sources of control, making it possible to set up and configure lighting for events of all sizes from a theatrical production in UW-Milwaukee's Mainstage Theatre to the Superbowl halftime show. Networks have been the backbone of the entertainment lighting industry for years, but they are often seen as the most intimidating or unknown component of an entertainment lighting system. With the growing market for networking equipment that caters specifically to entertainment lighting, companies such as Electronic Theatre Controls have developed software to allow for configuration of lighting networks. ETC's solution is a piece of software called Concert which allows users to manage and configure networking equipment from their personal computers. Over the course of eight months, Concert was integrated into UW-Milwaukee's Mainstage Theatre. This software was used to explore how a high level of control over the lighting network can positively impact workflow over the course of producing a theatrical production. In exchange for receiving unreleased software from ETC, user feedback was provided. Contact was established directly with the development team for the software and software defects were documented and reported as they arose. It was found that this software not only provided a user-friendly way to monitor and maintain the lighting system, but it also provided users with a better understanding of the capabilities and functionality of the network within the space.

As the entertainment lighting industry continues to innovate and grow, lighting systems will only increase in complexity. Having the capability to use software such as ETC's Concert to configure the network will prove to be invaluable and is paving the way for new and innovative methods of interacting with and configuring lighting.

#### **Zoe Hurdle**

Maternal Responsiveness: Facilitating Both Communication and Motor Skills Concurrently with Infants

Mentors: Victoria Moerchen & Jacqueline Westerdahl, Kinesiology

Maternal responsiveness is defined as the contingent reactions and emotions a mother expresses in response to her child. Maternal responsiveness has a crucial impact on a child's development. Understanding how maternal responsiveness supports novel learning for infants is important for early intervention. One approach to initiate this area of inquiry is to explore how maternal responsiveness to an infant during practice of a motor skill might be similar to maternal responsiveness to support communicative development. The purpose of this study was to examine whether mothers' responsiveness toward their infants during a novel motor task were similar to their responsiveness during a novel teaching activity. Mothers and their infants were studied as a dyad. Infants were typically developing 8-10 month olds who had not yet achieved walking. Two testing contexts were used: A novel teaching task and infant treadmill stepping. In both contexts, the mother supported the infant in learning and/or performing the task. During the treadmill trials, the infant stepped on the treadmill for 8 minutes supported by the mother, who was free to support the infant for rests and comfort as needed. Teaching and treadmill trials were videotaped, transcribed and later coded for: initiations and responses, and within these communicative behaviors including gestures, eye contact, vocalizations and verbalizations across mothers and infants. Within subjects' analyses using 3 exemplar dyads will be reported. Analyses from coding are pending. Preliminary analyses suggest that maternal responsiveness is greater in the treadmill trials than in the teaching task. Contextual differences in maternal responsiveness may be due to the level of support the mother had to provide for the infant for treadmill stepping. This study provides initial support for maternal responsiveness to an infant during a motor task that is aligned with responsiveness for communicative development.

#### **Diana Ilencik**

Citizenship as a Basket of Rights in the Era of Globalization

Mentor: Aneesh Aneesh, Sociology

Citizenship has long been referred to in the context of a nation-state membership. Various alternative approaches challenged the view on citizenship and introduced new frameworks, such as cosmopolitan, postnational, and transnational citizenship. These frameworks have in common their shift from referring to citizenship in terms of nationality to considering citizenship as based on human rights in contemporary world society. With the rise of dual and multiple citizenship formats, there is a gradual move away from exclusive nation-state membership. The loss of national exclusivity of citizenship is further emphasized by the increase in various citizenship-by-investment programs

which allow individuals to purchase a second citizenship for a price and therefore extend their rights and ability to travel freely or work in various countries throughout the world. The purpose of this project is to study the growth and extent of dual and multiple citizenship throughout various regimes and governments around the world in order to introduce a new framework — modular citizenship, which refers to citizenship as a dynamically changing basket of rights. The framework of modular citizenship allows for a better understanding of citizenship in the era of globalization.

**Victoria Isaac, Breannah Palubiski, Halle Sivertson, Sara Silvis & Ida Lucchesi**

Exploring Dance Improvisation's Functionality in the Realm of Performance

Mentor: Daniel Burkholder, Dance

The purpose of our research is to examine the impact of improvisational practices on the ability for improvisational dance to be learned and performed. We define improvisation as the act of performing movement not previously rehearsed or choreographed. This movement, however, can be created within the confines of a set score. A score can consist of three elements: an agreement detailing what will happen in the improvisation, a constraint limiting what can happen, and a possibility creating a gateway for an idea to occur. When improvisational technique is introduced within movement-based institutions, there tends to be an association of the technique with a lack of structure. We incorporated the supplemental readings of various authors to create a systematic pathway of introducing and implementing this technique through a pedagogical approach, maximizing the possibilities of the mover while allowing the instructor to apply a clear and standardized method of direction. By creating scores utilizing Laban movement analysis, anatomical oriented compositions, bodily spatial relationships and the capacity of sound, we were able to create a structure of improvisation embedded in movement and kinesthetic knowledge in order to implement an accessible and calculated avenue for performance.

**Caroline Ives & Sheldon Pearson**

Impact of Multifocal Lenses on Balance in Presbyopia Population Ages 40-70

Mentor: Roger O. Smith, Occupational Science & Technology

MFL are preferred for their convenience in adjusting focal length during occupational tasks like cooking, however, research shows significant impairment to the lower visual fields. Lower visual field distortion is correlated with falls from improper foot placement and inability to detect trip hazards, but there is a gap in literature on how MFL effect balance. The Berg Balance Scale (BBS) is the gold standard for measuring balance due to its reliability and contribution to measuring and quantifying fall risks in various populations. BBS research has found strong correlations between multiple falls and BBS scores below 36, however scores of healthy adults have shown to vary with age. We hypothesize that as the aging population loses vestibular and proprioceptive function, they are likely to compensate using their vision. Our protocol measures balance with the BBS, "Timed Up and Go" (TUG) test, and three functional

test protocols called Computerized Dynamic Postography (CDP) using the Betec Balance Advantage device. The Sensory Organization Test (SOT) examines how participants use vestibular, visual, and proprioceptive systems to control their balance. The Motor Control Test (MCT) measures participants' ability to restore their balance after unexpected movement of force plates. The Adaptation Test assesses adaptability to surface irregularities. Our study protocol will provide an accurate method of interpreting results that will differentiate the dependence of vision and the ability to compensate in aging adults with varying BBS scores. We have piloted the protocol and await IRB approval for data collection.

**Miguel Jaimes**

Continuous Covalent Organic Framework Membranes for Dye/Salt Separation

Mentors: Xiaoli Ma, Junwei Wang, & Zhiqin Qiang, Materials Science & Engineering

Covalent organic frameworks (COFs) are an emerging class of porous membrane materials constructed from organic building blocks via strong covalent bonds. They possess a wide range of unique properties including high crystallinity, ordered two or three-dimensional pore structure, tunable pore size and functionality, and excellent thermal and chemical stability. With a pore size in the range of 1-3 nm, COF membranes are well suited for nanofiltration applications such as the separation of dye molecules. In this work, we will present the synthesis and dye/salt separation properties of COF membranes based on ketoenamine-linked two dimensional (2D) COFs. Their pore structures are constructed by aldehydes and diamines through a Schiff base reaction followed by irreversible enol-keto tautomerism. These 2D COFs can be synthesized as continuous membranes on polymeric substrates using a facile and scalable interfacial crystallization method. In a cross-flow filtration setup, measurements using single dye or salt solution, the membranes showed a high water permeance of  $>50 \text{ L m}^{-2} \text{ h}^{-1} \text{ bar}^{-1}$  with a high rejection of dye molecules (e.g., 100% rejection of Congo Red) and low rejection rates ( $<5\%$ ) for mono- and divalent salts (e.g., NaCl and  $\text{MgSO}_4$ ). The dye/salt mixture separation properties of these membranes at different separation conditions will also be discussed in this poster presentation.

**Jocelyn Jarvis**

Relationship Between Socioeconomic Status, School Affiliation and Stress in Adolescents

Mentors: Krista Lisdahl & Ryan Sullivan, Psychology

Prior research on stress in adolescents have revealed that lower SES and ethnic minority status are both related to increased stress. Considering adolescents spend a large time within a school setting, research has shown that school affiliation can promote resilience against stress. Few studies have fully examined whether school affiliation moderates the relationship between SES and ethnic minority status and stress in a national diverse sample of 9 to 11-year-olds. The aim of this project is to determine the impact of SES variables, race/ethnicity, and school affiliation and disengagement on stress within younger adolescents. 11,875 participants, both youth (aged 9-10) and accompanying parents/guardians, completed

self-report questionnaires on demographic information [e.g., race/ethnicity, SES (including household income and parental education)], class engagement, and stress. This data draws from the baseline visit of the ABCD Study. A hierarchical multiple regression analyzed the impact of race/ethnicity and SES variables on stress, then, class engagement variables were added to determine their effect on the model. Findings showed race, ethnicity, and parental education, significantly impacted stress in school-aged children. School affiliation and disengagement variables were then added to the model and each had significant impacts on stress. As a set, these variables account for 3.7% of the variance in stress. These findings confirm that demographic factors, particularly race, ethnicity, and parental education, impact stress levels in youth. Interestingly, SES variables did not have a large effect on stress in this sample. Moreover, school engagement and positive notions towards school are buffering factors against higher levels of stress, whereas educational disengagement is associated with higher stress. Indicating that youth's feelings towards school, compounded with race and ethnicity, can affect stress in adolescents younger than previously investigated.

**Autumn Jensen, Sanya Kathuria, Erica Haven, & Matthew Sanville**

Mindfulness and Sleep with Rotator Cuff Disorders  
Mentor: Bhagwant Sindhu, Occupational Science & Technology

This study aims to discover how mindfulness impacts sleep among individuals experiencing rotator cuff disorders. One of the consequences is having a full, restful sleep due to the pain of this disorder. Mindfulness training has been developed to help sleep quality. In addition to, mindfulness is the state of being aware of internal and external experiences. The primary hypothesis is that mindfulness has a direct impact on sleep quality and the ability to cope with pain while sleeping with a rotator cuff disorder. We are conducting a literature review from articles within the past thirty years using search terms, mindfulness, and sleep, and rotator cuff disorders. After sorting through various articles, I focused on five articles that contain those three key words. Factors that affect the structural integrity of the shoulder joint are pain associated with the surgery and the disorder, as well as the ability to cope with stress from the disorder. Mindfulness predicts improved sleep functioning, in addition to overall wellbeing. In addition, accepting the amount of sleep one can receive instead of controlling the amount of sleep can further impact sleep quality and pain management with rotator cuff disorders. Individuals with a rotator cuff disorder have different pain tolerances, cope with stress differently, have different sleep habits, and have different types of rotator cuff disorders which impacts the data from each study reviewed. However, this study has reviewed a lack of evidence on the effect of mindfulness and sleep on individuals experiencing rotator cuff disorders. Consequently, future studies need to focus on how mindfulness may affect sleep when experiencing a rotator cuff disorder.

**Lena Jensen**

This is Milwaukee  
Mentor: Arijit Sen, Architecture

In the year leading up to the DNC, this project offers a direct encounter with Milwaukeeans who contribute to the public life of the city in some way. It tackles what Milwaukee can contribute to the national conversation about America's future. In order to do this, over 65 Milwaukee residents have already been interviewed, being asked the same four questions: What are the most pressing issues in Milwaukee? What are the qualities you search for in a political leader? Are you optimistic about the future? And, most importantly, what does democracy mean to *you*? Through audio processing and editing, a grassroots discussion of democracy was formed to compare to current academic literature and historical documents. What emerges from this work is that the intersection of caring and politics is much closer than believed in academic literature. In the grassroots acts of citizenship, there is a deep sense of caring for our democracy and what it means to individuals – how *they* choose to live it out in their lives. This speaks to a larger question of how grassroots and community values and actions play into democracy as a whole, and how we, as a diverse society, can continue to live the values laid out in historical documents despite it being a different time, with evolving ideas of what democracy means to us in our community and in our country. Individual narratives different from discourse on the national level, and this is important in understanding that social action is possible when we move away from rhetoric.

**Jillian Jorns**

Violence in the Lives of American Indian Women  
Mentor: Lucy Mkandawire-Valhmu, Nursing

The overall research goal is to extend to others the experiences of the American Indian women who faced intimate partner violence. This will ultimately contribute to expanding extensive healthcare and policy changes involving these women. The goal is to explore intimate partner violence (IPV) in Native American women to obtain a better understanding about the impacts. The expertise of the researcher in methodology is complemented by the experience of CO affiliates, who assist researchers to produce relevant and legitimate research with real-world impact. When it comes to research on violence against women, such collaborative relationships can provide important insight to researchers that are grounded in the experiences of advocates with women who have been victimized. A collaborative relationship also aids in recruitment due to the trust that had already been established between clients and advocates at the agency. There is a direct correlation between high rates of mental health and domestic abuse such as depression, PTSD, and anxiety. We have specifically chosen the Bad River reservation and the city of Milwaukee as our target population to examine and interview 50-70 participants that have experienced different barriers and disparities that are related to abuse. A qualitative critical ethnography methodology alongside an indigenous and postcolonial feminist framework will be used for examining gender-based violence, and oppression. After data analysis we will be able to apply this to policy-making around the world.

**Lintaro Kajiwara & Ryan King**

Case Studies for Waterfront Cities of the Great Lakes Basin  
Mentor: James Wasley, Architecture

Ryan King and I were tasked with researching and creating maps that depicted the details of the 15 largest waterfront cities (based on population size) around the Great Lakes Basin in the US and Canada. These maps would contain information detailing the city limits, industrial zones based on municipal zoning designations, and heavy rail lines for each of the 15 cities. The maps were created in Adobe Illustrator using information retrieved from various mapping resources found online, like ArcGIS, and various zoning designation maps from municipal websites. These maps were displayed at the 'Reimagining Water' NSF workshop in July 2019 held at the UWM School of Freshwater Sciences and led by Professor of Architecture James Wasley. The attendees from around the Great Lakes were encouraged to mark up these maps with resources, contact information, ongoing and proposed projects about sustainable urban waterfront systems, which we then compiled to create a "profile" for each major city. These profiles will be used as a resource for future students or professionals of differing disciplines to use for connecting between the two groups, as well as providing a base for future research paths. Their first use will be in responding to the call for the creation of an NSF Research Network on Sustainable Urban Systems that is expected in the next few months.

**Anna Kaminski**

A Climatology of Atmospheric Rivers Over the Northeast United States  
Mentor: Clark Evans, Mathematical Sciences

Atmospheric Rivers (ARs) are characterized by long, narrow corridors of enhanced integrated water vapor (IWV) and integrated vapor transport (IVT) located in the warm sector of midlatitude extratropical cyclones. ARs are well-known contributors to high-impact precipitation and precipitation-related events (e.g., floods, landslides, avalanches, etc) and water resources across the western United States. Recent research has also demonstrated that ~40% of southeast U.S. heavy precipitation events in the winter and the transition seasons occur in association with ARs, AR-like, or AR-related features. The goal of this research was to develop a complementary climatology of ARs over the northeast U.S. from 38–48N and 80–66W every six hours for the years 1988–2017 and apply those results to different occurrences of high-impact weather. While many objective algorithms have recently been developed to automatically identify corridors of IWV and IVT resembling ARs, herein we seek to subjectively identify ARs using objective criteria (e.g., an IVT magnitude  $>250 \text{ kg m}^{-1} \text{ s}^{-1}$  that is  $>2000 \text{ km}$  in length and  $<1000 \text{ km}$  wide or an aspect ratio of  $\sim 2:1$ , and linked to an extratropical cyclone). This presentation will review the results of the climatology summarizing the  $>3000$  ARs identified ( $\sim 101$  per year) over the NEUS. The ARs are approximately evenly distributed throughout the year, with an average duration over the domain of 43 hours, average direction of southwest, and an average maximum IVT magnitude of  $737 \text{ kg m}^{-1} \text{ s}^{-1}$ .

**MaryJo Kanelos**

The Role of The Nurse-Midwife in Early Initiation of Breastfeeding  
Mentor: Kaboni Gondwe, Nursing

Breastfeeding initiation within the first hour of life, also known as early initiation, is associated with positive maternal and infant outcomes. In Malawi, approximately a third of newborns are breastfed within the first hour of life. In addition, the more infants are breastfed within the first hour of the birth is conducted by a healthcare provider. Nurse-midwives form the backbone of the healthcare system and provide care to the majority of clients. However, previous analysis did not consider the nature of the skilled birth attendant and whether this was impacted by the location where the provider practices. We hypothesized the proportion of infants breastfed within the first hour of life would be higher in midwives compared to other attendants at birth. Using the Malawi Demographic Health Survey, we examined relationship between provider and breastfeeding initiation in the last-born infant born before the survey was administered. Findings showed that the proportion of infants breastfed within an hour was higher if a birth was performed by a midwife and more infants born from providers in rural areas were breastfed within in hour. These findings show the importance of midwives in provision of care and the need to empower both rural and urban providers to support breastfeeding.

**Ramprasad Karanam**

Non-Invasive Detection of Thin Biofilm  
Mentor: Marcia Silva, Global Water Center

*Salmonella*, *Escherichia coli* (*E. coli*), and *Shigella* are examples of bacterial pathogens that can enter the body through drinking water. Detection of bacterial growth and biofilm in a water pipes are pertinent to avoiding such bacterial infections. Current solutions to this problem include introducing a chemical to attract the bacteria to a single point to be detected and implementing optical transceivers. We have designed a sensor to actively detect and record biofilm growth in water through non-invasive means. This sensor is a non-invasive system that sends signals through the sample being tested on. The response of the system is measured and recorded to determine the amount of biofilm growth within the sample. This system was tested using salt solutions and a water bath to observe and record the response of the system when the medium is under different conditions. These tests were also performed with three piping materials: copper, cast-iron, and PVC. The non-invasive nature of its implementation as well as its ability to actively collect data gives this system an advantage over the current solutions.

**Patrycja Karwowski**

Perceptions of "Learn the Signs. Act Early" Training Materials by Early Care and Education Providers  
Mentor: Kris Barnekow, Occupational Science & Technology

Many children who have developmental delays are not identified prior to school entry. Failure to identify these children limits their access to early intervention services that would improve the child's and family's outcome. Early Care and Education

Providers (ECEPs) can play an important role in identifying developmental delays in children and can make referrals to appropriate sources that will aid in their development. But little is known about ECEPs' attitudes, knowledge, and practices in developmental monitoring and their referral processes. Qualitative data has been collected through parent and provider focus groups and open-ended questions on delayed surveys with ECEPs in their use and implementation of *Learn the Signs. Act Early (LTSAE)* materials and training. A team of researchers used constant comparative methods to decipher common themes found when using *LTSAE* materials. Common themes found in ECEP and parent responses were (1) credibility of the materials, (2) supporting of conversations between parents and providers, (3) teacher self-efficacy, and (4) strengthening of parent-provider relationships. Utilization of the materials is multifactorial and involves aspects of the materials, the ECEPs and the parents to provide accurate developmental monitoring and referrals for children with developmental delays.

#### **Sanya Kathuria**

Is Psychological Distress Related to Post-Operative Outcomes in Surgical Repair of Rotator Cuffs?

Mentors: Elizabeth Liedhegner & Bhagwant Sindhu, Biomedical Sciences

Damage to the rotator cuff causes shoulder pain and can lead to surgical repair, a problem that affects approximately 20% of the population with incidence increasing with age. Furthermore, psychological factors have been found to be key determinants of health and can influence patient reported outcomes undergoing a medical treatment. Thus, this study aims to review measures of psychological distress in the context of rotator cuff repair. Factors that cause psychological distress can be hospitalization, surgical outcomes, recovery period, financial burden, social support and absence from work. A variety of self-assessment measures are currently used to measure psychological distress and outcomes of the musculoskeletal surgeries and repair. However, the sensitivity, reliability and validity of these measures are not well defined. The goal of the review is to understand the current measures of psychological distress and evaluate their ability to predict patient outcomes in rotator cuff repair. After a preliminary literature review, patients experiencing greater distress show inferior results on the Visual Analog Scale (VAS) pain scale and low scores on the American Shoulder and Elbow Surgeons Shoulder Score. It was also found that Distress Questionnaire-5 was a better tool to determine psychological distress than Kessler's Questionnaire-5. No clinically approved definition for psychological distress and biases linked to self-assessed questionnaires are certain limitations to our study. In our future studies, we plan to employ a survey for psychological distress as well as a biomarker for stress, cortisol, to determine if reduction of both perceived stress and the stress hormone, cortisol, can improve patient outcomes for rotator cuff repair surgery. Furthermore, we propose to enroll patients in a mindfulness program to facilitate a reduction of stress and compare these outcomes to patients undergoing standard of care.

#### **Haley Kempf**

Literature Review on the Ultrastructural Variation in Trilobite Exoskeletons

Mentor: Victoria McCoy, Geosciences

Trilobites were extremely diverse and abundant arthropods, now extinct, with over 20,000 recognized species ranging in size from one mm to 72 cm. Unlike most living arthropods, trilobites had a heavily calcified exoskeleton, sometimes bearing elaborate ornamentation. The exoskeletal structure and composition in modern arthropods is well-studied and well understood. In trilobites, however, diagenesis (the process by which biological material is altered into a fossil over geologic time) often alters or obscures the original structure and composition of the exoskeleton, resulting in widely varying published descriptions. The aim of the present research is to determine as best as possible the true exoskeletal structure of living trilobites through collating, interpreting and synthesizing data from the literature. Fossil trilobites are reported to have between one and four exoskeletal layers; some of this variation may represent diagenetic variation and some may represent actual biological variation. Based on comparisons to modern arthropods and interpretations of the fossilization process, the majority of trilobites likely had a three-layer exoskeleton, composed of the outer epicuticle, the middle exocuticle, and the inner endocuticle. In these cases, the two commonly preserved layers are interpreted as the exocuticle and endocuticle: the exocuticle is preserved as an outer layer of prismatic calcite and the endocuticle (or "principal layer") is preserved as calcite with various non-prismatic textures. The epicuticular layer is typically not preserved. There are some trilobites whose fossil exoskeleton structure suggests the living exoskeleton did not conform to this typical three layer structure. *Tapinocalymene nodulosa*, for example, has four exoskeleton layers in the fossil suggesting more than three layers in life. In living arthropods the structure of the exoskeleton can provide information about functional morphology, so a better understanding of the exoskeletal structure of trilobites may help understand the function of various body parts, including the enigmatic ornamentation.

#### **Raunak Khaitan**

Real-Time Mobility Assistance for the Legally Blind

Mentor: Mohammad Rahman, Biomedical Engineering

With increasing autonomous technology around us, this research aims at bringing the vision to the legally blind. We are currently using a rover to develop and test the technology. It uses ultrasonic waves to detect objects at a certain distance and results in a five-bit sequence of 1/0 where 1 represents an object on path and 0 represents a clear path forward. This five-bit sequence divides the forward 180 degrees vision into five angles. This is done for both forward and backward motion of the rover. We are also using a Light Detection and Ranging (LiDAR) sensor that maps the surrounding and in conjunction with the rover inputs, it is capable of accurately detecting obstacles in the path. A webcam is used that recognizes objects using neural nets and its implementation is in progress. The webcam along with the machine learning model will be able of classifying objects as stationary and in motion and differentiate particularities like if the traffic sign for the pedestrian is on or off. All of these technologies will be integrated to provide

a cohesive and holistic experience to the legally blind person to navigate on the streets independently in real-time. The information will be converted in the form of audio commands and fed to the user to follow them. The long-term perspective of the research is to eliminate every assistive measure being currently used by blind people while navigating and shrink down the technology to smart glasses that are both easy to wear and adapt and fashionable at the same time. Haptic and braille language feedbacks are also a part of long-term ways to impart the sensory information to the user seamlessly in real-time.

#### **Samuel Kirby**

The Role of the Blue River Cafe in the Development of Fingerstyle Guitar in Southeast Wisconsin  
Mentor: John Stropes, Music

From 1974-82, the Blue River Cafe, an acoustic music club in downtown Milwaukee, presented national touring acts and provided a stage for regional musicians to develop their craft. It provided centrality for the acoustic music scene in Milwaukee. This research project explores the history and musical landscape of this venue and documents the performers and their music. Fingerstyle guitar is a type of playing which focuses on performing guitar pieces by plucking strings directly with the fingertips rather than with a pick. In the 1960s, a revitalization of the folk music genre infiltrated coffeehouses in North America and provided emerging figures such as Bob Dylan and Dave Van Ronk with a platform for career development. In the 1970s, in clubs like the Blue River Cafe, performers such as Dave Van Ronk, John Fahey, Peter Lang, Doc Watson, Elizabeth Cotten and many others continued to find currency. With contrasting styles, these individuals popularized fingerstyle guitar in the Midwest. This project utilizes a documentary-style video featuring interviews from former club owner Gary Lukitsch and frequent performer Peter Lang. Incorporation of materials from the cafe such as menus, calendars, press, contracts, and performance photos convey the nuances that allowed this destination to thrive. This research examines the role of the Blue River Cafe in the development of musical culture in southeast Wisconsin, and places this research in the context of earlier research on William C. Stahl (1869-1940), the Avant Garde Coffeehouse (1962-1968), and the 1969 and 1970 Ann Arbor Blues Festivals. The presentation will conclude with a performance and analysis of Van Ronk's fingerstyle arrangement of "Green, Green Rocky Road."

#### **Nathan Kohls**

Deep Learning Applications in Wastewater Treatment  
Mentor: Rudi Strickler, Biological Sciences

Wastewater treatment currently requires careful testing at multiple points in the treatment process. These tests are often slow and expensive, requiring trained personnel and lab time. Here we report an application of neural networks to supplement these tests in real time. As wastewater flows across a gravity belt, water is lost and a polymer is added to the sludge, thickening it. In order for the next steps in the treatment process to go smoothly, this sludge must be appropriately dry, or thickened. If the sludge is dry enough, it is of interest to the company

to reduce the amount of polymer used in order to cut costs. Our neural network aims to classify images of the polymer into "wet" and "dry" categories, in real time on a raspberry pi. To do this, we use open source technology like tensorflow and python. As a laser is shined into the sludge, it creates a pattern which the neural network uses to classify the images. Preliminary programs are successfully classifying sample data, and it is expected that further refinement of our models will yield faster and even more accurate results. By creating a more responsive process for testing the character of the sludge, we hope to set the stage for better water treatment systems.

#### **Tien Kolodziej**

The Effects of Anxiety Disorders on Response Speed  
Mentors: Han Joo Lee & Salahadin Lotfi, Psychology

It has been shown that the brain slows down in many reaction time tasks when people commit an error compared to when they correctly respond. This Post Error Slowing (PES) phenomenon is thought to re-evaluate attentional resources and readjust response execution properly to make a correct response. Anxiety symptoms are shown to be associated with general reaction time slowness, however, whether it is related to PES is still debatable. This study aims to shed light on whether anxious individuals diagnosed with General Anxiety Disorders (GAD) will have longer reaction times and increased PES compared to non-anxious individuals. This study is part of an ongoing experiment which recruited 59 college students (male =20, GAD = 19) and collected data on demographic information, anxiety symptoms and other psychological questions. All participants completed a 15-min the Eriksen Flanker Task to examine reaction time and cognitive processes accuracy. This task requires participants to click in the direction of a central arrow, while the flanking arrows point the same direction (congruent) or point in the opposite direction (incongruent). Participants had similar reaction times on the easier (congruent) trials ( $GAD_{mean}=360ms$ ,  $SD=10$ ;  $Control_{mean}=358ms$ ,  $SD=4$ ). However, the anxious individuals struggled significantly on the harder, cognitively taxing (incongruent) trials ( $GAD_{mean}=396ms$ ,  $SD=12$ ;  $Control_{mean}=378ms$ ,  $SD=7$ ). Additionally, we found that individuals in the GAD group are faster on the PES compared to the control ( $GAD_{mean}=334ms$ ,  $SD=8$ ;  $Control_{mean}=348ms$ ,  $SD=5$ ). This study is important because it supports previous evidence showing that anxiety is particularly associated with general reaction time slowness in cognitively demanding conditions. This result supports the idea that anxiety allocates excessive attentional resources to irrelevant information, therefore, reducing available resources to sufficiently respond to the task at hand. This study also raises the connection between anxiety and a reduced PES, indicating that anxiety might speed up the readjusting process after an error.

**Cheyenne Koran**

SEM Photographic Survey of Late Devonian Lime Creek Formation Microfossils from Fossil Prairie Park  
Mentor: Scott Schaefer, Geosciences

The prolific fossil beds at Fossil Prairie Park in Rockford, Iowa are frequented by amateur fossil collectors and academic researchers alike. The diverse fossil taxa of the Lime Creek Formation date to the late Devonian Period and exhibit an impressive degree of preservation. Academically, this site is of interest for research because temporally it falls mid-way through the late-Devonian mass extinction (Kellwasser Event). Detailed and annotated images are extremely valuable for amateur collecting and research purposes and currently no modern, comprehensive monograph exists. Scanning electron microscope (SEM) images from this project will provide significant morphological detail necessary for identification for both micro and macrofauna. Such images facilitate broader research on the late Devonian extinction both at Fossil Prairie Park, and abroad. Ultimately, microfossils imaged for this project will contribute to a comprehensive identification field guide complete with images of micro and macrofauna.

**Emma Kraco**

Water Temperature and Salinity Affect the Nutrition and Physical Size of *Perca flavescens* Embryos  
Mentor: Dong Fang Deng, Freshwater Sciences

*Perca flavescens* (yellow perch) is an ecologically and economically important species of fish in the Midwestern United States. Production from wild capture, however, has decreased due to declining populations in the Great Lakes. In aquaculture, the survival of larval fish during the first month post hatch is less than 15-20%. Factors resulting in the poor survival of yellow perch larva may include physiological challenges and poor quality of nutrition of newly hatched sac-fry. This preliminary study investigated the effects of different incubation temperature regimes (high, control and low temperature) and water salinity (freshwater and 5ppt salinity) on the quality of yellow perch embryos. The different water temperatures led to three hatching time periods: 8, 11, and 14 days for the high, control and low temperatures, respectively. Evaluation was based on the size of oil drop, yolk sac, and embryo, as well protein contents of embryos. Results showed that embryos incubated with the low temperature regime had significantly smaller embryos ( $P < 0.05$ ) but the size of yolk sac and oil drop was similar among the three water temperate treatments. Embryos incubated in 5ppt salinity water hatched earlier and had smaller embryos but larger yolk sac compared to those incubated in freshwater conditions. The oil drop size was not influenced by salinity. The hatchability was not affected by the temperature regime or salinity ( $P > 0.05$ ). The current results suggested that only the low temperatures changed the embryo growth during incubation period. The low salinity water advanced the hatching time and also help to reserve more yolk protein in the embryo. This may be critical for the survival of yellow perch larvae when they are transferred from endogenous to exogenous nutrients.

**Natalie Kuehl, Jessica Van Dyck, Edward Fang, Ian Luecht & Liam Kolstad**

False Walls  
Mentor: Michael Jefferson, Architecture

With new methods of production and innovative design processes, architecture has been enabled by processes that promise efficiency but that also complicate the agency of designers through the use of contemporary technology. False Walls examines the use of artificial intelligence and machine learning to understand and further agitate this new era of the design process. While iterating between machine learning, digital design, and model making; for example, novel design opportunities arise from misappropriations of various technologies. In machine learning this is called “unsupervised learning” in which machine learning models articulate patterns in data that humans do not detect, either by virtue of the complexity of this data or its vast quantity. Allowing algorithms to assist, favors new methods of analysis in the design process. Through the introduction of standard construction methods, the machine discovers frictions in framing techniques that yield interesting design opportunities. These “mistakes” and “transgressions” of typical wall-framing tectonics reveal the proclivities of the algorithm and generates new design opportunities in doing so. The new design alternatives discovered through this process will be exhibited in a built frame. This full scale model will be on display in the gallery at the School of Architecture and Urban Planning on April 17th with an accompanying lecture on the discovered design opportunities. In a world of growing technology we have entered a time where we have grown past how technology is used to increase the efficiency of making, and is instead a site that can be mined for design potentials.

**Carli Kugel**

Attention Training for Athletes: A Feasibility Assessment  
Mentors: Han Joo Lee & Maryam Ayazi, Psychology

Many athletes face negative consequences due to performance anxiety. One possible consequence may be how performance anxiety could affect attention negatively. Relevant literature suggests attention bias modification (ABM) as an effective treatment and modification for social-evaluative anxiety, and threat biases. The present study investigated ABM as a feasible therapeutic intervention for athletes who experience performance anxiety in competitive trapshooting. Computerized attention training was specifically utilized. This type of attention training is important because web-based interventions allow for accessible treatment and portability. Athletes recruited for ABM training were between the ages of 12 to 18. Once recruited, participants completed an online consent form, and pre-screening questions. A baseline assessment was then administered which involved questionnaires and AB assessment. A demographic survey and multiple psychological questionnaires assessed demographic information, and other emotional variables pertaining to sport anxiety. Baseline AB assessment was tested by Posner’s Spatial Cueing Task—a computerized attention task. After baseline assessment, participants were randomly assigned to active ABM or ACC (control) condition. There were 8 training sessions across a 4-week span. After the first 4 ABM sessions,

midtraining assessment was distributed. After training was complete, a post-training assessment and a one month follow up assessment were provided. A total of 14 participants were recruited, and of these 14 participants, 6 fully completed ABM training. To conclude, this study provides feasibility in ABM training for performance anxiety in athletes. Due to difficulties the athletes faced, such as school workload, and busy schedules, it was difficult for all recruited participants to complete full training, hence a high withdrawal rate. This study can help further future research on performance anxiety in athletes because it provides pilot data which examines the feasibility, and clinical usefulness of ABM as a therapeutic intervention.

#### **Miki Kurihara**

Markov-Chain Monte Carlo Fitting of X-ray Light Curves of Active Galactic Nuclei

Mentors: Sarah Vigeland & Tingting Liu, Physics

Some galaxies in the Universe have a very bright region called Active Galactic Nuclei (AGN) at the center. While AGN has the extreme luminosity compared to other astronomical objects, the number of photons they emit tends to vary according to time. Fitting observed light curve data, which shows its variability, provides us information about the system behind it. We use the Markov-Chain Monte Carlo (MCMC) method to achieve that. We prepared several models, including the power-law and free spectrum. Through the iteration, MCMC tries to find out the best fit parameter set of the model so that the likelihood is maximized. We applied it to data from 30 light curves from the Swift Burst Alert Telescope. As for the power-law model, the results we gained were consistent with the previous independent study.

#### **Janet Lagunez-Garcia**

Individual Factors Associated with Anxiety-Induced Stereotype-Specific Deficits in Cognitive Control

Mentors: Christine Larson & Richard Ward, Psychology

Implicit racial bias encompasses the attitudes one has about specific groups that occur outside of their own conscious awareness. Current theories propose that cognitive control may help regulate implicit racial bias. In addition, others have found that one's external and internal motivation to respond without prejudice can affect implicit racial bias. Given that anxiety has been shown to disrupt cognitive control, the current study aimed to investigate how an anxious state impacts cognitive control and implicit racial bias. Using a Go/NoGo paradigm consisting of Black or White face primes paired with stereotype consistent or inconsistent words, we examined one's ability to engage in cognitive control on specific race-congruent trials. We recorded electroencephalography (EEG) as participants completed this task to examine the N2 event-related potential (ERP). Participants were separated into a threat group where they would receive shocks, or a safe group where they didn't. In addition, participants completed the Internal and External Motivation to Respond Without Prejudice questionnaire to determine individual external (EMS) motivation to respond without prejudice. First, we conducted a 2 (Safe vs Threat) x 2 (Go vs NoGo trials) ANOVA to demonstrate a NoGo N2 ERP effect. Next, we conducted a 2 (Safe vs Threat) x 2 (Stereotype Consistent vs Stereotype Inconsistent) x 2 (Black vs White Face) ANOVA to examine specific condition differences. Results yielded null main effects and interactions. However, Pearson's *r* correlational analyses for EMS found that individuals with greater EMS showed an enhanced N2 on

trials containing Black faces with Inconsistent Stereotypes in the Threat group. We identified individual differences in EMS that may interact with factors involved with the regulation of implicit racial bias. This work adds to a growing body of literature demonstrating how external pressures to respond in a non-prejudiced manner influence implicit racial bias and cognitive control.

#### **Stephanie Leader**

Representations of Fish on Ancient Cypriot Vases

Mentor: Derek Counts, Art History

In the summer of 2019, I had the privilege to study abroad and excavate on the island of Cyprus in the eastern Mediterranean as part of the Athienou Archaeological Project (AAP) fieldschool, sponsored by Davidson College. AAP provided an opportunity to learn excavation methods, visit archaeological and historical sites, and learn about the history of the island and establish an understanding of the art and culture upon which to base my research. My capstone project for the fieldschool was an independent research paper looking at images of fish on Cypriot vases. My interest started at the Cyprus Archaeological Museum where I noticed representations of fish on a variety of Cypriot vases. Using a selection of five vases as a case study, my project traced the presence of this artistic motif from the late Bronze Age (ca. 1600-1400 BCE) to the Archaic period (ca. 750-475 BCE). Mycenaean imported vases show some of the first depictions of marine life on Cyprus and my research suggests that such motifs were common and continued for the next 1000 years. I was able to conclude that Cypriot depictions of fish likely began with Mycenaean imports, but as often is the case in Cyprus, these images were gradually changed and made into a uniquely Cypriot design.

#### **Trent Lechleitner**

Analysis of Levels of Student Processing to Investigate Students' Science Literacy

Mentors: Kristen Murphy & Allison Tmoczyk, Chemistry & Biochemistry

The American Association for the Advancement of Science (AAAS) has outlined four themes that define science literacy; these are systems, models, constancy and change, and scale. More recently, the National Research Council has released the framework for K-12 science education that includes "Scale, Proportion, and Quantity." Previous research in chemistry has shown that scale literacy is a better predictor for success than traditional measures in general chemistry I or II. Scale has been integrated as a theme in the undergraduate general chemistry curriculum. Targeted scale instruction has led to increases in student learning measured by final exam performance. However, the learning gains in general chemistry I were higher than general chemistry II. The goal of this project is to understand the processing students use to solve general chemistry II problems that include the concept of scale. Linked problems were studied in a treatment of general chemistry II that included all aspects of the incorporation of scale-themed instruction. Results of the categorizations, levels of expertise, as well as the relationship between these levels of expertise and scale literacy will be presented.

**Dayna LeClair**

Does Instruction Provide Changes in Jump Landing Mechanics?  
Mentor: Hayley Ericksen, Kinesiology

Increased knee abduction and hip adduction angles during jump-landing have been linked to increased risk of non-contact ACL injury in females. Exercise interventions to reduce injury risk include using internally(IF) or externally(EF) focused verbal instruction. The purpose of this investigation was to evaluate differences in hip and knee kinematics between those who received EF, IF instruction and controls (CON). Participants were randomly assigned to one of 3 groups EF (n=15), IF (n=14), or CON (n=10). Pretest kinematic data was recorded while participants completed five trials of a standardized jump-landing task. Immediately after, EF, IF, or CON instruction was given while the participant performed 6 sets of 6 jump landings. Following the intervention, posttest kinematic data was recorded while participants performed the same jump-landing task. Data were analyzed with a repeated measures ANOVA comparing hip and knee angles at maximum knee flexion across groups (EF,IF,CON) and time (pretest, posttest). Alpha levels were set at  $p < 0.05$ . Significant main effects for time were found in hip and knee sagittal plane angles ( $p = 0.0001$ ), hip frontal plane angles ( $p = 0.001$ ), and knee frontal plane angles ( $p = 0.0001$ ). Specifically, mean differences from pretest and posttest included 5.1 degrees of increased hip flexion, 9.1 degrees of increased knee flexion, 2.5 degrees of increased hip abduction and 4.3 degrees of increased knee adduction. No significant interactions between groups and time were found. This study found increases in hip flexion, hip abduction, knee flexion, and adduction in all participants, regardless of group. These changes reflect an improved movement pattern, thought to be less risky for knee injuries. The EF and IF instruction both created the desired result and demonstrated improvements in jump-landing mechanics. We found that the CON group also made improvements even though the instruction they received did not directly address changing landing mechanics.

**Kristen Leer**

Maximus: The Hybrid Archetype Hero of the 21st Century

The ideal hero has been subjected to change based on the ever-evolving values of American culture. Within the sword-and-sandal film epics of the 1950-60s heroism was molded into a particular image of American glory, honor, and duty to serve one's society for the greater good. However, this genre of film came to a halt, apart from some scattered sword-and-sandal spoof films that were produced, until Ridley Scott's Oscar-winning *Gladiator* (2000) marked a revival of classical movies which attracted mainstream interest in the ancient world. It begs the question: What happened during this approximate gap of 30 years? There was speculation that the interruption of the genre was due to "stilted dialogue, predictable stereotypes..." etc. (Briggs, 2008). However, I argue that the change in ideals of heroism was responsible for the halt of sword-and-sandal films from the 1950-60s to the 21st century. Due to the counterculture occurrence of the 1960-70s, heroes who maintained traditional virtues couldn't thrive or adapt to a rapidly developing American culture as it was these ideals that were being opposed. Despite the break, inspiration from the

sword-and-sandal films can be noted in the 1970-80s sci-fi films. These, in turn, inspired further evolved ideas of heroism depicted through historical war films. An important evolution to be noted through these films is the ideals of heroism being reintroduced to American audiences. Monica Cyrino argues that "*Gladiator* reinvents ancient Rome," but I propose that *Gladiator* instead reinvents the epic hero through hybridization of the traditional and counterculture attitudes that ultimately influence the 21st century's relationship with heroes (2004). *Gladiator*'s protagonist, Maximus, successfully does this by evoking psychological insight into these heroes. As Joaquin Phoenix, who plays Commodus in *Gladiator*, says, "Now we care about heroes with flaws and humanity" (Cyrino, 2004).

**Kristen Leer**

Eve and the Serpent: A Re-telling in *The Shape of Water*  
Mentor: Jacqueline Stuhmiller, Honors College

Despite the book of Genesis being introduced to Western society thousands of years ago, it remains a monumental cultural influence within our contemporary society. More specifically, the narrative within Genesis of Eve and the serpent is still modernized for today's audience. The relationship between these two figures have been debated for centuries, but an area that hasn't been fully explored is the intimate relationship that Eve and the serpent are theorized to have. Eve is the representation of women and the serpent represents animals. It is through the serpent that Eve not only is recognized, as the serpent is the first to speak with her, but who gives her a sense of agency – to gain knowledge. Eve does not get this sense of agency with God or Adam, who is the archetype for man. This dynamic that Eve and the serpent share is recognized to be dangerous, for God steps in and severs the relationship between these two – inhibiting their communication from existing. Though Eve and the serpent – woman and animal – cannot speak to each other, vocally, ritual practices (ex. Li Grand Zombi), folktales (ex. a Chinese folktale "The Goddess of the Silkworm"), and contemporary adaptations (ex. *Bear* by Marian Engel) depict their union physically. A contemporary film to explore the relationship in this capacity is the 2017 Oscar-winning film *The Shape of Water*. The film not only sparked media attention because of the film's quality, but discussion arose about the role of women and animals in response to the intimate relationship the protagonist, Elisa, has with the amphibian humanoid, the creature. I argue that this film is a re-meeting of "Eve" and the "serpent" after their separation by God. Furthermore, this film allows us to examine how intimate depictions of Eve and the serpent exist.

**Joseph Lentz**

EMI Characterization of Wide Band Gap Power Electronic Devices  
Mentor: Robert Cuzner, Electrical Engineering

When designing resilient micro grids you need ensure they will survive in the presence of malicious and non-malicious threats. In order to do this, you need to address several aspects of the micro grid such as its susceptibility, vulnerability and recover-ability in various configurations. With new wide band gap semiconductors that switch at much higher frequencies

than what's commercially available today in power electronic converters, a lot of EMI/EMC problems can be introduced. To characterize this EMI a custom EMI test bench has been built in the lab. This allows us to precisely characterize the EMI introduced by these devices to design an optimized filter that will meet current EMI/EMC standards.

#### **Carnita Lincoln**

The Role of the Nucleus Reunians in Memory Consolidation and Visualization of its Projections

Mentor: Karyn Frick, Psychology

Concurrent activity in both the dorsal hippocampus (DH) and medial prefrontal cortex (mPFC) is necessary for the consolidation of spatial memory in mice and it is hypothesized that other brain regions might mediate communication between the two. Because the nucleus reunians of the thalamus has been shown to facilitate communication between the DH and mPFC, the goal of this study was to determine whether the nucleus reunians (RE) is also necessary for spatial memory consolidation. To inactivate the RE, we used a technique called DREADDs (designer receptors exclusively activated by designer drugs) which uses a viral vector to express a synthetic receptor that inhibits neuron activity after application of a synthetic, selective drug. Female mice were trained in an object placement memory task, RE was inactivated, and memory tested 4 hours later. Inactivation of the RE impaired object placement memory. Because this inactivation method targets the entire RE, which projects to multiple brain regions, we next want to specifically inactivate projections from RE to either the DH or mPFC. We tested retrograde Cre viral construct combined with Green Fluorescent Protein that allows us to label neurons that project to a specific brain region and target these neurons for inactivation. The retrograde Cre was infused into the mPFC, DH, or RE of young female mice, and brains were collected 3, 4, or 6 weeks later to determine the extent of viral expression. Brains were flash frozen, sectioned using a cryostat, mounted on slides, and imaged using a fluorescent microscope. Imaging allowed us to identify which projection cells expressed the virus and determine an optimal expression time (3, 4, or 6 weeks). The results from this and future studies will allow us to better understand the circuitry underlying memory formation and may lead to advances in treatments for memory consolidation.

#### **Ashley Lopez**

A Systematic Review of Effectiveness of Health Promotion Interventions for Transgender People

Mentor: Lance Weinhardt, Public Health

This is the first systematic review of articles examining all health promotion intervention programs not related to gender transition that have been tested among transgender people. Included are peer-reviewed, published articles from which intervention effects on participants identifying as transgender (or with a gender identity under the transgender umbrella) were the sole focus or could be separated from other participants in the study. Articles only examining the effects of medical gender transition related treatments (e.g., surgery, hormone treatments) were beyond the scope of our paper and excluded. This paper will present the methodological details and results

of 15 studies addressing physical health, 3 studies addressing mental health, and 5 studies addressing both physical and mental health outcomes. These studies focused on HIV and STD risk reduction, substance use, PTSD, depression, anxiety, coping, and resilience. The most important conclusion gleaned from this review is that, given the physical and mental health disparities between transgender and non-transgender people, there is a great need for development and testing of new health promotion programs tailored for the transgender community. Future research is necessary to assess the success of health promotion interventions for physical and mental health such as exercise, nutrition, sexual health education, mindfulness, and community connectedness.

#### **Hunter Louis & Ally Emrich**

Milwaukee, Mentors, & Making: A Study of Community Through Art Based Collaborative Research

Mentor: Jessica Meuninck-Ganger, Art & Design

We have been working with the renowned Brooklyn artist, Mary Miss, on the City as Living Laboratory: Sustainability Made Tangible through the Arts (CALL) and WaterMarks projects – incorporating partnerships with the Center for Collaborative Research (CCR), Global Water Institute, the Milwaukee Dept of Public Works, 16th Street Community Health Center, Pulaski Park Neighborhood Association, and the Kinnickinnick River Neighbors in Action. We are offering a series of community papermaking and printmaking workshops associated with the Kinnickinnick riverbed re-naturalization project. As an extension of the CALL and CCR, we are working with community leaders to grow the presence and accessibility of art-based collaborative research in Milwaukee's neighborhoods by offering workshops and events through the CCR's Press on Wheels (POW) program. POW was originally a medical van that we converted into a mobile printmaking and papermaking facility. Enthusiasm is growing as a result of our engagement, and we have gathered new partners, including the Milwaukee Artists Resource Network (MARN), the Museum of Wisconsin Art, and the American Civil Liberties Union and its Youth Justice Institute. We hope to further facilitate mentorships between middle and high school MPS students, UWM interns/fellows, and MARN artists in tandem with offering outreach, creative activities, and sanctuary spaces. Expanding beyond our local focus, we will be traveling to Puerto Rico in late March and early April. We will design and build a set of portable printmaking and papermaking labs using repurposed materials to showcase at the upcoming "Puertographic" 2020 SGC International printmaking conference. Following our presentations, we will donate the equipment to schools and arts organizations in San Juan.

#### **Lilly Luft, Sophia Hermann & Lisdon Brannon**

Divergent Fates

Mentor: Yevgeniya Kaganovich, Art & Design

Divergent Fates is a project that builds on professor Kaganovich's long standing research interests in materiality, ecology, and human impact on the environment. The focus of the research is on the ways in which trees are modified by humans with particular interest in three specific possible fates; continuing to be a tree, becoming paper, and becoming

a chair and reinterpreting those fates through objects of physical speculative fiction. The project has involved a wide range of exploration of these possible fates and the ways they can reinterpret one another, asking and answering questions like “Can paper remember being a tree?” and “Can a tree intuit the existence of a chair?” through a wide range of methods. The research includes developing and adapting new processes for realizing the answers to these questions. Some example processes include building custom machines for reverse engineering logs out of paper, developing multi year aggressive grafting routines for bending and grafting trees into facsimile chairs, and using woodworking techniques to create fractally repeating chair structures. These speculative objects have been in multiple exhibitions, such as the 2020 Museum of Wisconsin Artists Biennial in West Bend, Wisconsin, Cartography of Desire at St. Catherine University Galleries in St. Paul, Minnesota, 10 Wisconsin Sculptors at the UWM Union Art Gallery, and WOW-Women at Alverno College in Milwaukee, Wisconsin. Divergent Fates: tree intuit chair project is currently in development on site at the Lynden Sculpture Garden in Milwaukee, Wisconsin.

#### Connor Lynch

Analyzing Parent-Child Feeding Through Child Behavior and Feeding Relationship Disturbance

Mentor: W. Hobart Davies, Psychology

Feeding relationship disturbance can stem from the parent's and child's attitude toward mealtime as well as the environment surrounding the mealtime. In the parent-child feeding relationship, feeding relationship disturbance may be related to the child's problematic behavior, including internalizing symptoms (ex: feels hopeless), externalizing symptoms (ex: fights with other children), and attention problems (ex: has trouble concentrating). Studies suggested that children with feeding relationship disturbance are more likely to experience behavior dysregulation (Winsper & Welke, 2014; Dovey et al., 2019). While previous research has investigated the relationship between feeding relationship disturbance and child behavior among preschool age children, this relationship has not yet been studied among school age children. The aim of this study is to evaluate the relationship between parent-feeding child-feeding relationship and child behavior among school age children. It is hypothesized that an increase disruption to the parent-child feeding relationship will be correlated with an increase in child problem behavior. A community sample of caregivers, recruited by students in an advanced psychology course, completed an online survey including the About Your Child's Eating (AYCE) inventory and Pediatric System Checklist (PSC-17), as part of a larger online survey. The AYCE measures feeding relationship disturbance as child resistance to eating, positive mealtime environment, and parent aversion to mealtime. The PSC-17 measures the child's behavior through the constructs of internalizing, attention, and externalizing. Pearson correlations were conducted to analyze the relationship between AYCE measures and child problem behaviors. The study resulted in significant correlations across internalizing systems and parent aversion to mealtime ( $r(159) = .299, p = .001$ ) and externalizing and parent aversion to mealtime ( $r(158) = .413, p = .001$ ) among others showing a relationship between feeding relationship disturbance and child problem behavior. These findings argue that psychologists should evaluate child behavior when treating feeding relationship disturbance.

University of Wisconsin-Milwaukee

#### Abigail Lynch

Milwaukee's Housing Choice Voucher Landscape: Advocacy, Policy and New Developments

Mentor: James Harris, Urban Studies

This presentation reports on preliminary research findings from a qualitative housing study that uses archival and ethnographic methods to investigate and analyze a variety of housing developments, policy changes, and advocacy initiatives in the metropolitan Milwaukee region. The study includes an examination of Choice Neighborhoods, Low Income Housing Tax Credits (LIHTC), Housing Choice Vouchers (Section 8), and inclusionary zoning across city, metropolitan, and statewide contexts. Housing policy research frequently focuses on federal policy making and ignores the significance of local advocacy and historical factors to shape housing policy outcomes. This study seeks to analyze local efforts and identify ways in which local context matters. In my presentation, I focus on Housing Choice Vouchers and their significance as a type of housing assistance in Milwaukee. In particular, I examine housing advocacy efforts directed at expanding voucher income protections under Milwaukee County's Fair Housing ordinance (which effectively bans voucher use as a basis for not renting to a potential tenant) along with responses from housing program practitioners and other key groups such as landlord associations. Milwaukee has consistently been ranked as one of the most hypersegregated regions in the U.S. and one that suffers from high levels of concentrated poverty. As a policy approach, Housing Choice Vouchers have been cited as having the ability to promote mobility to higher opportunity neighborhoods (DeLuca, 2017), an effective means to counter racial segregation (Squires, 2018), and a way to address housing instability resulting from eviction (Desmond, 2016). Drawing on archival and ethnographic data such as community social media forums, public meetings, legislative testimony, and interviews with key actors, I discuss the role these different groups played and other important factors that led to the successful adoption of this policy change as well as the initiative's implications on housing outcomes and processes of policy change.

#### Ryan Majinski

Asymmetric Synthesis of the Anticancer Agent

(+)-Elacomine

Mentor: M Mahmum Hossain, Chemistry & Biochemistry

(+)-Elacomine is a natural anticancer agent found in certain shrubs of the *Elaeagnus* genus. It has been found to be toxic to melanoma cells while also having almost no effect on normal human cell lines. This allows for a uniquely targeted treatment to melanoma, and therefore elacomine has been the subject of recent synthetic research. Modeled after a recent synthetic route for (-)-coerulescine, a structurally similar analgesic agent, we devised an efficient method of creating elacomine in only six successive reactions. The first step consists of the formation of a 3-hydroxyacrylic acid ester, which has already been optimized. The second step involves the asymmetric alkylation of the acrylate product, and it is currently being optimized. After optimization of all steps using model compounds, we can apply these reaction parameters to the synthesis of the anticancer agent elacomine.

**Margaret Marshall**

O Cricket, Where Art Thou: Do Black Widow Spiders Remember the Site of Prey Capture in a Complex Web  
Mentors: Rafael Rodríguez Sevilla & Clinton Sergi, Biological Sciences

Different animals form memories about varied aspects of their environment. There is evidence that web spiders form memories about the layout and content of their webs. However, most of this evidence comes from spiders that form two-dimensional webs. Here I analyzed the memory capability of Western Black Widow spiders, which build three-dimensional webs (consisting of a sheet and a forest of gum-footed lines). I tested the hypothesis that spiders form memories of the sites at which they have captured their prey. This hypothesis makes the prediction that spiders will predominantly search the sheet of their webs when looking for prey that was captured in the sheet, and that they will be more likely to search the gum-footed lines of their webs when looking for prey that was captured in a gum-footed line. I tested this prediction by offering prey to spiders in both the sheet and gum-footed lines of their webs, then experimentally removing the prey after the spiders had successfully captured the prey. The spiders in the control groups were either subject to damage to the web (equivalent to the damage spiders cause when removing prey from the web) or were given prey and left to consume it after capture. I will discuss the results in terms of spiders' ability to form memories about the site of prey capture in relation to the structure of their web.

**Emma Martinez**

Impacts of Food Security: A Study on the Refugee Population in Malawi  
Mentor: Lucy Mkandawire, Nursing

Food insecurity remains a major health determinant among refugee populations in Malawi. It is important to understand the adverse experiences that result from limited food supply and food insecurity for people living in low-income countries. The Dzaleka refugee camp in Malawi houses approximately 38,000 refugees who rely on food assistance during their stay. Refugees desire the right to work and to meet their own basic needs. Socially and politically empowered gender roles, however, influence food production and therefore food security. The purpose of this literature review was to explore the hypothesis that empowering and educating women and children will improve food security in refugee camps, as well as, throughout the country. Resources utilized were UWM libraries data base and various organizations addressing agricultural issues in African countries including World Food program, United Nations, National Geographic, and UNHCR. Key words searched were refugees, food insecurity, income, food aid, malnutrition, agriculture, and women and children refugees. Abstracts and conclusions were used to select articles for inclusion. Data extraction included information to understand gender roles and the impact of food insecurity in refugee populations in Malawi. The literature identified that socially and politically empowered gender roles influence food production and food security in Malawi, including the refugee population. Empowering and educating women and children improves food security, as well as decreases gender-

based violence, childhood marriages, and halted education. The information obtained from this literature review, supports that educating women and children in refugee camps about sustainable agricultural practices and best business practices will enable refugee women and their families to attain improved health determinants. Women and children are often the most vulnerable in Malawi. When we educate women and children on sustainable agriculture practices, they are more likely to feed not only themselves, but their families, communities, and the rest of the country.

**Sofia Mattson, Joseph Kornkven & Amberly Krause**

Working Memory Filtering Efficiency of Threatening Words  
Mentor: Christine Larson, Psychology

In the current study, we examined if working memory was also impacted by threatening words, specifically investigating working memory filtering efficiency of threatening words. Using Electroencephalography (EEG), we recorded 54 undergraduates as they completed a change detection task consisting of 4 conditions: one neutral target word, two neutral target words, one neutral target word combined with one neutral distracter word, and one neutral target word combined with one threatening distracter word. We measured the contralateral delay activity (CDA), and event-related potential (ERP) that provides an index of working memory filtering efficiency for distracters. By using the CDA, we were able to calculate one's filtering efficiency using a well-validated formula taking into account the low and high loads in relation to the distracter load. We conducted group level analyses by using repeated measures ANOVA for each dependent variable of interest. The results from our behavioral analyses showed no differences in filtering efficiency for neutral distracters compared to threatening distracters. In addition, our CDA analyses yielded null differences in filtering efficiency. Contrary to our group level analyses, moderation multiple regression results displayed an interaction between working memory capacity and attentional control. This predicted the ability to efficiently filter threatening words, but not neutral words. This same pattern was observed for individuals with average working memory capacity. However, for individuals with high working memory capacity, level of attentional control did not matter in terms of predicting filtering efficiency. Our findings add to the literature examining working memory filtering efficiency of threatening stimuli.

**Kelly McGavock**

Simple and Effective Home Health Monitoring Using Spatiotemporal Data  
Mentor: Roger O. Smith & Nathan Spaeth, Occupational Science & Technology

As more older adults are choosing to live independently in their homes, there is a need to monitor the level and nature of their daily activities. The aim of this project is to create a simple spatiotemporal prototype system to track an individual's activity in the home. The future prototype will use a smartphone or smartwatch as its platform, be unobtrusive, low cost, and non-invasive. Methods for this project included creating and testing a semi-structured interview. The data such as that collected from the semi-structured interviews will be

converted into real-time daily schedules that will include time, location, and duration of activities. In the future, we plan to work with computer scientists to create a computer learning algorithm to identify activities using spatiotemporal variables such as sequence, frequency, duration, and location in order to predict an activity an individual is participating in. We have conducted three pilot interviews and are in the process of analyzing the data. We are anticipating that the time invested in analyzing the semi-structured interviews may not justify the quality of data gathered. We may change our direction to include adding an activity configuration chart component that will be filled out by the participant with prompting from the researcher and compare the results against the data gathered from the interviews.

#### **Michael McMahon**

Processing of a Low Cost, Energy Efficient Internet of Things Harmful Algal Bloom Monitoring Buoy  
Mentor: Todd Miller, Public Health

Harmful algal blooms (HABs) are large accumulations of toxin algae in lakes and oceans and an ever-increasing problem in water bodies globally. Not only do they negatively affect the ecosystems they inhabit but also the surrounding area. Generally, the public, water resource managers, and public health professionals demand economically efficient and timely warnings of HABs in local waterways. The development of a low cost, energy efficient buoy capable of detecting HABs benefits both scientists and the general public alike. Our goal is to produce an economical scientific buoy that can track HABs within a water body in real time while also providing a platform that is web accessible for the general public to view the real time data. On top of this, the buoys will utilize a suite of sensors that each gather numerous forms of data on the potential for HABs in a given area. Once each sensor has collected data in situ, it is organized and saved to an onboard SD card and sent to an Internet of Things (IoT) cloud computing platform via a mounted cellular modem. We present the results from initial testing of different hardware configurations and development of software to efficiently run the buoy system and send data to the IoT database.

#### **Vladislav Melnikov**

Rational Transitive Mate Choice in *Enchenopa binotata*  
Treehoppers (Hemiptera: Membracidae)  
Mentor: Rafael Rodríguez Sevilla, Biological Sciences

Mate choice is a crucial decision for females. Mate choice decisions are based on mate preference functions, which are curves that describe the relationship between the attractiveness of sexual ornaments and variation in their features. One possibility for how mate choice decisions relate to preference functions involves rationality, whereby females always select the male with the preferred traits when in the presence of less-preferred males. A competing alternative — with support from humans and some vertebrates — involves irrationality, whereby the presence of very low or very high quality males can cause females to alter their preferences in the available mates. We test whether treehoppers use rational choice to select mates, and predict that responsiveness will be higher for preferred male signals regardless whether a decoy was presented. Using

vibrational playback stimuli that varied in a single variable, frequency, we presented females with preferred and less-preferred males in the presence or absence of attractive and unattractive decoy males. We found that females selected the preferred males over the less-preferred males regardless of the presence of a decoy or the quality of the decoy. These findings show that *Enchenopa* treehoppers use rational mate choice.

#### **Maisey Michelz**

Life Cycle Analysis of Wooden vs Plastic Pallets  
Mentor: Wilkistar Otieno, Industrial & Manufacturing Engineering

Wood pallets take up 96% of the pallet industry, while plastic is second with 37%. Both of these are the most popular materials that manufacturers use for their shipping purposes. Currently, there are more than 1.8 billion pallets in use in the US at a cost of \$12 per pallet. This means over 12 billion dollars are spent on pallets, most of which is embedded in the product pricing, and hence is eventually paid for by the consumer. 400-450 million pallets are produced annually and only about 148 million of them will be recycled. The purpose of the research is to produce a life cycle assessment of wooden pallets, and plastic pallets and compare their environmental impact and their cost-benefit analyses. Our goal is to produce a model flow-chart with pallets as the case study, which can be repurposed to create the life cycle assessment for other products. The results of this proposal will enable product end of life decisions which may include reuse or recycling in the form of mulch, pellet fuel, or recycled plastics. To summarize, our results show that in this case study wooden pallets are more cost beneficial than plastics.

#### **Anna Mikulo**

What is “What? Where? When?”? A Russian Gameshow’s History, Participants, and Global Reach  
Mentor: Christine Evans, History

“Chto? Gde? Kogda?” is an intellectual TV game which originated in Soviet Union and it remains on Russian-language media today. The game is played by six experts who, after a minute for discussion and deliberation, give answers to questions asked by a team of viewers, creating a conflict between the experts on set and the viewing public across Russia and beyond. If the “experts” answer correctly, they get a point; if not, the “team” of TV viewers triumphs. After getting public recognition, for many years, the show still holds a significant position in Russian-speaking cultural life as an innovative game, combining intellectualism, enthusiasm, and eagerness to win. To gain insight not only into the show’s rules but the organization and significance of the show as a whole, — on stage as well as behind the scenes — I gathered information from newspapers and online articles, video interviews of players and their social media accounts, online chats including discussions among viewers, and the actual footage of games. Over time, a small but strong community of regular players was formed which began playing an important role in the show’s life. Moreover, the show has expanded into a global network of amateur players, hosting analogous events all over the world, creating a network of like-minded people that suggests the significance of this show for researchers interested in global media, Russophone culture, and diasporic social networks.

**Skyler Miller**

Archaeological Analyses of Prehistoric Projectile Points: New Insights in Technology and Variability  
Mentor: Gregg Jamison, College of General Studies - Social Sciences & Business

This project is an analysis of a collection of Native American prehistoric projectile points at UWM-Waukesha. This will include applying traditional methods of documentation and classification with new approaches including three-dimensional scanning and morphometric analyses. The combination of these two provides an incredible tool for obtaining a more objective understanding of the typology, variability, production and styles of projectile points. This will be focusing on providing a clearer picture of a specific type of projectile point by analyzing a wide selection of examples. By using comparative methods we will be able to isolate the defining characteristics of a very imprecise classification. This research is a novel, multi-faceted approach to the study of one of the most important forms of material culture from prehistoric Wisconsin, with the potential to provide new insights into the lives and activities of its earliest inhabitants.

**Tessa Miskimen**

Effects of Physical Salience and Learned Aversive Value on the Deployment of Attention  
Mentors: Deborah Hannula & Fred Helmstetter, Psychology

Recent work from our lab indicates that attention capture can be observed for learned fearful stimuli. However, aversive items in our original work were onsets, distinctive not only based on learned value, but also by their sudden appearance in the search display. In this experiment, we eliminate this potential confound and examine whether capture effects persist. Participants in these experiments search for a target stimulus defined by color during a training phase. They are told to make a single eye movement to the target location as quickly and accurately as possible. Shock delivery was dictated by the color of the target stimulus so that one target becomes a conditional stimulus (CS+) and the other a predictor of relative safety (CS-). Next, participants search for a shape target and occasionally, one of the distractors is either the CS+/-, but no shock administered. Results from Experiment 1 indicate that eye movements during test are made in error more often to the CS+ than the CS- and that this occurs even in the absence of explicit knowledge about shock-color contingencies. However, contingency awareness was assessed using an insufficiently sensitive post-experimental questionnaire. In Experiment 2, we attempt to replicate these results with participants making button responses to indicate how likely they are to be shocked. This approach will permit us to make more definitive claims about capture with and without awareness. Finally, this study will provide context for future studies to investigate the effects of fear conditioning on those with anxiety disorders or PTSD.

**Emily Moen**

The Milwaukee Visionaries Project  
Mentor: Kim Cosier, Art & Design

The Milwaukee Visionaries Project (MVP) is an after-school arts program which combines UWM and creators with Milwaukee community middle and highschoolers. The research will be a qualitative study that explores how students describe the impact of MVP. We will be seeking to understand how they see MVP supporting them as artists and filmmakers who communicate and express themselves through the use of specific art mediums. A second outcome we will measure is students' ability to cooperate and collaborate with teams. The goal of the program is to create films ready to apply to the Milwaukee Film Fest. In MVP students pitch ideas to the whole group and for stories to be told through video and/or animation. Teams of students form through discussions and the teams work together to realize a vision of a story that has been collectively developed. Differences of opinion are resolved through open dialogue and consensus building. In-process critiques give each team a chance to engage in every project. Through critique, ideas are shared, strengthened, and challenged in a supportive environment. In these ways, cooperation and collaboration are central to the mission of MVP. This study is relevant because it centers on student voice and highlights the importance of art programs and their benefit on students who do not have access to art resources. It also informs students on new ways to communicate and collaborate with fellows creatives. The methodology will include observation, notes and surveys. As well, we will be producing a short video including in-person interviews conducted on camera. The story will be rounded out through capturing relationships among students and staff. We hope to host the video on our website to draw more students into the program by sharing the story of the impacts of MVP among Milwaukee community students.

**Nimo Mohamed**

Strong Fathers: Strong Babies  
Mentors: Kris Barnekow & David Pate, Occupational Science & Technology and Social Work

Infant mortality is the number of deaths per 1,000 live birth of children under one year of age. In Milwaukee, infant mortality disproportionately affects the African American population (43%) compared to the White population (13%). There are many factors that contribute to infant mortality. The Wisconsin Lifecourse Initiative for Healthy Families mentioned, "lack of fatherhood involvement" as one of the root causes. A father's absence can influence a child's cognitive development, emotional and social health. Some of the negative implications that the children might experience include, but are not limited to, lack of academic achievement, behavioral problems, and overall well-being. This research was conducted to become knowledgeable about the experiences of Black fathers and determine effective interventions that support Black fathers in their occupational role. Focus group methodology and qualitative analysis were used to answer questions such as the father's engagement level with their children, their knowledge about infant mortality in Milwaukee, and how an app can educate them about important issues like infant mortality. The

study consists of forty-one African American fathers, who are involved in their child's life, participants of Fatherhood programs, and between the ages 21-57. The fathers participated in four separate focus groups with 8-12 men in each group to evaluate and analyze the Strong Babies Campaign. The Strong Babies Campaign is a health communication tool aimed at educating parents about improving their children's health and decreasing infant childhood mortality. According to the focus group participation, The Strong Babies Campaign did not effectively convey the message. The fathers stated that the posters about infant mortality were misleading. A more in-depth analysis to verify themes is needed.

#### **Abigail Moore**

Does Size-Assortative Mating Improve Fertilization Success in Grey Treefrogs?

Mentor: Gerlinde Hoebel, Biological Sciences

Success of external fertilization is often optimized by the closeness of egg and sperm release. In frogs, males and females perform amplexus, mating embrace, during egg laying. We hypothesized that size-assortative mating improves fertilization success. This hypothesis makes two predictions: (1) fertilization success should be correlated with a particular within-pair size difference; and (2) size differences observed in nature should align with the optimal size ratio. To test prediction (1) we collected 20 pairs of Eastern Grey Treefrogs (*Hyla versicolor*), and allowed them to oviposit into separate marked containers. Fertilized embryos, at four days post-oviposition, were distinguishable from unfertilized eggs. Proportions of fertilized eggs were then calculated using photo analysis. The body length of each adult frog was measured using calipers. Size ratios for each adult pair was compared to the fertilization success of their eggs. We also collected additional mated pairs and measured their size ratios. We found that there is indeed a size ratio that optimizes fertilization success, but that about 50% of the breeding population does not mate with optimally size-matched partners.

#### **Valerie Moscherosch**

Strengthening the Future Health Work Force:

Applying the Transtheoretical Model to Improve Retention in Spanish Language Circles

Mentor: Rose Hennessy, Public Health

Learning how to communicate effectively in Spanish, shows respect and helps health professionals implement culturally specific services and treat patients. As the Spanish-speaking community grows, there is a need to address language barriers in health care. The Spanish Tables for Health Students program at UW-Milwaukee allows English-speaking undergraduates and graduates from all disciplines to improve health communication ability in Spanish. This is completed through bi-monthly sessions where students sit around a table together to practice Spanish and learn about health issues in Latino communities. A semi-structured interview was conducted with the program developer of Spanish Tables for health Students from the UW-Milwaukee. Observation of Spanish Tables for Health to support the research to identify the behavioral theories for public health change and program recommendations. One to thirteen participants attend each Spanish session, but the individual participants vary week to week. Therefore, there is a

need for improvement in the retention of participants. The use of a Logic Model to help identify the key activities that lead to participating and retention while analyzing the out-puts, and outcomes to better Spanish Tables for Health Students. The Transtheoretical Model is an integrative theory that assesses a readiness to act on a process of change and will be applied to help achieve a greater retention rate. Logic Models are effective tools to assist in program planning, implementation, and evaluation. Theory-based recommendations may assist to improve recruitment and proactive recruitment procedures. The personnel of Spanish Tables for Health Students may consider adapting the recommendations provided. Improving retention of Spanish Tables for Health could help decrease public health disparities in minority health.

#### **Alex Moxon**

Simulating Self-Assembly of Tornado Storm Chasers Using Agent-Based Modeling

Mentor: Paul Roebber, Mathematical Sciences

Given the risk to public health and safety and the limited ability to forecast their occurrence, tornadoes are of great research interest to atmospheric scientists. Most importantly, more data is needed to better understand their development and evolution, with the ultimate goal of better predictions. On days in which tornadoes are forecast, storm chasers travel to areas where these storms are expected to develop with the intention of obtaining these data. However, this goal is difficult to accomplish because of timing and location uncertainties, issues that are further complicated by the inherent safety risks that they present. This project uses agent-based modeling techniques to determine the most ideal locations and routes that storm spotters can take during a simulated tornadic thunderstorm event. This research will help us to understand whether the emergent behavior of a cluster of storm chasers would be sufficient to satisfy both safety and data collection goals, compared to more traditional, centrally controlled field experiment deployments. Some recent experiences with real tornado events suggest this possibility, and there is a need to test whether such a result was unusual or would be characteristic of this kind of activity. Such a result would influence the design of future scientific field experiments and would be of great interest to the community.

#### **Brian Myers**

Testing Force & Pressure Deformation of PDMS for Tactile Sensing

Mentor: Veysi Malkoc, Biomedical Engineering

Polydimethylsiloxane (PDMS) is the most widely used, silicone-based organic polymer. Silicon wafers are used to design channels, and in our case specific patterns. PDMS is then poured over these wafers and left to harden. When removed, even the smallest of details is left imprinted in the PDMS. By testing the microfabrication's modes of deformation like stress and strain, we will see which porous structure has the best characteristics for compatibility with a tactile sensor, compared to its original solid structure. An elastic modulus is a quantity that measures an object or substance's resistance to being deformed elastically (non-permanently) when a stress is applied to it. The elastic modulus of an object is defined as

the slope of its stress–strain curve in the elastic deformation region. A stiffer material will have a higher elastic modulus. Stress is defined as the force causing the deformation divided by the area to which the force is applied, while strain is the ratio of the change in some parameter caused by the deformation to the original value of the parameter. Changing the topology of PDMS by adding depressions that may or may not be through holes will drop its modulus of elasticity which then in turn should decrease the stiffness. In theory, this should enhance the sensitivity of a capacitive sensor. Finding the right pattern and dimensions for PDMS to coincide with a sensor will provide electronic feedback based on its deformation. This information can determine the rigidity of materials. For example, this information can help determine if a robotic hand is touching a wood desk versus a pillow. Incorporating this form of tactile sensing to prosthetics allow patients to feel how much pressure to apply to an object, improving functionality and their quality of life.

#### **Ryan Nelsen**

Factor Xa Generation Reveals Tissue Factor Fusion Protein Does Not Affect Procoagulant Activity

Mentor: Julie Oliver & Brittany Vanderhoof, Biological Sciences

The expression of tissue factor (TF) outside of the vasculature regulates initiation of blood coagulation by recruiting Factor VIIa to convert Factor X into Xa. We hypothesized that TF activity, measured as Factor Xa production, depends on TF expression level and not the presence of an experimental fluorophore tag. To quantify TF expression, cells were transfected with plasmids containing TF, with or without a fluorophore tag. We demonstrated that cell lines expressing TF fusion proteins tagged with mTurquoise (mTQ) or super yellow fluorescent protein 2 (SYFP2) fluorophores, along with lines expressing untagged TF, can be characterized as having high and low expression of TF using indirect staining and flow cytometry analysis. Single transfectants of each fluorophore and double transfectants containing both fluorophores were characterized. Cell lines were matched for total TF expression level, then used in procoagulant activity assays to test whether the fluorophore tags impact TF function. TF activity was quantified with a chromogenic substrate to measure the amount of Factor Xa produced from X. Our results show that Factor Xa generation is similar between lines with similar levels of total TF, whether the proteins are tagged or untagged. This confirms our hypothesis that the fluorophore tag has no significant impact on TF function. While future tests of fluorophore impact on TF signaling functions would be helpful, these results support the broad conclusion that the fluorophore-tagged fusion proteins commonly used in a wide range of biological model systems have normal, unaltered function.

#### **Anna Niyokwizera**

Impact of Health Disparities Factors by Race/Ethnicity on Pregnancy, Birth, & Infant Outcomes

Mentor: Teresa Johnson, Nursing

In Southeast (SE) Wisconsin, racial disparities in pregnancy, birth, and infant outcomes continue to be some of the worst in the US. The chance of an African American infant dying before

their first birthday is 3 times that of a Caucasian infant. African American women have 2.5 times the risk of dying after giving birth than Caucasian women. The purpose of this study was to examine differences in risk factors by race and ethnicity for adverse pregnancy, birth, and infant outcomes. De-identified data were obtained from PeriData® from a single hospital in a single county in SE Wisconsin from 2013 to 2018, capturing 70% of the births in that county. The sample consisted of 2,415 Black or African American, 5,405 White, and 999 of other race and ethnicities of mother-infant dyads (pair). The study examined the risk factors by race and ethnicity including hypertension, prematurity, fetal death, breast feeding, and admission to the Neonatal Intensive Care Unit (NICU) for maternal and infant morbidity and mortality. Analyses included descriptive statistics. Results revealed significant differences between Black or African American and White mothers and infants, across all variables ( $p=0.00$ ). Hypertension was 13.5% vs 12.2%, prematurity was 28.4% vs 23.0%, fetal intrapartum (stillbirth) death was 0.7% vs 0.3%, NICU admission was 14.4% vs 13.1% for Black or African American and White mother-infant dyads respectively. In contrast, fewer African American women reported breast feeding their infants (49.0%) than White women (79.1%). Black or African American women and infants in Southeast Wisconsin have risk factors that impact maternal and infant health outcomes. These data may inform nurses and community partners to develop and implement programs to improve outcome for Black and African American maternal infant dyads.

#### **Isaac Ngui**

Omnidirectional Mobile Manipulator Platform Kinematic Trajectory Tracking

Mentor: Mohammad Rahman, Mechanical Engineering

Mobile robots have been looked to for solving various tasks such as navigating planets, search and rescue, and carrying objects in factory settings. The reason for their popularity is due to their high maneuverability and their high degree of autonomy. This work presents the use of three-wheeled omnidirectional robots as platform for mobile manipulator robots. We present the kinematics, communication system, and trajectory tracking results of these robots. Their benefits to being mobile manipulator platforms will also be examined in this work.

#### **Chinh Nguyen**

Pre-Amplifier Characterization and K-Wave Simulations

Mentor: Sarah Patch, Physics

In cancer treatment, most patients will go through a “CatScan” before undergoing proton therapy. In the days between the “CatScan” and proton therapy, patients’ organs may move several centimeters. Our research focuses on range verification with a direct correlation to the underlying anatomy. Although there are procedures to stop the treatment when equipment failure is detected, there is no safety net when it comes to the changes in anatomy. Modified K – wave software used the initial pressure distribution taken from Monte Carlo simulations of dose deposited by a clinical proton beam to model thermoacoustic measurements at select receiver positions. A hydrophone can be used to observe

thermoacoustic pulses generated by a proton beam scattering through a phantom. Simulations of thermoacoustic pulses generated by clinical proton beams are bandlimited below 100kHz, with amplitudes below 1 mV so preamplifiers are needed. We tested a commercial preamplifier by conducting a pitch-catch experiment, using the same piezoelectric element models for both hydrophones to transmit and “listen”. The experiment was conducted in different media such as water, oil and coconut milk to mimics the different layers in human anatomy. The results indicated that the commercial product was bandlimited below 50 kHz. Hence, we ordered a custom preamp and repeated the experiments to confirm bandwidth exceeding 100 kHz, which suffices for proton therapy. Whether this preamplifier would suffice for carbon ion therapy remains to be determined. Furthermore, the preamplifiers were grounded to avoid electrical noise that could corrupt the data.

### **Ciera Oglesby**

Morphological Analyses of Regular-Spiking and Late-Spiking Neurons in Hippocampus

Mentor: James Moyer, Psychology

The hippocampus is a brain structure that plays an important role in information processing and long-term memory formation. It can be further divided into two separate regions: the dorsal hippocampus and the ventral hippocampus. Neurons within the hippocampus consist of different firing types which include regular spiking (RS), late spiking (LS), fast spiking (FS) and burst spiking (BS). RS and LS neurons are different in the way they respond to inputs. RS neurons will respond to inputs in a much quicker manner than LS neurons. LS neurons have a more delayed response to inputs, which is likely due to the presence of an underlying potassium current. However, morphological differences may also influence the late response of LS neurons. The present study is designed to investigate the differences in morphology between RS and LS neurons and observe if there are differences unique to the dorsal or ventral hippocampus. This is accomplished by obtaining biocytin-filled neurons from patch-clamp electrophysiological recordings, and imaging these neurons using confocal microscopy. Finally, these neurons are then reconstructed 3-dimensionally using NeuroLucida. The goal of this study is to examine the relationship between morphology and physiology in hippocampal neurons to better understand the role of the hippocampus in information processing. Initial results suggest that there are distinct morphological differences between RS and LS neurons, including altered dendritic branching and complexity. Specifically, the total number of apical dendrite branches for RS neurons in the ventral and dorsal hippocampus are greater than LS neurons. Sholl analysis reveals that RS neurons are more complex closer to the cell body than LS neurons. These initial findings suggest that the difference in dendritic complexity of RS and LS neurons may contribute to differences in firing properties in not only the hippocampus but possibly in other brain regions where these neurons types are found.

### **Danielle O'Hagan-Kennedy**

Searching for a Gerrymandering Antidote  
Mentor: Matthew Petering, Industrial & Manufacturing Engineering

Gerrymandering is an issue that is relevant to every American citizen, regardless of an individual's party preference. When election maps are gerrymandered, one side is given an unfair political advantage by the manipulation of district boundary lines. For example, in the 2018 midterm elections, Democratic candidates for Wisconsin State Assembly received 53% of all votes cast but only ended up winning 36% of the seats. On the other hand, in the same year Republican candidates for U.S. Congress in Maryland received 32.5% of all votes cast but only won 12.5%—one of eight—of Maryland's U.S. Congressional districts. These and other cases of extreme gerrymandering have become serious enough to be argued before the U.S. Supreme Court. The primary goal of this project is to develop a three-step process for creating fair political districts without bias. In step 1, political and demographic data is obtained from online sources and then checked for correctness. In step 2, a computer algorithm coded in C++ automatically assigns small geographic units called wards to political districts. In step 3, the ArcGIS mapping software program is used to visualize the resulting assignments. This presentation focuses on steps 1 and 3 of the above process. We discuss where the data for this project was found and how it was checked. We then describe how maps were created to visualize the proposed district plans created by the computer algorithm. Several maps for Wisconsin's eight U.S. Congressional Districts are proposed, and the advantages and disadvantages of each map are discussed in detail.

### **Emma Oldehoeft**

Among-Female Assessment Variation and Male-Male Spacing in Eastern Gray Treefrogs (*Hyla versicolor*)

Mentor: Gerlinde Höebel, Biological Sciences

Female preferences have been widely researched as a source of sexual selection on male mating signals. The complexity of mate choice in an anuran chorus entails 1) female call assessment, 2) acoustic variation in male displays, and 3) male-male spatial dynamics. While calls and preferences are well characterized in Eastern Gray Treefrogs, assessment and localization of closely perched males is not. We explored female response to isolated and clustered artificial calls in a four-speaker playback design. Using a repeated-measure design that forces females to select a mate based on the attractiveness of a call and its proximity to other males of varying attractiveness, we examined among-female variation in dense-chorus choice scenarios. We found very strong preference against the lone call in all scenarios, while choices made among clustered calls differed between females. This preference against the lone call weakened as clustered calls dispersed. Many individuals were repeatedly able to localize an attractive stimulus centered within a meter of multiple other inferior calls. Interestingly, these females expressed choice significantly faster. Lengthier choice times of less discriminant individuals seems to indicate that “confusion” can be observed in the expression of active preference. We also present unexpected evidence of spatial habituation; females appeared to remember the orientation of the cluster across trials. This study provides greater insight into the real-world mate choice dynamics of multi-signal assessment in a treefrog chorus.

**Aleia Olson**

Sex Differences in Immediate Early Genes in Retrosplenial Cortex Following Context Fear Learning  
Mentors: James Moyer, Hanna Yousuf & Chad Smies, Psychology

Many people experience traumatic events that lead to long-lasting fear memories that are key components of anxiety disorders. Pavlovian conditioning can be used to model fear learning. Females express more susceptibility to fear learning compared to males. For example, female mice show stronger context fear learning compared to male mice. While some studies have shown sex differences in context fear learning, other work did not observe sex differences in short-term acquisition. They observed sex differences in molecular mechanisms that may underlie differences in later retrieval of fear learning. Fear-related research has been mostly focused on male subjects, and little is known about the molecular mechanisms that underlie sex differences in fear learning. We examined a brain region that is involved in context fear learning called the retrosplenial cortex (RSC). Contextual fear conditioning involves exposing a rat to an aversive stimulus (e.g., footshock) so that the rat learns to associate the environment (context) with the footshock. The rat expresses fear in a form of immobility (freezing). The following day, a memory test is given by placing the rat back in the same testing chamber without presenting the footshock. One hour following the memory retrieval test, brains are extracted and processed. We are currently measuring immediate early gene (IEG) expression by using western blot analysis to quantify sex- and learning-related changes in expression. IEGs are activity markers that are induced by environmental stimuli. It will be interesting to see if there are any sex differences in IEG expression, as this would suggest that the molecular mechanisms may differ between males and females. These data may aid in understanding why women tend to be more susceptible to developing fear memories.

**Alexander Olson**

3D Printing and Recycling of Smart Composites  
Mentors: Chiu Law & Rani El Hajjar, Mechanical Engineering

Terfenol-D, like other magnetostrictive materials, will strain when a magnetic field is applied to it; however, Terfenol-D has an advantage over other magnetostrictive materials due to its large magnetostrictive response and low applied magnetic field. As a result, it is the most promising magnetostrictive material for engineering but has had little advancement in the way of composite manufacturing. The aim of this project is to integrate Terfenol-D into acrylonitrile butadiene styrene (ABS) to form a composite which would then be extruded as a filament approximately 2mm thick. Various ratios of ABS pellets to Terfenol-D powder are used to construct these composite filaments and the effects of each ratio is studied. The filament created is used in 3D printers to manufacture parts or tools exhibiting magnetostrictive properties. As the composite material is extruded to form parts, the Terfenol-D particles must be aligned using permanent magnets. When parts or tools made from the composite are no longer needed, they can be broken down or shredded into small pieces to be re-extruded into filament. Recycling the composite will cause

some loss of material integrity. The number of times an amount of filament can be extruded, recycled, and re-extruded before complete loss of structural integrity is an area of focus in this project. The composite will undergo tensile tests, compression tests, visual inspections, and Fourier-transform infrared spectroscopy (FTIR) to test for impurities that accumulate upon levels of recycling. An acceptable number of recycle loops will be determined using the data retrieved. The reach of this research is space travel, where 3D printing is the most efficient method of manufacturing. A 3D printable, recyclable composite like this will aid in reducing waste, reducing overall weight of the spacecraft, and will encourage research on the use of Terfenol-D in space exploration.

**Joey O'Neill**

Unequal Access to Justice: How Legal Representation Effects Your Case  
Mentor: Rebecca Konkel, Criminal Justice

Milwaukee, one of the most economically and racially segregated cities in the United States, has a long history in disparities in housing-related outcomes (Massey & Tannen, 2015). As a means to combat one such issue, the Eviction Defense Project (EDP) offers free legal aid and attorney representation to individuals facing eviction from their homes. In May 2017, The University of Wisconsin-Milwaukee partnered with EDP to launch a project examining areas of one's life that were impacted following an eviction. Data were collected via surveys with EDP clients following their court hearings, as well as with through a series of phone follow-up surveys. Surveys included questions related to the outcome of the case (i.e., stipulated, dismissed, evicted), satisfaction with the court process, the ability and helpfulness of EDP attorneys, and how the eviction process impacted their employment, children's schooling, and health (mental or physical). Findings indicate that eviction is negatively correlated with several aspects related to quality of life measures; however, access to an EDP attorney was viewed as helpful and a positive component of the court process.

**Maria Ortiz**

MLC Library  
Mentor: Candance Doerr-Stevens, Teaching & Learning

Over the course of a year, this project has focused on the development of a library that promotes cultures, languages, and literacy in schools and within learning. The Multiliteracy, Language, and Culture groups in the School of Education, also known as the MLC Committee, have gathered resources to build an interdisciplinary library that reinforces students' readiness into the field of teaching. Through the continuation of this project, I have focused on three elements to form the MLC Library: organization of resources, cataloging of resources, and searching for potential partnerships. In past research, a questionnaire was developed and administered to teacher candidates, practicing teachers, and graduate students. This questionnaire was used to determine what resources were valuable to those who will access the library. With this data, I was able to organize a space that is most assessable to all. Contributing to the organization of the library, I have cataloged nearly 1,000 items in an online cataloging system called Libib. These items consist of various types of books,

curriculum sets, and activity sets to be used in the classroom. Moving forward, this research project will focus on designing a website for viewers to receive information regarding the MLC Library. For this task, I will collaborate with the School of Education's website designer to establish the website. With the MLC Library obtaining more resources, I will continue to catalog these additional materials with hopes to expand the library's overall selection.

### **Xai Osa**

Language and Feminist Empowerment Post #MeToo - Echo Ascension: Her Voice is Heard  
Mentor: Amanda Schoofs, Music

Echo Ascension: *Her Voice is Heard* is a project by UWM Music Composition & Technology major Xai Osa with the goal of creating a mini-opera that provokes discussion about the #MeToo movement. Xai's research focuses on individual stories within the #MeToo movement that, through whatever method, reached multiple people, and how the sharing of those stories strengthens our language. In her research she sites viral posts, memoirs, and local stories within the Milwaukee community that contain powerful language surrounding rape culture and feminism. Her research revealed that social media platforms are the easiest access to progressive language for most audiences to discuss sexual assault and the various processes and responses to trauma, and interpreted these snippets of powerful statements as an "echo"; sounds with meaning that travel and disperse to others. Access to language empowers survivors to begin or continue their process of healing, and her opera illustrates this by sharing 5 different perspectives of #MeToo for a silent character to explore. These perspectives are drawn from compilations of powerful feminist images to create concise characters with individual stories, focusing on healing from childhood trauma, activism and the validity of anger, victim response to domestic violence, post-traumatic stress following violent sexual assault, and the importance of sharing empathetic language and resources with victims. Each aforementioned description matches a character in the opera who all work to encourage the silent character to process her trauma, and to make her own empowered choice of taking her next step. In summary, this opera is a conversation that leads to reflection and sharing of experiences, echoing together and ascending together. Echo Ascension: *Her Voice is Heard* was composed for 5 voices and string quartet with a premiere date of March 27, 2020.

### **Ashna Pandya**

The Relationship Between Attention Control and Hyperarousal Symptoms in PTSD  
Mentors: Han-Joo Lee & Able S. Mattew, Psychology

Research has shown deficits in working memory in association to post-traumatic stress disorder (PTSD). However, few studies have evaluated this relationship in working memory affiliates, such as attention control (AC). The purpose of this study was to evaluate the relationship between various PTSD symptom clusters (e.g., re-experiencing, hyperarousal, avoidance, mood/cognition) and AC after controlling for other PTSD covariates, such as negative affect and emotional dysregulation. Thirty veterans were recruited from the Milwaukee VA as part of a

larger study evaluating working memory training in individuals with PTSD. Participants completed the Attention Control Survey (ACS), Depression, Anxiety, and Stress Scale (DASS-21) and an emotional dysregulation measure as assessed by heart rate variability (RMSSD). A two-step hierarchical regression was conducted with each of the PTSD symptom clusters as the dependent variable. Step 1 included DASS-21 and RMSSD. Step 2 of the regression included ACS. Of all the PCL-5 symptom clusters, only Cluster E, Hyperarousal was significantly predicted by AC after controlling for negative affect and emotional dysregulation,  $\Delta R^2 = 0.46$ ,  $F(1,24) = 0.174$ ,  $p < 0.01$ . This relationship was not found in other PTSD symptom clusters ( $p > .05$ ). After controlling for emotional dysregulation and negative affect, AC was shown to significantly associate with PTSD hyperarousal symptoms. The results suggest that poorer attentional control may lead to greater hyperarousal symptoms in PTSD. Further research may consider targeted treatments to improve AC in individuals with PTSD.

### **Preston Pape**

Visualizing Home: Design of Virtual Reality Manual for Assembly of Algorithmic Micro-Housing  
Mentor: Gabriela Bustos, Architecture

Virtual reality is at the forefront of shaping visualization within the field of architecture. Using virtual reality as a means of communication, we are developing an interactive manual for the assembly of a micro house designed algorithmically. Intended for individuals affected by homelessness and manmade/natural disasters, the structure focuses on economics and sustainability by employing recycled plastic foam material. The micro house proper, through geographic and climatic parameters, is adapted to the specific climate in which it will be deployed; consequently, complexity is introduced. Therefore, it is vital that the recipient can simply and rapidly erect the structure. This interactive manual will be developed following an iterative visual process until the desired result is obtained. Functionally, this iterative system allows for 3-dimensional models to be advanced and easily imported into the Unity development platform. Unity allows for the product to be exported with ease to economic cardboard virtual reality viewers to be distributed to recipients. The end result will allow everyday people to understand how this complex kit of parts comes together. Similar to IKEA construction manuals, the visualization transcends language barriers by relying on image-based animation. Requiring zero knowledge of architecture or construction, the interactive tutorial democratizes shelter. Completed, this project will tackle the issue of homelessness and reduce the span in which individuals are without basic shelter following disaster events.

### **Trevor Pedersen**

Mathematical Model of Liposome-Mediated Drug Delivery to Brain Capillary Networks  
Mentor: Peter Hinow, Mathematical Sciences

The process of delivering drugs to the brain is complicated by the presence of the blood-brain barrier. Recent research in pharmaceutical science has focused on liposomes that can release their cargo when exposed to an ultrasound signa.

Mathematical modeling and simulation help understanding of the transport processes in the blood, across the blood-brain barrier and within the tissue. Building on earlier work, we present a mathematical model for drug delivery through capillary networks with increasingly complex geometries and topologies. The model is applied to the delivery of L-Dopa, the primary drug used in the therapy of Parkinson's Disease. Our model imitates blood flow rates and ratios previously seen in between plasma and tissue concentrations. The model will be tested with experimental observations from pharmaceutical scientists at the University of Otago in Dunedin, New Zealand.

#### **Valerie Perkins & Aimee Roekle**

Factors Affecting Perception of English Vowels by Native Chinese Learners

Mentor: Jae Yung Song, Linguistics

Previous studies have indicated that native speakers of Chinese have difficulty perceiving differences in English vowels, but there is little data to indicate what factors affect their perception. We examined first the relevance of the presence of the target English vowels in Chinese, and second the effect of degrees of difference between vowels on the rate of improvement over time. Data was collected from eight native Chinese learners of English who were asked to identify a target word that contained a vowel that was a part of one of three vowel pairs (/i/-I/, /ε/-ae/, /a/-Λ /). In the pre-test and post-test, each word was presented to the listener in a sentence such as “You will hear bit now,” with a total of 120 targets in each test. In the three training sessions, each sentence contained one of the target vowels that received contrastive focus (ex. “He said bit, not beat”) as recorded by a native English speaker. We predicted that the English vowel that also exists in Chinese (/i/) would be perceived accurately more often than the other vowels. This was reflected by the data as pair 1 (i/-I/) received the highest scores overall. Second, we found that vowel pair that demonstrated more degrees of difference (/a/-Λ /) was the only pair that saw statistically significant improvement between the pre and post-tests. Degrees of difference were measured by the qualities used to describe vowels, which are tongue height, tongue frontness, and vowel tenseness. These data can be used as the basis for further exploration into the most effective ways of teaching perception to native Chinese speakers learning English.

#### **Mackenzie Peters**

Living with Dementia: Content Domains Assessed in Measures of QoL

Mentor: Sabine Heuer, Communication Sciences & Disorders

Quality of Life (QoL) measures have gained importance in health care settings as outcome measures of treatment effectiveness and an important indicator of client satisfaction in response to treatment. There is consensus that QoL is composed of subjective and objective content domains. However, it remains unclear which specific domains are of particular relevance as QoL outcomes for people with dementia. This is due, in part, to varying conceptual frameworks of QoL. The purpose of this project was to identify common content domains that underpin the construct of QoL as determined by a content

analysis of patient-reported, proxy-reported and observational measures used to assess QoL in people with dementia. Based on a systematic literature review, 28 self-reported, proxy-reported and observational measures were identified. Each individual item was coded using an iterative process that involves constant comparison to categorize domains and subdomains. We mapped the 702 test items into a model of 7 content domains: The most commonly addressed domains were engagement in activities or with others (279 items), emotional health (240 items), and physical health (95 items). Less frequently, self-determination (40 items), cognition (33 items), environment (12 items) and global QoL (3 items) were addressed in the reviewed assessments. This work contributes to a conceptual framework for a novel QoL measure. The heterogeneity in terms of content domains covered across measures reflected the diverse conceptualization of QoL. For speech-language pathologists working with people with dementia, understanding the content domains assessed in existing tools is critical to select appropriate measures for individuals to meet the purpose of the assessment: the impact of provided intervention on the client's QoL.

#### **Kim Phan**

Centering Pregnancy Group Prenatal Care Fidelity and Outcomes

Mentor: Teresa Johnson, Nursing

The US has a higher prematurity rate than many developed countries of the world, with 9.8% of babies born prematurely (2017) and 8.2% of infants born low birth weight (March of Dimes, 2016). Prematurity and low birth weight are two leading causes of infant mortality. Although multiple programs were focused to lower the rates of infant mortality of African Americans infants and eliminate disparities, African American infants still have 3x the risk of dying during their first year of life than a Caucasian infant. The CenteringPregnancy® group prenatal care program was originally developed to improve quality of healthcare for women and infants during pregnancy, birth, and postpartum. The purpose of this literature review is to examine the fidelity of the CenteringPregnancy® program. Maintaining the program fidelity is essential for positive outcomes associated with the program such as improving preterm birth, adequacy of prenatal care, cost benefit ratio, and breastfeeding. An integrative literature review was conducted. The search was generated using PubMed, CINAHAL Plus, and Google Scholar. Inclusion criteria: rigor of CenteringPregnancy® program, content of the program, participation, patient and provider satisfaction, adequacy of prenatal care, conducted in the United States, published in English, and between the years of 2009-2019 using PRISMA guidelines. The sample consisted of 25 articles (12 qualitative studies, 1 observational design, 5 retrospective cohort, 1 cost-benefit modeling, 4 mixed methods studies, 1 literature review, and 1 case control matching) published predominantly in nursing and midwifery journals. The overall theme of the articles is maintaining a sustainable program with positive satisfaction and participation of the women and built on good communication between staff members to create a comfortable environment for women throughout their pregnancy to improve pregnancy, birth, and infant outcomes.

**Claire Piehowski**

Differences in Approaches to Feeding Children as a Function of Parent Marital Status

Mentors: W. Hobart Davies & Paulina Lim, Psychology

The existing literature has limited background on comparing marital status and how this influences Pediatric Feeding Problems (PFPs). PFPs are an impaired oral intake that is not age-appropriate and is associated with medical, nutritional, feeding skill, and/or psychosocial dysfunction. The present study aims to compare the Feeding Strategies Questionnaire (FSQ), Mealtime Behavior Questionnaire (MBQ), and About Your Child's Eating (AYCE) to address feeding-based problems using the biobehavioral and feeding dynamics approach among single parent and married parent households. A total of 1,028 parents with at least 1 child between the ages of 1-5 were recruited by students from a large midwestern university in an advanced undergraduate psychology lab course. Parents completed a demographics survey and the FSQ, MBQ, and AYCE as part of a larger online survey. An independent sample t-test demonstrated significant differences in FSQ measures of consistent mealtime schedule between single ( $M=16.6, SD=4.8$ ) and married ( $M=17.9, SD=5.2$ ) households ( $t(771)=-3.4, p=0.001$ ), child control of intake between single ( $M=29.3, SD=6.6$ ) and married ( $M=30.5, SD=6.5$ ) households ( $t(765)=-2.4, p=0.016$ ), mealtime structure between single ( $M=27.9, SD=5.0$ ) and married ( $M=29.9, SD=5.0$ ) households ( $t(774)=-3.3, p=0.001$ ), and encouragement of a clean plate between single ( $M=5.0, SD=2.2$ ) and married ( $M=4.5, SD=2.1$ ) households ( $t(792)=3.4, p=0.001$ ). There were significant differences in MBQ measures of food manipulation between single ( $M=11.9, SD=4.63$ ) and married ( $M=10.7, SD=3.70$ ) households ( $t(806)=3.91, p=0.000$ ) and choking/gagging/vomiting between single ( $M=3.94, SD=1.87$ ) and married ( $M=3.64, SD=1.58$ ) households ( $t(809)=2.31, p=0.021$ ). These results are consistent with our hypothesis in that individuals who identified as single have lower consistency in mealtime schedule, child control of intake, structure. Married status individuals may have higher scores on the measures due to shared responsibilities with a partner, leading to decreased stress on the feeding relationship. The present study should be replicated to further validate the current findings and expand on varying communities, cultures, and ethnicities.

**Anthony Pierson**

ASME Tilting Trike Stability Analysis

Mentor: Andrew Dressel, Civil & Environmental Engineering

The tilting trike built by the UWM ASME Club incorporates a variable stability mechanism. The geometry of said mechanism changes the path the center of mass follows as the trike is leaned from vertical. The path of the center of mass is well understood using a kinematic model made in MATLAB. The slope of the path the center of mass takes is thought to affect the roll acceleration of the tricycle. Roll acceleration is an important metric for determining the handling characteristic of the trike. A higher roll acceleration will allow the bike to react very quickly to steering input, making it hard to control at slow forward speeds. In this study, an Inertial Measurement Unit (IMU) was used to record the roll acceleration of the tricycle as the bellcrank geometry was changed, and as the

amount of friction under the rear wheel contact patches was varied. Preliminary results show a quantifiable difference in the roll acceleration as the bellcrank geometry was changed, but a very minimal change in roll acceleration as the amount of friction was changed. This preliminary data suggests that this stability mechanism does affect the roll acceleration of the tricycle. This information could be used to make tilting tricycles easier to handle because the roll acceleration could be slowed considerably. A primary application of this technology is in the cargo bike market, as the heavy and cumbersome cargo bikes could be made much easier to ride due to the decreased roll acceleration.

**Raga Madhuri Podugu**

A Mobile Application for Monitoring Community Mobility in Children with Osteogenesis Imperfecta

Mentor: Jacob Rammer, Biomedical Engineering

Children with Osteogenesis Imperfecta (OI) have increased bone fragility and low bone mass. They face a significant risk of bone fractures during everyday activities, which can cause reduced participation in the community and with their peers. Though much research has been conducted with patients in various stages of OI, there is less information about real-world activities and mobility in children with OI. This study will identify the best technological method to track mobility in this community by developing and testing a prototype mobile application. Prior to the development of the app, studying the capability of Android/iPhone built-in sensors (accelerometer, gyroscope, magnetometer, GPS, etc.) is essential as these sensors are the main source to capture human motion. The prototype mobile application uses built-in sensors in a smartphone to collect and store the motion of children with OI. The sensor data that is stored in the mobile app can be related to gait analysis via machine learning algorithms. Through this study, the data results can provide crucial information about current children with OI and can be used as a starting point for future research activities in this OI population.

**Tiffany Polzin**

Molecular Mechanisms of Estradiol/TrkB Interactions in the Dorsal Hippocampus of Female Mice

Mentors: Karyn Frick & Kellie Gross, Psychology

Our laboratory has previously demonstrated that  $17\beta$ -estradiol (E2) enhances memory consolidation in both object placement (OP) and object recognition (OR) tasks, but the molecular mechanisms underlying these effects have yet to be fully uncovered. Brain derived neurotrophic factor (BDNF) is a positive regulator of memory in the hippocampus via activation at its receptor TrkB. Although BDNF is known to interact with E2, the role of TrkB activation in the memory-enhancing effects of E2 has yet to be understood. In previous Frick lab experiments, intracranially cannulated ovariectomized female C57BL/6 mice were infused with vehicle or a non-memory impairing dose of ANA-12, a TrkB antagonist, into the dorsal hippocampus (DH), and either vehicle or E2 in the dorsal third ventricle. OR and OP memory were tested either 24 or 48 hours later. ANA-12 blocked the memory-enhancing effects of E2, suggesting that BDNF/TrkB signaling is needed for E2 to enhance object recognition and spatial memory consolidation.

The present study harvested the brains of these mice and then used we blotting and PCR to measure effects of vehicle and E2 on protein and mRNA in the dorsal hippocampus. We found that E2 increased TrkB phosphorylation and BDNF mRNA in the dorsal hippocampus 4 hours after E2 treatment, suggesting that E2 activates TrkB/BDNF signaling. We next strived to uncover how E2 interacts with TrkB interacts to influence memory, and focused on the NMDA receptor subunit, NR2B, because E2 increases NR2B phosphorylation. We discovered that E2 increased NR2B phosphorylation, and this phosphorylation was blocked by ANA-12, suggesting a key role for NR2B phosphorylation in the interactions between E2 and TrkB. These findings provide new information on the molecular mechanisms through which E2 modulates hippocampal memory consolidation. Current work aims to uncover how E2-induced TrkB activation results in NR2B phosphorylation and the implications of this on memory.

### John Poppe

Evaluation of Upper Extremity EMG Signal Processing Methods in Individuals with Spinal Cord Injury  
Mentors: Brooke Slavens & Matthew Hanks, Occupational Science & Technology

Within biomechanics research, it is important to understand the musculoskeletal system in the context of human movement. One method that is commonly used in biomechanics research is surface electromyography (EMG); however, signal processing strategies for maximum voluntary isometric contraction (MVIC) EMG data remain highly variable. The aim of this study was to investigate the most appropriate methods for data analysis and signal processing of MVIC EMG data in individuals with spinal cord injury (SCI). Raw MVIC EMG data of the anterior deltoid, middle deltoid, posterior deltoid, biceps brachii, triceps brachii, pectoralis major, upper trapezius, infraspinatus, latissimus dorsi, and serratus anterior were collected using Delsys Trigno EMG sensors at a sampling rate of 1,926 Hz while an individual with SCI performed a series of isometric muscle contractions on a BTE multi-joint dynamometer. Custom MATLAB code was used to investigate differences in peak MVIC EMG using a spectrum of root mean square (RMS) filters. Peak MVIC EMG data were calculated using the mean maximum datapoint for three isometric muscle contraction trials for each muscle. This study found that using an RMS filter of 500 ms was most appropriate for processing raw MVIC EMG data in populations with SCI. RMS filter lengths shorter than 500 ms were shown to include outlying datapoints within the MVIC EMG signal, and longer RMS filter lengths were shown to excessively smooth the MVIC EMG signal. Employing valid and reliable MVIC EMG signal processing strategies can improve the quality of musculoskeletal data in biomechanics research. The methods from this study will be the basis for MVIC EMG signal processing in research investigating upper extremity biomechanics in individuals with SCI. Our future directions will include investigating RMS filters in additional upper extremity muscles during activities such as overhead throwing and wheelchair propulsion.

### Alisa Preiksaitis

Feasibility of Superconducting Active Radiation Shielding During Extended Space Travel  
Mentor: Prasenjit Guptasarma, Physics

Radiation exposure remains one of the most challenging problems facing long-term, deep-space, human exploration missions. The hazards associated with long-term exposure to Galactic Cosmic Radiation threaten the feasibility of such missions. NASA has concluded that passive shielding cannot be the only mechanism for long duration, deep-space missions. One promising solution is the use of active radiation shielding (ARS) designs that divert harmful radiation away from crew. The most important advantage to using ARS designs is that they have the potential to reduce radiation exposure to acceptable levels using a significantly lower mass penalty. High temperature superconducting materials like YBaCuO and BiSrCaCuO enable the construction of powerful magnetic fields that are relatively lightweight, and can feasibly fit into conventional launch systems. Unfortunately, few such materials have ever been studied in a space radiation environment. Our experimental study involves High Temperature superconducting materials, which are complex oxides in which crystal structure and defect structure are critical to function and physical properties. We will study the effects of high energy heavy ion and proton radiation exposure using terrestrial particle accelerators at Brookhaven National Laboratory (NSRL), Argonne National Laboratory (ATLAS) and (possibly) the National Institute of Radiological Sciences and Chiba, Japan. Using preliminary information gained from such studies, we hope to send materials to the International Space Station for supplementary data. The information gathered will be published and will hopefully help mission designers assess superconductor suitability in the space radiation environment, potentially allowing for a novel ARS for extended human presence in deep-space.

### Maddie Prokop, Alex Seager, & Lyndsay Sorg

Milwaukee through Embodied Research  
Mentor: Simone Ferro, Dance

Our communities are our home. The stories within them our brick and mortar, the voices within them the foundation. Art helps to solidify these aspects, aids in making sure the foundation stays strong and the walls remain upright, certifies that voices are heard. With this idea, under the direction of Simone Ferro, three students from the Department of Dance have visited the area of Sherman Park consistently for the past year. There, while collaborating with community leaders and bonding with locals, the team of artists contributed in event planning and participated in various projects such as gardening and community maintenance, working actively to restore art within the neighborhood. With these outreaches, the students performed site-specific works on various plots of land and inside Tricklebee Café with the goal of sharing their craft, similarly holding local “Hip Hop Jams” to provide a chance to come together and move. Originally, the team planned to present their collected work via a presentation on-site; with a four-wall projection, the dancers would perform in front of footage taken from their outreach. These videos consist of site-specific performances in both public (such as community parks) and private (such as the front porches of community members)

spaces. Due to recent circumstances, however, the ultimate usage of technology in the final product will be more present—the dancers will situate themselves in their homes, broadcasting both the videos from the past and performing in the present to encompass a similar set-up as the original. Despite the new limitations set, this opportunity to come together demonstrates the power our stories have and the strength of the homes we've built, showcasing a community where the voices won't crumble.

#### **Nikolaus Prusinski**

Star Formation and Galactic Outflows in the Early Universe  
Mentor: Dawn Erb, Physics

Intense star formation in galaxies results in powerful, galactic-scale outflows of gas. Because stars form from gas, these outflows have a strong effect on the evolution of galaxies, but the primary driving mechanisms are still uncertain. We investigate the connection between galactic outflows and the morphology of star formation using two independent data sets covering a sample of galaxies in the early universe. The *Hubble Space Telescope (HST)* provides high spatial resolution emission line spectra yielding maps of the extent and strength of star formation, while absorption line spectra from the Keck Observatory at Mauna Kea provide the intensity and velocity of the outflows. The joint HST/Keck dataset enables direct comparisons between star forming regions and the outflows they drive. Future facilities such as the *James Webb Space Telescope (JWST)* and the upcoming extremely large telescopes (ELTs) will extend these studies to lower masses and star formation rates, probing galactic feedback across orders of magnitude in galaxy properties.

#### **Alondra Quechol, Elizabeth Papandria, Grace Mussell, Abigail Ambrose, Cassie Kinney & Zachary Small**

Hostile Terrain 94  
Mentor: Jasmine Alinder, History

This research project is committed to acknowledge and raise awareness about the violent impact of immigration policies at the U.S. and Mexican border. It aims to contextualize the pop-up exhibition Hostile Terrain 94 (HT-94), a multidisciplinary project created by the Undocumented Migration project based on the research of anthropologist Professor Jason De Leon. HT-94 is a wall of toe tags representing the death of migrants in the Sonoran Desert. The research analyzes the rhetoric and system of immigration policy and how it has led to increased violence and migrant deaths. The interviews, anthropologic evidence, statistical studies, and material culture show the direct consequences of immigration policy on migrants, their communities, and more broadly society. The project takes into account how the geography of the Sonoran Desert functions as a tool for violence on migrants and how border conflict impacts indigenous communities. We are analyzing the personal, economic, and political motivation that was developed from the U.S. over time and how it has affected migration at the southern border. This research will culminate in an exhibition in collaboration with the Emile H. Mathis Gallery which will include primary source, text, photographs, oral histories, and objects left behind by migrants crossing the desert, in addition to HT 94. Overall, our goal is to use this exhibition and coordinate events that support and involve the migrant communities in Milwaukee and on our campus.

#### **John Quinn**

Modeling of Adhesive Interactions Between Tumor Cells and Endothelial Cells  
Mentor: Mahsa Dabagh, Biomedical Engineering

Computer simulation has been a growing field, driven in large part by the increase in computing power easily available. One way to harness this power is to simulate that which we cannot easily analyze in the real world, in this case the possible interactions that simulated cancer cells may have with other blood components (red blood cells, white blood cells and plasma) or other surfaces that may come into contact with blood flow such as arterial walls, endothelial cells lining the arterial wall, and common implanted biomaterials. This will be done by using the molecular dynamic simulation software LAMMPS and fluid dynamics simulation software Palabos to model these interactions. These have been coupled before and their coupling has been validated with real world data, however our study goes a few steps further by simulating other possible blood components as well as the titular cancer cells and the other surfaces that blood may contact. The objective of our study is to couple LAMMPS and Palabos to model the circulation and its adhesive interactions with endothelial cells of the arterial wall. The important outputs of the simulations may be an increased understanding of how cancer cell interactions within the blood thus gaining a better knowledge of mechanisms underlying the cancer metastasis. Finally if this behavior can be understood better using these programs there may be new treatments that could be developed based on this data, and similar techniques used in this study may be applied to other disorders affecting blood flow such as sickle cell anemia (model the sickle cells) or maybe the uptake of glucose in diabetic patients may be modeled.

#### **Ashley Quisler**

Effect of 670nm Photobiomodulation on Retinal Function & Energy Metabolism in Aging Mice  
Mentor: Janis Eells, Biomedical Sciences

Metabolic dysfunction is a common hallmark of aging. Recent studies have established the metabolic footprint of aging in the mouse. Aging has been shown to reduce retinal function and modify mitochondrial metabolism and redox homeostasis. Photobiomodulation (PBM) with far-red to near infrared (NIR) light has been demonstrated to improve/restore mitochondrial function and improve redox homeostasis in mammalian and drosophila models of aging. We tested the hypothesis that PBM would protect against the loss of retinal function and modify the metabolic footprint of aging in C57/BL mice. Experiments were conducted in 12-month old C57BL/6 mice. Baseline full-flash electroretinograms (ERGs) were recorded and animals were divided into two treatment groups: PBM and Sham. Mice were treated daily for 4 weeks with 670nm light at a dose of 4.5J/cm<sup>2</sup>. Sham treated animals were restrained, but not exposed to 670nm light. Mice were euthanized following the recording of post-treatment ERGs. Tissues (retina, brain, liver, kidney and skeletal muscle) were harvested, flash-frozen in liquid nitrogen at stored at -80C until analyzed for metabolites. The difference between post-treatment and baseline ERG b-wave responses at 10,000mcds/m<sup>2</sup> in sham treated animals was -19µV. In PBM-treated animals

it was  $-72\mu\text{V}$ . These data indicate that 670nm PBM protects against the loss of retinal function in aged C57BL/6. We have begun to analyze the effect of PBM on metabolites reported to be significantly depleted in aged tissues in the C57/BL mouse including cytochrome c-oxidase, transcription factor A (TFAM), and Bax. This study was designed to improve our understanding of PBM on metabolic aging. Moreover, the identification of biomarkers of aging may spur the rational design of strategies to attenuate the decline in key metabolic networks and prevent accelerated aging.

### Estela Rangel

Healthcare Disparities: The Leading Cause for Prematurity and Infant Mortality

Mentor: Kris Barnekow, Occupational Science & Technology

Healthcare disparities refer to the difference in people's ability to have health insurance, access to health and receive the same quality of care. Healthcare disparities create a downward spiral that might not allow individuals to receive the best healthcare they deserve. Factors associated with disparities include race, ethnicity, and socioeconomic status. These factors can negatively affect the health of mothers and children. For instance, healthcare disparities lead to increased risk of premature births and can even lead to infant mortality. This study was a literature review using a guided search grid that contained questions to guide the search and narrow down the number of articles. The literature search focused on the Black-White disparities in health and the influence these disparities create for both the mother and child. When compared by racial groups, African American women are more likely to experience preeclampsia, placental abruption and preterm births, and fetal death/stillbirth. African American women also have higher rates of adverse pregnancy outcomes than Whites or Hispanics. This is a result of the many healthcare disparities facing women and children today, that put them at risk of having preterm births, which in turn increase the risk of infant mortality. There are many families who are experiencing healthcare disparities that often lead to poor access to healthcare. Lack of access to healthcare can exacerbate healthcare issues. It is important to review articles related to healthcare disparities and discuss the negative effects of healthcare disparities in minority groups to be able to meet the needs of the people. Understanding the role that race, ethnicity and socioeconomic status play in these disparities, will promote development of new and effective ways of lowering the rates of infant mortality and improving birth outcomes.

### Madeline Rech

Nail Biting and Nail Picking: A Comparison of Related Behaviors

Mentors: Han Joo Lee & Abel S. Mathew, Psychology

Body focused repetitive behaviors (BFRBs) are urge-driven behaviors, which include skin picking, hairpulling, cheek biting, nail biting (NB) and nail picking (NP). Individuals who engage in BFRBs often experience significant distress and impairment due to the behavior(s). Research has shown comorbidities between differing BFRBs, though each may have distinguishing clinical characteristics and symptom features. The purpose

of this study was to compare and contrast two commonly occurring yet understudied BFRBs, NB and NP. Subjects were individuals who predominantly reported NB ( $N=473$ ) or NP ( $N=236$ ), with average ages of 19.17 ( $SD=2.03$ ) and 19.21 ( $SD=3.20$ ), respectively. The sample was drawn from a larger study investigating the relationship between BFRBs and non-suicidal self-injury (NSSIs), which recruited individuals from two urban universities. Participants completed the Depression, Anxiety, and Stress Scale (DASS-21), as well as a questionnaire evaluating clinical characteristics and symptom features in three domains: behavior, motivation, and consequence. Using a t-test, it was found that individuals with NB and NP displayed similar emotional symptoms, with anxiety rated the highest (minimum score of 15 to be rated 'severe') within both groups,  $t(707)=0.25, p = 0.802$ ; NB anxiety ( $M=20.31$ ) and NP anxiety ( $M=20.36$ ) It was also found that reports in the domain of consequence (e.g., how it felt after giving into urges to engage in the behavior) differed between groups but only in the degree to which tension was relieved, with the NB group reporting greater tension relief,  $t(707)=2.28, p < .05$ . Interestingly, NB individuals also reported an earlier onset of behavior engagement ( $M=9.75$ ) than NP individuals ( $M=11.08$ ). Taken together, it was found that NB and NP individuals had unique clinical characteristics in this sample, which may suggest a need for assessing the behaviors separately, despite the same area of the body being affected.

### Isaac Repinski

Experimental Validity of A Wheelchair Propulsion in Pediatric Manual Wheelchair Users

Mentor: Jacob Rammer, Biomedical Engineering

Biomechanical assessment of steady-state manual wheelchair propulsion is often difficult to conduct overground in laboratory conditions, due to space constraints. Wheelchair roller systems, an analog to treadmills for running, resolve this issue but introduce questions of validity. The purpose of this study is to assess differences in upper extremity kinematics between roller and overground conditions in a population of pediatric manual wheelchair users. These aims will be completed by analyzing an existing data set of twelve pediatric manual wheelchair users, each tested in overground and roller conditions, to obtain upper extremity triaxial joint kinematics and comparing the two conditions and assessing the validity of the roller platform. The study validates necessary equipment to conduct laboratory research involving manual wheelchair users, thus continuing the current line of research and enabling future work to be done with the system.

### Isaac Repinski

Performances of Finger-Style Guitarists at the 1969 and 1970 Ann Arbor Blues Festivals

Mentor: John Stropes, Music

The Ann Arbor Blues Festivals of 1969 and 1970 were historic cultural events that are now understood as pivotal moments in American music. They brought together the leading electric blues guitar players of the time and many of the seminal acoustic blues guitar players who were still touring. In this period of cultural reconfiguration, this music was interesting to a wider, curious audience. This research builds on work which

began in Fall 2017: the accession, digitization, and integrations of materials (color slides, audio recordings, programs, photos, and other ephemera) related to the 1969 and 1970 Ann Arbor Blues Festivals. This extraordinary collection of materials provides the basis for case studies of the evolution of the blues, its dissemination in the US, and the comparative analysis of blues guitar technique. In this project, materials were cross-referenced with contemporaneous print documentation to determine their correspondence with extant audio and video. Set lists were established and personnel were verified. Biographical and discographical information was organized to provide context for the analysis of the guitar technique and repertoire of each artist. This information can now be accessed on the web along with audio excerpts. A social media strategy has been implemented to bring together blues scholars and enthusiasts around the world who share an interest in this topic. The presentation will conclude with an analysis and performance of the music of Mississippi Fred McDowell.

**Bronwen Risse-Connelly, Margarita Garcia Rojas & Paul Newcomb**

Implementing Oral History into a Milwaukee Public High School Curriculum  
Mentor: Rachel Buff, History

This workshop was a series of four classes working closely with upperclassmen at Audubon Technology and Communication High School to incorporate oral history methods in their US History class. The purpose is to deconstruct conventional ideas of what defines history. As undergraduates at the University of Wisconsin Milwaukee, we have studied Ethnic Studies extensively and utilized oral histories in collaborative and individual projects. To supplement their US History education, we introduced stories and histories outside of the dominant narrative. With our assistance, high school students will conduct their own oral history interviews and produce an accompanying creative piece that will be displayed in a format of their choice. In Class One, our goal was to get students thinking about their everyday relationship with history. For Class Two, students explored three main questions: what is oral history, why is it important, and what makes it different from other ways of recording history? We presented examples of oral histories and explore possible themes with the students. For Class Three, students came to class with a theme, set of questions, and a person in mind to be interviewed. Themes included migration, education, and growing up. This session was an opportunity to workshop questions and gain familiarity with the mechanics of interviewing before interviewing an older family or community member for the project. Class Four was the final session and included a discussion and reflection on what the students learned. The final assignment will be an interpretive art piece that somehow expresses or interprets the students' experience interviewing their family or community member.

**Klaudia Rixmann & Jordan Solis**

Mapping German and Polish Borderlands  
Mentor: Karolina May-Chu, Foreign Languages & Literature

Ideas surrounding borders and their figurative meanings have gained increasing attention in the academic and literary world;

however, support for these ideas in the educational world is lacking. Physical borders are staging grounds for social and cultural crossings, like the language barriers that are created between separated families. These figurative borders can be further abstracted to include life and death or belonging and ostracization. The project seeks to map the shifting physical borders of Germany, Poland, and Ukraine during the 20th and 21st centuries, while tracing the journeys of fictional characters in the novels *Katzenberge* (2010) and *Ambra* (2012) by Sabrina Janesch, *House of Day, House of Night* (2003) by Olga Tokarczuk, and *Himmelskörper* (1998) by Tanja Drückers. ArcGIS Online, a cloud-based geographic information system, will be used to map these borders on layers. Viewers can click through layers to observe both physical and figurative border shifts. Each location visited by the characters as well as the location of symbolic events and figures will be marked. The characters' locations and figurative crossings will be highlighted by pop-up features that will include quoted text, photographs, and basic historical context. The conglomeration of these mapped case studies will serve as a visual aid of border fluidity and cosmopolitanism to students, instructors, and scholars.

**Sparrow Roch**

Geodetic Precession and Pulse Profile Changes Over Time of Pulsar B1913+16  
Mentors: Joseph Swiggum & David Kaplan, Physics

Pulsars are dense and quickly rotating neutron stars that emit radiation from their magnetic poles. A pulsar's magnetic axis is offset from its spin axis, so for those emitting towards Earth, we observe a regular, repeating "pulse" as the pulsar spins. Ten percent of known pulsars orbit binary companions and this work focuses on the first discovered binary pulsar: B1913+16. Observations of this star confirmed predictions of orbital decay due to gravitational wave emissions, which earned the discovery team, Joseph Taylor and Russell Hulse, the Nobel Prize in Physics in 1993. In July/August 2019, we observed PSR B1913+16 daily over the course of two weeks with the Arecibo Observatory. Collected data is based on observed times of arrivals of pulses over a range of radio wavelengths. Of particular note is that the star's unique pulse profile has been changing over time. Comparing this new data with earlier observations (1985-2016) allows for further information about the geodetic precession, or wobble, of B1913+16 over time. Analyzing the changes in B1913+16's pulse profile shape allows for more accurate modeling of the star's emission beam and a greater understanding of its orbital behavior in its dynamic system.

**Max Rock**

Working Alongside Nature's Chief Engineer  
Mentor: Changshan Wu, Geography

The Milwaukee Riverkeeper, the Milwaukee Metropolitan Sewage District (MMSD), and the University of Wisconsin-Milwaukee (UWM) are investigating a watershed-scale restoration. The project focuses on the North American Beaver, *Castor canadensis*, to achieve a range of watershed restoration goals. University researchers developed a modeling framework to assess the potential impacts of beaver constructed dams on the hydrological processes in the Milwaukee River watershed.

The framework includes a GIS-based model to assess the potentials of beaver re-establishments in the watershed, and a hydrological model to evaluate impacts of beaver dams on the hydrograph as well as surface and groundwater storage. After the model has been completed, Milwaukee Riverkeeper will conduct field study visits to 10 of the most promising sites. Based on those field visits, Riverkeeper will create a summary report with a habitat overview. Specific report details will be given on the those sites identified as having the best estimated metrics for potential flood mitigation and beaver habitat. This work is on the forefront of low tech ecological restoration research. Modeling framework and research of this extent will aid in suppressing the effects of a changing climate, such as flood mitigation during heavy rainfall, water purification through the natural construction of wetlands, and water retention and dispersal during periods of drought and heavy fire activity.

#### **Autumn Routson**

Secondary Mineralogy of the Olkelduhals Hydrothermal System: Applications to Past Mars Environments  
Mentors: Lindsay McHenry & Jordan Ludyen, Geosciences

Opaline and amorphous silica, sulfate-rich soils, and Fe-oxides in association with volcanic materials observed by the MER Spirit rover near Home Plate, Gusev crater have been interpreted as evidence of hydrothermal activity on Mars. To better constrain the processes that form secondary minerals in hydrothermal environments, our studies are focused on the Olkelduhals hydrothermal area, Iceland. Geochemical analysis of hydrothermally altered sediment samples from Olkelduhals indicates the acidic alteration has caused the concentration of immobile silica and titanium to become enriched in the alteration products. More mobile phases such as sodium and potassium oxides have been leached out of the system. Each sample's bulk mineralogy was determined by X-Ray Diffraction (XRD). In order to detect the major, minor, and trace oxides, the samples were analyzed using X-Ray Fluorescence (XRF). The resulting dominant minerals include pyrite, amorphous silica, and clays such as montmorillonite and kaolinite. The high silica and titanium content found at Olkelduhals is similar to that which is found at Gusev crater, Mars, allowing for the comparison of the processes which produce these secondary minerals.

#### **Carly Rowe, Megan Kocher & Westly Roth**

The Exploration of Cosmic Rays and the Expertise of Scintillators Physics

A scintillator is used in order to accurately determine the number of high energy particles per time related to the altitude of the atmosphere. Cosmic rays are high energy (GeV/nuclei range) particles that travel at relativistic speeds (near the speed of light). The particles ranging from 1 GeV to 10 GeV originate from the sun, the particles ranging from 10 GeV to  $10^6$  GeV originate from high energy bodies in our galaxy such as supernovas and pulsars. These particles are important to understand because they are one of the most threatening phenomena in space, for they threaten the life of equipment and astronauts. In addition, building cheaper detectors will aid in future studies in pulsars and supernovas from our location in the galaxy. Furthermore, the increasing exposure will narrow

down our understanding of solar wind emissions. High energy particles are regularly invisible requiring special detection equipment. Scintillators are currently the most common way to detect high energy particles; a scintillator is generally a clear plastic or crystal. High energy particles enter the scintillator at relativistic speeds and the particle loses energy due to resistance via obstruction. As the particle continues through the scintillator energy is transferred to the atoms in the scintillator through laws of quantum physics. The energy gained by the scintillator is emitted as photons. When the photon reaches the detector, they are then counted. Along with the detections, we will be measuring time and cross referencing to altitude as recorded through Inertial Measurement Unit (IMU). From these detectors, we will be able to take our data and determine if we are able to accurately measure the number of particles with the energy, we expected them to be at a certain altitude. We have two designs currently. Our first design uses multiple scintillators and the only detection required is the number of photons detected from each scintillator. Our second design includes only one scintillator and the detector required must have a high energy resolution in order to differentiate between photos emitted from high energy particles and photons from low energy particles. The final result in our design will be dependent on budgeting.

#### **Valerie Rubalcava**

Microstructural Analysis of Metabasites from the Southern Iberian Shear Zone  
Mentor: Dyanna Czeck, Geosciences

Fault zones at depth are not widely investigated in situ because the area of interest is too deep and expensive to probe. At depth, increased heat and pressure cause the style of deformation to change from brittle fracturing to ductile flow, and faults that flow ductilely are referred to as shear zones. Subsequent erosion can cause ancient shear zones to be exposed for study and used as analogues for contemporary faults at depth. One of these exposed zones is the South Iberian Shear Zone (SISZ), which formed due to continental collision following the closing of the Rheic Ocean in the late Paleozoic. The SISZ exposes deformed Acebuches metabasites (north of the shear zone) and Pulo do Lobo schists (south of the shear zone). In this study, we examined the fluid-rock interactions of the Acebuches metabasites. To do this, we analyzed thirteen Acebuches metabasite samples along the Almonaster and Calabazares transects of the shear zone for mineralogy and microstructures including solution seams, veins, and undulose extinction. Mineralogy is dominated by amphiboles and plagioclase, then by actinolite closer to the shear zone. Veins and solution seams show no patterns in their location or abundance indicating that fracturing and fluid interaction were dispersed. Undulose extinction is more prevalent in plagioclase and generally increases within both predominant minerals towards the shear zone indicating that 1) amphiboles are stronger than plagioclase and 2) crystal-plastic deformation increases towards the shear zone.

**Emily Ruder & Jacob Rankin**

Small-Scale Sustainable Charcoal Production in Kenya  
Mentor: Mai Phillips, Conservation and Environmental Science

Woodfuel accounts for 80% of energy consumption in Kenya and accounts for most of the deforestation after agriculture. The Dryland Natural Resource Center (DNRC) in Mbumbuni, Kenya is producing sustainable charcoal to combat these issues during a transition to modern energy technologies. The DNRC's goal is to profit from charcoal production and pay farmers a relatively high price for their crop. To accomplish this goal, they need to produce product efficiently to keep production costs low. This research intends to find a way to achieve highest yields in charcoal production at the DNRC. We studied four species most commonly harvested by farmers (*Terminalia brownii*, *Senna siamea*, *Acacia polyacantha*, *Senna spectabilis*). Samples per species n=6, total n=24. These were harvested and dried for 1, 2, and 3-month periods. Moisture, diameter, and weight measurements were taken before carbonization (process of turning wood to charcoal). Mass after carbonization was used to find yield. Observational data were also collected and considered. Our findings will result in recommendations to increase sustainable charcoal yields in small-scale production at the DNRC.

**Amira Rupnick**

The Problem of Domestic Abuse and Femicide in Brazil  
Mentor: Natasha Borges Sugiyama, Political Science

Domestic violence and homicide against women in Brazil is a longstanding problem which has risen to national attention in recent decades. Through my research, I wanted to analyze and discover the answers to my main questions: How big of a problem is domestic violence and femicide in Brazil? What has been done to address domestic violence in Brazil? And third, is there progress being made? To find these answers, I identified and analyzed original data and statistics that are provided by the Brazilian government. I also analyzed government reports and scholarly research on the topic. My main findings are: First, that location matters. Rates of femicide in Brazil tend to be higher in the Northern states of Brazil, Afro-Brazilian women are the main victims of domestic violence and femicide in Brazil and it is continuously rising, whereas the rates for white Brazilian women are actually decreasing. Second, with regard to policy, public outcry over the repeated attempted murder and assaults incurred by Maria da Penha and the subsequent impunity towards her husband, led the government to finally address and enact legal reforms. The Maria da Penha Law was implemented in 2006, in attempt to decrease the domestic violence rates in Brazil, by increasing the punishment for the domestic abuse offenders. The Maria da Penha Law also led to the requirement of Brazilian authorities to institute 24 hour shelters for victims. In conclusion, there needs to be more done to solve this problem. There is information that is difficult to obtain, such as updated murder rates and the specific data of murders involving women. There needs to be much more data available to the public, more data recorded and overall there needs to be more information on this extremely important topic.

**Matthew Ryther**

Strength in Numbers – The Mussels of The Prins Willem IV Shipwreck  
Mentor: Russell Cuhel & Carmen Aguilar, Freshwater Sciences

Population parameters of the invasive voracious filter-feeder *Dreissena rostriformis bugensis* (quagga mussel, QM) on different surfaces of the Prins Willem V shipwreck in Lake Michigan were analyzed from two separate years (2018 & 2019). We collected samples with a remotely operated vehicle, launched from the RV Neeskay, from specific areas of the Prins Willem IV, enabling analysis of growth patterns of mussels based on the surface that they grow upon. Samples were collected from a wood deck, metal hatch, suspended wire, steel hull, railing, and open clay surrounding the wreck. Each sample of mussels was measured to form morphometric profiles and identify size-frequency-based community structure. These measurements indicate that quagga mussel size distribution was highly dependent on their location and surface structure of growth. Morphometric characteristics of individual quagga mussels were similar and showed little variance among all surface types. In locations with high levels of particles due to constant current flow, there was a large proportion of quagga mussels that were smaller than 4 mm; indicating recent spawning. Furthermore, excretion of ammonium and phosphate in particle free water was analyzed via colorimetric spectrophotometry. Excretion rates exhibited a cubic function of length (i.e., volumetric) of the quagga mussels and differed with location on the shipwreck. The body tissue of the mussels was prepared for CHN analysis to obtain carbon and nitrogen ratios. Phosphorous content was determined by spectrophotometry in order to determine the full C:N:P ratio of the tissue as compared to the Redfield ratio to help determine food web interactions.

**Sophia Salas**

Neural Underpinnings of Attention in Children with Neurofibromatosis Type 1  
Mentor: Bonita Klein-Tasman, Psychology

Electroencephalogram, or EEG, is a safe, noninvasive form of measuring the physiological differences associated with cognition. EEG directly measures neural activity through the summed electrical potential of many neurons that rapidly travel through the brain. More specifically, we will be measuring event-related potentials (ERPs), which are small voltages in the brain in response to specific stimuli or events. ERPs can be subcategorized into different waveforms, such as N2 and P3, which can be further analyzed for their amplitude and latency. Since EEG is a useful indicator of neural activity, researchers have aimed to use this measure to characterize various neurodevelopmental disorders, such as ADHD. Therefore, we are piloting such methodology to measure the neural underpinnings of attention functioning in children with NF1 using ERPs. Participants will range in ages from six- to ten-years-old from both with and without NF1. This will be accomplished through administering two experimental tasks that both measure attention: the Go-no-go task and Flanker. We will also evaluate differences between the two groups on behavioral measures. Since this is a pilot study, our current goal is to first test this process on the typically developing

population and then proceed to include the NF1 population. Based on previous research with children with NF1, we expect to observe impaired impulse control and attention as well as reduced ERP correlates when compared to a control group. Specifically, we expect decreased and delayed N2 and P3 components. This information is useful in understanding the neurophysiological processes associated with the attention profile of those with NF1, which can be used to identify new methods of measuring treatment effectiveness.

#### Sara Saleh

Motility is Important for Competitive Nodulation of *Mimosa pudica* by *Paraburkholderia phymatum*

Mentors: Gyaneshwar Prasad & Shashini Welmillage,  
Biological Sciences

Nitrogen (N) is the most limiting nutrients for plants and plant growth requires supplementation with N-fertilizer that results in environmental degradation. However, many bacteria can fix atmospheric nitrogen and some plants, such as legumes, form a symbiotic relationship with N-fixing bacteria, giving them a richer, more steady supply of nitrogen than most other plants. The mechanisms important for the rhizobial-legume symbiosis are extensively studied. However, these studies have been performed in sterile and well-defined conditions in the laboratory. In contrast, very little is known about the mechanisms that mediate rhizobial-legume symbiosis in natural soils that contain many other microorganisms. To study legume nodulation in soils, we are utilizing the symbiosis between *Mimosa pudica* and *Paraburkholderia phymatum*. *M. pudica* is native to Brazil and the soils of Midwestern USA lack *P. phymatum*. Random transposon insertion mutants in *P. phymatum* were screened for defects in motility as compared to the wild type strain. A total of two mutants that were significantly less motile than the wild type were selected and evaluated for their ability to nodulate *M. pudica*. All mutants were able to nodulate *M. pudica* similar to the wild type in both axenic and soil conditions. These results indicate that motility is not required for nodulation. To determine if motility can confer competitive advantage, the mutants were co-inoculated with the wild type strain in different ratios and their nodulation ability was determined by reisolating mutants from the nodules. In contrast to the results with individual inoculation, the mutants showed significant defect in symbiosis when co-inoculated with the wild type. Only ~25% of the nodules contained the mutants. These results show that rhizobial motility is not essential but is required for competitive ability of these bacteria to colonize their legume host.

#### Sara Saleh

Investigating the Use of Study Resources by Introduction Level Chemistry Students

Mentor: Anja Blecking, Chemistry & Biochemistry

Chemistry is the basis of many natural sciences. Understanding the fundamentals of chemistry is critical for proper training and career development in many scientific fields. Without a thorough understanding of these fundamentals, one will always struggle to make connections and see the bigger picture. This is because chemical literacy harbors multiple perspectives, without which, one is scientifically shortsighted.

It is for this reason that low levels of chemical literacy in the United States are so concerning. This is a global issue, across many scientific fields; looking at these levels in detail reveals some socio-economic implications which will take years and significant social changes to overcome. Investigating students' preferred study methods can give insight into what type of resources students value. It is also important to look into what students consider to be the more difficult concepts in introductory chemistry. Surveys were designed for each lower-level chemistry course and improved over the course of two semesters. The questions were all specific for their courses, so we could better apply our results to the courses in question. The questions identified preferred study and review methods, methods for reaching out and getting help, and categorized chemistry topics in terms of difficulty. The surveys were published in the spring of 2020. Analysis of the surveys showed that students rank calculation-based concepts to be the most difficult; it also showed that students utilize a lot of online help from websites to online tutoring.

#### Trent Sanborn

Patterns of Gene Expression in Lake Malawi Cichlids Raised in Turbulent versus Calm Conditions

Mentor: Michael Pauers, College of General Studies -  
Mathematics & Natural Sciences

The cichlid fishes of Lake Malawi in eastern Africa are famous among biologists for the speed at which they diversified, as well as for the vast number of species that resulted from this diversification. Here we investigate one possible mechanism for this diversification, changes in gene expression as a result of morphological change during adaptation to a new habitat. We used the quantitative polymerase chain reaction (qPCR) to compare the expression of protein-encoding genes in three tissues (snout, fin, and epaxial muscle) harvested from two species of *Labeotropheus* (*L. fuelleborni* and *L. trewavasae*) that were raised in two distinct conditions, wave-like turbulence and a control condition in which there was no turbulence. These results could help explain how adaptation can induce morphological change by influencing the degree to which genes important in the physical structuring of the body are expressed.

#### Madeline Sandvik

Solvent Effects on the Extraction of Azo Dyes by Hydrophobic Deep-Melting Eutectics from Waste Water

Mentors: Mark Dietz & Nathan Kaul, Chemistry  
& Biochemistry

The discharge of toxic dyestuffs from textile and leather processing into waterways represents a major source of environmental pollution in Third World countries. Although many methods have been proposed for the removal of dyes from water, all suffer from one or more drawbacks that limit their utility. Adsorption on activated charcoal, for example, requires that the sorbent be either regenerated or disposed of, thereby either consuming energy or chemicals or creating a secondary waste disposal problem. Solvent extraction, in which dye-laden water is contacted with an immiscible organic solvent into which the dye is readily extracted, represents a potentially less-problematic alternative. Unfortunately, conventional organic solvents are themselves

often environmentally unfriendly. As a result, there has been growing interest in the use of “green solvents”, including plant-derived oils, ionic liquids (ILs), liquid polymers, and hydrophobic deep eutectics (HDESs), in this application. In this study, we examine the effectiveness of HDESs, unique liquids formed by combining an appropriate hydrogen bond donor and a hydrogen bond acceptor, as extraction solvents for the removal of representative azo dyes (e.g., Methyl Yellow, Orange IV, Bromothymol Blue), a particularly problematic dye family. Following synthesis of selected HDESs and their characterization by thermogravimetric analysis and differential scanning calorimetry, several HDESs comprising mixtures of menthol and various long-chain carboxylic acids have been evaluated as extraction solvents. Preliminary results indicate that these solvents are able to efficiently extract all of the dyes examined. Work to quantify the differences between the various HDES systems and to determine the effect of solution conditions on the extraction efficiency is now in progress

#### **Matthew Sanville**

Definition and Measurement of Psychological Distress in Non-Psychiatric Clinical Populations

Mentor: Bhagwant Sindhu, Occupational Science & Technology

Currently there is no specific questionnaire to measure psychological distress in clinical non-psychiatric populations, such as those who have rotator cuff disorders. This issue may be due to psychological distress not being clearly defined in those settings. There are 2 different kinds of definitions, one that is more focused on symptoms of depression and anxiety, and one that is more general in terms of causes and symptoms of psychological distress. Using an inappropriate definition of psychological distress could lead to the selection of an improper questionnaire which could then negatively impact the construct validity of the study. The purpose of this study is twofold. First, find an appropriate definition of psychological distress for non-psychiatric clinical populations. Second, to find which psychological assessment(s) would be appropriate to measure the levels of psychological distress in those populations. A literature review is being performed by searching scientific databases such as PubMed and Medline for relevant research regarding the definition of psychological distress and its measurements. Different scales of measurement will then be compared to determine which would best suit our needs. Our expected results are a clear definition of psychological distress for our research, and the appropriate assessment(s) to measure psychological distress. The umbrella project that this research is contributing to is to observe how mindfulness can influence the recovery process in patients who have undergone rotator cuff surgery. The implications of this research are finding a measure to assess psychological distress in people experiencing rotator cuff disorders. This assessment could then be then used to examine the effect of mindfulness on reducing psychological distress in other groups of people with musculoskeletal disorders.

#### **Giorgio Sarro**

An Investigation of Post-Transition Extremes for Extratropically Transitioning Tropical Cyclones

Mentor: Clark Evans, Mathematical Sciences

Extratropical transition (ET) is the process by which a tropical cyclone (i.e., hurricane) transforms into a non-tropical, or extratropical, cyclone after it encounters frontal systems and reduced sea-surface temperature at higher latitudes. In this study, we focus on improving understanding of the atmospheric conditions associated with different ET outcomes, looking at the cyclone intensity post-ET, cyclone thermal structure post-ET, and the time to complete ET. The only previous study that focused on this topic (Hart et al., 2006, *Mon. Wea. Rev.*) examined a limited number of cyclones using coarse atmospheric analysis data that included a fake tropical cyclone vortex. The primary goal of this research is to quantify the reliability of their results over larger samples using state-of-the-art high-resolution atmospheric reanalysis data. Herein, we focus on the North Atlantic basin and analyze all National Hurricane Center-classified tropical cyclones that complete ET since 1995. Atmospheric fields are derived from ERA5 reanalysis data. A cyclone phase space (CPS) is used to objectively identify ET timing and diagnose post-transition cyclone structure. Cyclones are divided into three categories: (1) cyclones that become stronger, weaker, or do not change intensity after ET, (2) cyclones that have a cold-core versus warm-seclusion structure post-ET, and (3) cyclones with fast versus slow time to complete ET. ERA5 reanalysis is used to generate composites of atmospheric fields at selected milestones along an ET-timing-relative timeline, which allows for direct comparisons between individual cyclones. Moreover, limitations of the CPS are highlighted when transitioning tropical cyclones instantly become warm-core extratropical cyclones.

#### **Arik Scapellato**

The Native Copper of Aztalan

Mentor: John Richards, Anthropology

The archeological site of Aztalan has been an interest of archeologists since the mid-nineteenth century. The site was occupied by Late Woodland and Mississippian Indians from the tenth-century through the mid-1300s. Multiple researchers have studied the site's ceramics, stone tools, floral and faunal remains, as well as the construction of the site itself. Major collections from Aztalan are housed at the Milwaukee Public Museum, UWM, UW-Madison, the Wisconsin Historical Society, and Lawrence University. However, little research in any of these collections has been conducted on the use of native copper by the site's inhabitants. By creating a detailed catalog of copper artifacts, researchers can learn more about how this material was used at the site, variations in the multiple collections, and how the site's copper compares to contemporary sites. Our project focuses on collections held by UWM. The initial step involved developing an inventory of all copper items in the UWM collections. After pulling out all of the copper artifacts associated with the site from UWM's collection, a relational database was created that links the copper items to their recovery location within the site and to other, previously studied material culture categories. The database also allows recording of morphological and metric

data on each piece. Many of the characteristics that were recorded are consistent with those reported in Jacqueline Pozza's UWM Master's Thesis "Investigating the Functions of Copper Material Culture from Four Oneota Sites in the Lake Koshkonong Locality of Wisconsin." Preliminary results suggest a difference between the Aztalan and Koshkonong assemblages. The common patina colors varied, as well as the frequency of different types of artifacts. The Koshkonong assemblage consists largely of ornaments and tools including beads, pendants and awls, while the Aztalan assemblage contains few formal tools and is dominated by sheet copper fragments and rolled copper beads.

#### **Audrey Schlais**

Sizing Up the Memory of Western Black Widow Spiders,  
*Latrodectus hesperus* (Araneae: Theridiidae)  
Mentors: Rafael Rodríguez Sevilla & Clinton Sergi,  
Biological Sciences

The memory capabilities of animals vary according to their ecology and the limitations imposed by the size and architecture of their brains. Research on the memory of web spiders has been limited to species that build two-dimensional orb webs. I analyzed the memory capability of a spider that builds more complex, three-dimensional webs: the Western Black Widow Spider, *Latrodectus hesperus*. I first tested the hypothesis that *L. hesperus* form a memory about having captured prey. This hypothesis makes the prediction that the spiders will search for prey that they have captured and then lost. I then tested the hypothesis that *L. hesperus* memories of captured prey include details about the size of the prey. This hypothesis makes the prediction that search effort (e.g., search duration, search bouts) will vary with prey size. I offered *L. hesperus* spiders prey items of varying mass and then removed that prey after capture was complete. The control spiders either experienced damage to the web (holes equivalent to what the spiders create when removing prey from the web), or no damage to the web, and were left to consume the prey after capture. I will discuss the results in terms of spiders' ability to retain memories about lost prey in relation to prey size and/or value.

#### **Samantha Schwartz**

Impact of Blood Vessel Wall Stiffness and Atherogenic Flow Profiles on Subcellular Signaling  
Mentor: Mahsa Dabagh, Biomedical Engineering

Mechanical signal transduction in endothelial cells leads to the differential expression of genes, reorganization of the cytoskeleton, and altered cellular properties. The signals transduced typically result from the shear forces applied to the cells via blood flow. Endothelial cells maintain a confluent organization in the lining of blood vessels to prevent vascular diseases such as atherosclerosis. Local hemodynamics are linked to the non-uniform distribution of atherosclerotic lesions resulting from disruption of this organization in arteries, while arterial wall stiffness has been linked to the progression of atherosclerosis. It has been suggested that local hemodynamics and stiffness of the extracellular matrix (ECM) influence the forces experienced by subcellular components of endothelial cells. We developed a 3D, multiscale, multi-

component computational model of an endothelial cell monolayer to investigate how the flow direction and ECM stiffness affect the transmission of forces within and between endothelial cells. The model includes structural components such as cytoskeleton, nuclei, adherens junctions, focal adhesions, and an ECM. Using this model, we can show the effects of atherogenic conditions (arterial stiffening and disturbed flow) on subcellular structures relative to non-atherogenic conditions (arterial softening and laminar flow). By investigating the effects of differing stiffnesses and flow patterns, we can better visualize what happens inside the cells when there are alterations to their surroundings and what force transmission pathways may be active in subcellular components. The validation of this model will include numerous tests of different parameters to determine that the results are sensible for each test. This model will be valuable to discover new areas of concentration for biological researchers trying to determine the mechanism of mechanical force transmission in endothelial cells and subcellular organelles. It will identify the role of each individual mechanosensor in mechanical force transmission events, which may lead to novel therapies to prevent progression of atherosclerosis.

#### **Anne Lise Schi**

The Future of International Accounting in the United States from Regulation, Academia, and Practice  
Mentor: Veena Brown, Business

The future of International Accounting as a University course, and in practice, in the United States has gotten more attention in recent years since the signing of the Norwalk Agreement in September 2002. The landscape surrounding the crossing point of International Financial Reporting Standards (IFRS) with the U.S. Generally Accepted Accounting Principles (U.S. GAAP) has drastically changed since the U.S. is no longer considering converging with IFRS. As such, the extent of the knowledge of International Accounting needed by accounting graduates is unclear. This research examines the importance and use of International Accounting (including IFRS) to practitioners in the United States to better inform academia and the Accounting curriculum. Universities want to ensure that accounting graduates have the knowledge needed to better prepare them for a career in accounting. This study bridges the gap between practice and academia. The research draws upon prior literature, interviews, hand-collected, and survey data. It also entailed contacting the Department Chair of Accounting in 160 different universities to obtain perspectives on the topic.

#### **Sara Seidita**

Lifetime Changes in Mate Choosiness in *Enchenopa binotata* Treehoppers (Hemiptera: Membracidae)  
Mentors: Rafael Rodríguez Sevilla & Bretta Speck,  
Biological Sciences

Mate choice decisions are influenced by choosiness, the effort individuals are prepared to invest in securing their preferred mate types. We tested the hypothesis that females adjust choosiness as they age, because they are selected to attempt to obtain preferred mate types while ensuring that mating occurs. This hypothesis predicts that choosiness will decrease over a female's lifetime (a pattern expected due to the diminishing

availability of males over the course of the mating season). We tested this prediction with 60 female *Enchenopa* treehoppers, herbivorous insects that communicate with plant-borne vibrational signals. We assessed female responses from first sexual maturity until death using vibrational playbacks and laser vibrometry. We measured choosiness as the difference in female duetting effort with attractive versus unattractive vibrational playbacks. We found that female choosiness decreased with age, while their mass did not, indicating that the change in choosiness was not simply due to decreasing condition. Choosiness plays a significant role in mate choice decisions throughout the female treehoppers' lifetime. The decrease in choosiness gives an increased availability in mate selection which is important for biological fitness in nature.

### Brandon Selbig

Climatology of Peak Wind Gusts Around Lake Michigan  
Mentor: Jonathan Kahl, Mathematical Sciences

Wind gusts are a major factor in different areas across not only the United States but different parts of the globe as they have different ecological and economical impacts. Specifically, wind gusts can affect different areas along bodies of water such as coastlines or in this project large lakes like Lake Michigan, as not only are different cities affected but also companies that rely on water travel. Water travel for companies along Lake Michigan have to worry about many factors driven by winds and wind gusts which can affect wave heights and the ships ability to navigate waters and also winds enhanced by lake breezes can have an affect on surrounding lakeside areas. Past researchers have taken wind measurements from US National Weather Service Automated Surface Observation System (ASOS) sites from a span of years that allowed them to create gust factors (GF), the ratio of peak wind gust to average wind speed, and used them to analyze "gustiness" either across the country or for specific sites. What I plan to do is to calculate Gust Factors that are created using 1 minute wind data from 2010-2017, for ASOS sites surrounding Lake Michigan to analyze the "gustiness" across the lake. I will construct GF web plots, which illustrate gust factors and their dependence on wind speed and direction at several sites around Lake Michigan. From there we can spatially analyze how these GFs change throughout the geographic locations surrounding Lake Michigan. Also I will construct a climatology of winds in these areas over the same span of years to be able to show the windiest/gustiest times of year for a certain area around the lake. I expect the results to reveal climatological features of gustiness around Lake Michigan.

### Sana Shakir

The Resolution of Visuospatial Attention is Variable Between Individuals  
Mentor: Adam Greenberg, Psychology

Attention is the process by which relevant sensory information is highlighted for further processing. Spatially selective attention in the visual domain has a limited resolution (i.e., the minimum spacing required between target items for attention to select one item, rather than both). Our goal was to measure this resolution through a novel paradigm in which a series of small, colored disks were arranged in a circle (at 10 degrees eccentricity) around a central stream of rapidly updating

alphanumeric characters (which acted as a fixation point). The central stream consisted primarily of letters with rare digits embedded during each trial. Participants were asked to respond by pressing the keyboard space bar as quickly as possible when they identified a digit in the central stream. Additionally, each trial contained a briefly presented (50 msec) cue: a single smaller black dot appearing on (or near) one of the colored peripheral disks. The entire display then disappeared while the participant selected (with a mouse) the color of the disk they believed was nearest to the black cue. We found that participants detected a digit within the central stream at a rate of 62%, suggesting that they maintained fixation throughout most trials. Subjects accurately identified the cued color on 28% of trials, which is well above chance performance. Analysis of color errors provides an estimate of the attentional resolution, in which we found a high degree of variability between individuals. Importantly, errors due to color space (e.g. selecting light blue instead of dark blue) can be differentiated from errors of spatial attention, and estimates of attentional window size change significantly when controlling for this confound. Our measurements of visuospatial resolution suggest that attention operates at a somewhat large granularity (compared to visual perception) and is highly variable between individuals.

### Jennifer Sheridan

Antibiotic Resistance Among *E. coli* Isolates Within Hospital Wastewater Compared to Urban Wastewater  
Mentor: Troy Skwor, Biomedical Sciences

In the United States, each year 2.8 million people acquire antibiotic resistant infections. Of these, the CDC has identified carbapenem-resistance and extended spectrum beta-lactamase-producing Enterobacteriaceae as urgent and serious public health threats respectively. Our study focus was to investigate the prevalence of antibiotic resistance among *Escherichia coli* isolates and their corresponding antibiotic resistance genes (ARGs) from hospital wastewater and throughout the urban wastewater system, including assessing the potential impact of chlorination on resistant populations. Antimicrobial susceptibility of 124 *E. coli* isolates was determined using Kirby-Bauer disk diffusion assay for 12 antibiotics, as well as minimum inhibitory concentrations (MIC) assays on some resistant populations, and PCR used to determine the presence of ARGs and type 1 integrons among resistant isolates. The average multiple antibiotic resistance (MAR) index was significantly greater in hospital isolates compared to urban influents (0.220 vs 0.029 respectively). Of these, multi-drug resistance (3 or more antibiotic groups) was highest among hospital isolates (29.73%) followed by pre-chlorinated effluents (3.57%) and urban influents (0%) equal to post-chlorination (0%). All isolates were susceptible to carbapenems, but the hospital isolates had the highest prevalence of third-generation cephalosporin resistance which associated with extended-spectrum  $\beta$ -lactamase (ESBL) producers where *blaCTX-M-15* was detected in 90% of the isolates. Of the tet genes analyzed, *tetA* and *tetB* were the most abundant, with the presence of both genes correlating with the higher MIC. Class 1 integrons were most abundant among hospital isolates, where over half carried a class 1 integron encoding a couple of ARGs. Our results highlight the overwhelming presence of MDR *E. coli* isolates within hospital wastewater, although their continual presence throughout the wastewater system appears minimal.

**Aime Skrober**

Life Stressors Predict PTSD Symptoms Following a Traumatic Injury

Mentors: Christine Larson, Elisabeth Webb & Jayson Schalk, Psychology

Previous research has shown that life stressors may contribute to the risk of developing Posttraumatic Stress Disorder (PTSD) after a traumatic experience. However, the relationship between specific life stressors and PTSD symptom severity remains largely unknown. In the present study, we investigated whether specific trauma-unrelated life stressors predicted PTSD symptom severity 6 months after a traumatic injury. Trauma-exposed participants (N = 232) were recruited for the study from an emergency department. Participants were administered a battery of self-report measures and cognitive tasks 2-weeks and 6-months post-trauma. Financial, career, housing, legal, and relationship life stressors were assessed using the Crisis in Family Systems survey. A multiple regression analysis was used to investigate the relationship between the various trauma-unrelated life stressors and PTSD symptom severity. After controlling for demographic variables (i.e. gender and age), greater exposure to financial and career stressors were significantly predictive of PTSD symptom severity 6 months post-trauma ( $p < .05$ ). However, housing, legal and relationship stressors were not predictive of PTSD 6 months post-trauma. These findings add to the growing body of literature suggesting life stressors may have a significant impact on the development of PTSD symptom severity. Our results suggest exposure to financial and career stressors, but not other life stressors, are significantly predictive of PTSD development after a traumatic injury. The source of financial and career stressors may be related to the socioeconomic position of participants. This study suggests trauma-unrelated life stressors should be considered in the treatment of PTSD.

**Marina Slawinski & Daniel Collison**

Shape Programming of Protein Hydrogels Using Metal Cations

Mentors: Ionel Popa & Luai Khoury, Physics

The ability to program a temporary shape in biomaterials that can revert to their original shape in response to a stimulus is referred to as shape programming, which is essential to the future of medicine and soft robotics. Here we use hydrogels made from covalently cross-linked pure proteins, which we program into new shapes using adsorption of cations. We synthesize bovine serum albumin (BSA) hydrogels through a photoactivated reaction with a primary covalent cross-linking network via tyrosine amino acids. Incubation in solutions of divalent metal cations ( $Zn^{2+}$  and  $Cu^{2+}$ ) induces the formation of a secondary physical cross-linking network via ionic interactions with histidine amino acids. The dual cross-linking stiffens the hydrogel, allowing for temporary shape morphing and restoration with the addition and removal of the secondary network. Following incubation in  $Zn^{2+}$  and  $Cu^{2+}$  solutions, force-clamp rheometer measurements revealed an increase in Young's modulus directly related to the concentration of the solution. The addition of the secondary network allowed us to program complex shapes, while diffusion of adsorbed cations removed the secondary network and restored the original

shape. The shape manipulation of BSA hydrogels at room temperature in response to different aqueous solutions explores the possibilities to engineer responsive and biocompatible tissues, whose stiffness and form react to their environment.

**Natassja Sook**

Heavy Rain Events Drive Sediment Pollution Loads in the Milwaukee River

Mentors: Val Klump & Jessie Grow, Freshwater Sciences

Like many other urban watersheds, the Milwaukee River watershed is impaired and one of the main concerns is the delivery of high quantities of suspended sediment in the river and ultimately into the harbor and the lake. Sources include agricultural runoff, urban stormwater, and combined sewer overflows which result in degraded water quality, bacterial contamination, sediments in-filling the harbor, an unattractive, murky appearance, and river plumes. This project's goal is to determine the timing and source of the sediments transported in this system. More specifically, my study focuses on understanding what fraction of the total suspended solids (TSS) load in the Milwaukee River occurs during large precipitation "events." The MMSD Cherry Street turbidity data was used as well as the USGS flow data to look at the combination of discharge and precipitation to get a better understanding of the timing of these sediment additions into the river and their flux downstream. Through this study we found that the majority of TSS in the Milwaukee River occur during wet weather "events." This means that to limit sediment levels, water quality managers should focus on controlling peak concentrations during wet weather. In addition to flow and TSS load data, sediment samples were collected along the Milwaukee River watershed and throughout the main stem of the river. In the future, we will continue to characterize these samples, using elemental, isotopic, and radioisotopic tracers to determine the age and source of these inputs. Overall this project helps us to determine how to reduce the sediment runoff entering the Milwaukee River, and identify actions needed for improving and maintaining the health of the Milwaukee River watershed.

**Melissa Stec**

Plantar Pressure Analysis of Children with Hypermobility Ehlers-Danlos Syndrome During Gait

Mentor: Brooke Slavens, Biomedical Engineering and Occupational Science & Technology

Ehlers-Danlos Syndrome (EDS) is a heritable genetic disorder that causes the collagen in connective tissue to be fragile and elastic. The prevalence of EDS is one in every 5,000 to 10,000 people worldwide. Hypermobility EDS (hEDS) is a common subtype of EDS that includes symptoms such as pain, hyperflexible joints and frequent dislocations. Those symptoms can lead to abnormal walking, poor balance, and osteoarthritis. Adults with hEDS have been shown to have specific plantar (foot) pressure patterns which cause pain and excessive fatigue during walking. There are limited studies that quantify plantar pressure in children with hEDS. Therefore, we used a Novel EMED system to collect plantar pressure data from eight subjects ( $12.2 \pm 5.4$  years; range 9-17 years). The subjects walked at a self-selected speed across a 4-meter walkway with an imbedded pressure platform. For each subject,

five steps of the dominant foot were analyzed by dividing each foot into ten regions plus the total foot according to the Peter Richard Cavanagh (PRC) mask. For each region, means were calculated for parameters of foot pressure, force, area, and time of contact. A Z-test was used to compare the children with hEDS to healthy individuals from a Novel database. Children with hEDS showed a statistically significant increase in peak pressure and mean pressure, respectively, for the medial forefoot ( $p=0.0165$ ,  $p=0.0199$ ), medial hindfoot ( $p=0.003$ ,  $p=0.001$ ), and total foot ( $p=0.0207$ ,  $p<0.001$ ) regions. For eight of the regions there was significantly less contact area ( $p<0.05$ ) and not a significant difference in maximum force. Therefore, future therapeutic strategies should consider increasing the contact area and redistributing pressures, which may ultimately lead to a decrease in foot pain. These findings enhance our understanding of hEDS and improve diagnosis by contributing to the biomedical phenotype of this rare disease.

### Rob Steger

Cardiovascular Reactivity in Runners

Mentors: Raymond Fleming & Hanna Johnson, Psychology

Regular cardiovascular exercise, such as running, is physiologically and psychologically protective against stress. Once accustomed to these positive effects, runners who are deprived of exercise exhibit increased stress responses during their period of deprivation, even in deprivation periods as short as 24 hours. Therefore, recreational runners tend to experience higher stress responses on rest days than on running days. The study recruited 20 runners (and 20 non-exercising controls) and monitored their physiological reactivity (including heart rate and heart rate variability), affect, and performance on a stress task on one running day and one rest day. Participants wore a monitoring device similar to a heart rate monitor for a period of four hours each day, completed brief intermittent mood questionnaires, and engaged in an acute stressor task (a five-minute period of simple addition problems). Runners reported greater positive affect and tranquility on running day than rest day. Analysis of physiological data is currently underway—it is expected that runners will exhibit greater physiological indices of stress on rest day than running day. This study contributes to the research on short-term exercise deprivation by assessing stress reactance on three dimensions and by collecting data in a naturalistic setting over an extended period of time. Preliminary results indicate that runners experience greater stress on non-running days than running days.

### Lantrell Stewart

Detection of Tissue Factor Expression on Transfected Cells

Mentor: Julie Oliver, Biological Sciences

We detected human tissue factor (TF) expression by direct and indirect methods on transfected clones of the 300.19 mouse pre-B cell line. TF is a trans-membrane protein receptor responsible for initiating coagulation. It is constitutively expressed on cells outside the vasculature, and under pathological conditions, can be expressed on endothelial cells and some leukocytes. The cell lines used in this experiment contained fusion proteins of TF with an attached fluorophore, either singly transfected TF-mTurquoise (mTq), singly transfected TF-super yellow fluorescent protein 2 (SYFP2), or

lines co-transfected with both. We employed flow cytometry analysis of the attached fluorophore for direct TF detection. Using a FACSCalibur flow cytometer, we were able to quantify expression in lines transfected with TF-SYFP2. However, the fluorescence capabilities of the instrument do not allow direct analysis of TF-mTq expression. Therefore, we used indirect detection to quantify TF expression in the mTq- and co-transfected lines. Cells were labeled with a mouse anti-human TF monoclonal antibody and a goat anti-mouse IgG antibody conjugated with Alexa Fluor 647. We hypothesized that in co-transfectants, about half the total TF detected by the indirect method could be explained by the direct SYFP2 flow cytometry signal. This was our actual observation in every co-transfectant tested. We were able to confirm the flow cytometry results by qualitative fluorescence microscopy imaging using filter sets appropriate for all three fluorophores used (mTq, SYFP2, and Alexa Fluor 647). Therefore, using a combination of detection methods has provided us great flexibility in analysis of transfected TF expression.

### Leah Stewart

Adsorptive Removal Methods of PFAS from Water and Wastewater

Mentors: Yin Wang & Qianqian Dong, Civil & Environmental Engineering

Per- and Polyfluoroalkyl substances and surfactants (PFAS) are a group of synthetic chemicals which have been widely used in commercial and industrial products since the 1940s. PFAS are extremely persistent in the natural environment and some have been shown to accumulate in human and animal tissues and are potentially toxic to humans, making them an emerging contaminant of concern. The Environmental Protection Agency (EPA) is currently studying these compounds to set an enforceable drinking water standard. Additionally, the National Defense Authorization Act (NDAA), which added PFAS to the Toxics Release Inventory (TRI), became effective December 20, 2019 and requires certain industries to track their PFAS usage. Because of this new and anticipated regulation, low-cost and effective PFAS remediation methods are needed. Removal of PFAS represents a special challenge for water/wastewater treatment because of their unique chemical/physical properties that include high water solubility, the high stability of C-F bonds, and varied chemical structures. In this study, we prepared a suite of mineral-based adsorbents via modification of representative naturally occurring clays with various organic functionalities. The performance of the adsorbents was examined for the removal of both short- and long-chained perfluorocarboxylic and perfluorosulfonic acids (PFCAs/PFSAs). Preliminary research shows promising capacity for some high-performance media, indicating potential scalability for remediation efforts in natural waters.

### Omar Suárez Sacramento

Mexico – U.S. Migration Dynamics

Mentor: Kevin Thom, Economics

In a climate of growing policy and social implications surrounding immigration, accurate measurements of migration are an important part of informed decision making. This research project investigates an alternative method for

estimating Mexico-U.S. migration. Specifically, estimations of gross and net migration rates between Mexico and the United States from the years 1990-2015 will be made utilizing census data from Mexico's statistical agency (INEGI). To determine estimates, descriptive statistics will be conducted for the 1990, 2000, and 2010 waves of the Mexican Census of Households and the 1995, 2005, and 2015 waves of Mexico's intermedial census, the Conteo. The project will examine how the population of individuals born in Mexico in 1983 shrinks between the years 2000 and 2010 after adjusting for mortality rates and migration to other destinations. The alternate estimates produced by the project will be compared to conventional estimates based on legal visa totals and border apprehensions. Many Mexico-US migrants engage in circular migration, therefore complete models that describes how the propensity to migrate has changed are valuable. This research project is part of a larger project where the cohort-level migration rates produced will be combined with other data sets to contribute to such a model.

#### **William Sullivan**

Effects of Salinity & Decapsulation on *Artemia salina*  
Hatching Efficiency & Nutritional Composition  
Mentor: Dong-Fang Deng, Freshwater Sciences

*Artemia salina* commonly known as brine shrimp is a commonly used live feed for aquatic species during early life stage feeding because of their small size, and nutritional quality (protein and lipid). *Artemia* cysts (eggs) can be stored for long periods and hatched when needed. However, hatching efficiency, nutrition and physical quality may be influenced by the hatching conditions. The objective of this study is to evaluate the effects of decapsulation and varying salinities (15g/L, 20g/L, 25g/L, 30g/L, 35g/L) of the hatching medium on *Artemia* quality based on hatching efficiency, physical size, and nutrient composition. The ultimate goal is to optimize a protocol for hatching high quality *Artemia*. Decapsulation is the process of removing the alveolar (outer) layer of the cyst to ease the energetic burden of hatching; this was achieved through submersion in a bleach solution while under constant aeration followed by washing with dechlorinated water. Temperature was stable at 28°C with constant aeration and illumination; stocking density was 5g dried cysts in 3L of hatching medium. *Artemia* samples were collected to evaluate for percentage of hatching, nutrient contents, and the body dimensions at 18, 24, 42, and 48 hours after hatching. Hatching efficiency was found to increase significantly ( $P < 0.05$ ) across all salinities with decapsulation, along with a trend of increasing hatching efficiency as salinity decreased, with 15g/L having the greatest overall. The hatching reach peak level at 42 hours for *Artemia* hatched under different conditions. The results on nutrient density are pending for analysis and will be completed by the presentation. These findings suggest that decapsulation should be considered in *Artemia* hatching protocol and that a salinity of 15g/L is recommended as the hatching salinity. The information of this study will provide baseline information to aid fish hatcheries optimize protocols on *Artemia* production.

#### **Megan Sullivan**

Usability Assessment of AccessPlace during Initial Public Community Launch  
Mentors: Roger O. Smith & Nathan Spaeth, Occupational Science & Technology

People with disabilities consistently face challenges participating in the community due to inaccessible mobile, cognitive, and sensory environments. AccessPlace is a mobile web-based app that allows users to leave ratings and reviews of their experiences related to the accessibility of community buildings as well as search for accessibility information in order to determine which establishments best fit their needs. It is designed to be simple, quick, and easy to use for the average community member. We held our Pilot Community Event to begin populating the AccessPlace database and receive community feedback on the usability and functionality of the web-app. After having time in the community to use the web-app and leave ratings and reviews of local restaurants, 16 individuals were surveyed about their experiences. We found that 87.5% of participants reported that they had an overall positive experience and 43.75% gave specific suggestions for future improvements. Even with the need for continued improvements and further developing, the majority of our participants were enthusiastic about the implications of the web-app and found the overall design to be easy to navigate and use. From this feedback gathered from our interviews, we are able to conclude that, with continued improvements, the AccessPlace web-app will be an intuitive tool for community members to leave reviews of their experiences which will help us make accessibility information readily available to the community.

#### **Wilson Tarpey**

Comparing Toxicity of Buoyant and Non-Buoyant Microcystis Populations

Mentors: Ryan Newton & Todd Miller, Freshwater Sciences

Microcystins are a class of toxic compounds naturally produced from certain species of cyanobacteria, and in particular Microcystis species. These cyanobacteria populations experience an exponential growth phase during the summer months, known as a 'bloom'. These blooms happen readily in eutrophic systems during the warm summer months when photoactive radiation duration and intensity peaks. The environmental drivers of microcystin production are still unknown. Microcystis regulates its position in the water column with air-filled vacuoles, giving it a unique environmental advantage. Here, we examined how the buoyant state of Microcystis cells affects toxin production in an urban freshwater lagoon along the Lake Michigan coast in Milwaukee, WI, that is persistently affected by toxic Microcystis blooms. From a homogenous mixture, we allowed buoyant Microcystis cells to separate from the rest of the population, and then took a surface sample before re-homogenizing for a second mixed sample. The two samples were analyzed for eleven microcystins and a suite of related peptides including nodularin, anabaenopeptins, cyanopeptolins, and micoginin-690 via liquid chromatography tandem mass spectrometry. Algal pigments chlorophyll a and phycocyanin were measured spectrophotometrically alongside 16s cell counts and toxin producing genes via qPCR. We show that toxin dynamics vary over time, space and under some scenarios between buoyant and non-buoyant populations.

**Nathaniel Tennies**

Where Will it Grow? Bull Kelp Distribution Modeling in the Salish Sea

Mentor: Filipe Alberto, Biological Sciences

The bull kelp, *Nereocystis luetkeana*, is a foundational species for aquatic ecosystems in the Salish Sea on the border of Washington and British Columbia. Its ecological importance, population contractions, and the present environmental pressure in these bodies of water require an increased research effort on bull kelp dynamics in the Salish Sea. We're approaching this issue by developing a species distribution model (SDM) to predict, in a spatially explicit way, the probability of *N. luetkeana* occurrence across the Salish Sea. These SDM models are built from presence and absence species occurrence data (the response variable) and its association with a set of spatially explicit environmental data (the predictor variables). Environmental data were obtained from the Aqua-MODIS NASA satellite, the Bio-ORACLE global marine dataset, and local digital elevation models. Model development started in summer 2019 and is planned to be finished during spring 2020. The main technique we're using is generalized linear modeling, a form of multiple regression analysis better suited for presence-absence responses. Once our first model is finalized, we intend to use other model types and compare the results. We will compare the different modeling approaches on their accuracy and set of predictors identified in association with species probability of occurrence. An SDM model will be valuable to guide current restoration efforts of the species before spending resources on reestablishing extinct populations in places where the local environment is no longer suitable.

**Ryan Thiede**

Learning-Induced Changes in Astrocytic Immediate Early Gene Expression in the Dorsal Hippocampus

Mentor: Karyn Frick, Psychology

Dementia is an ever-growing mental health problem that affects millions of people every year. Identifying ways in which to prevent and reduce memory loss may lead to novel treatments that could improve the quality of life for dementia patients and their families. Our long-term goal is to identify the neurobiological mechanisms of memory formation within the hippocampus, a brain region critical for memory processes whose function is significantly compromised in Alzheimer's disease. The aim of the present study is to examine the role of astrocytes in the brain in memory formation. Despite the fact that they are the most abundant cell type in the brain, astrocytes are historically understudied with respect to memory consolidation compared with neurons. To determine the extent to which astrocytes are activated in response to learning, female mice were allowed to explore two novel objects in a large arena until they had accumulated 30 minutes of object exploration. Ninety minutes after object exposure, mice were anesthetized and perfused intracardially with 0.9% phosphate buffered saline followed by 4% paraformaldehyde in 0.1M phosphate buffer to exsanguinate and fix the brain tissue. Following perfusion, brains were extracted and 20µm slices were cut on a cryostat. Immunohistochemistry was then used to detect immediate early gene (IEG) expression, which is upregulated in response to learning, within the dorsal hippocampus. The IEG c-fos was examined because this IEG is activated by many forms of

learning and memory. We expect that c-fos expression in dorsal hippocampal astrocytes will be elevated in response to object exploration, suggesting a role for astrocytic activity in learning.

**Andrew Thompson**

Clean Water in Port Report: Dockside Particle Detector Environmental Analysis

Mentors: Marcia Silva & Thomas Hansen, Global Water Center & Freshwater Sciences

Marine ports, while necessary for modern trade, also come with environmental concerns. Trade vessels run on bunker fuel which has a higher sulfate level than diesel does and is known to dirty the water. To the port, cars and trucks deliver people, products, and pollution. Even small vessels may resuspend sediment and erode waterways. The Milwaukee Municipal Mooring Basin is no exception. The methods to measure pollution in water can be slow and costly. This study focuses on testing a particle detector produced at UWM as a surrogate to detect pollution intrusion in the Milwaukee Municipal Mooring Basin. The results show a correlation between the particle sensor and traditional methods for detecting various water quality indicators. With the sensor already being faster than the traditional methods and lower cost than most, the Milwaukee Municipal Mooring Basin may one day be easier to take care of because of it.

**Tori Tran**

The Impact of Discursive Representations of Immigration in a Post Truth Era with a Focus on DACA

Mentor: Sandra Pucci, Linguistics

The 2016 election of Donald Trump ushered in a level of anti-immigrant rhetoric not seen in recent years. While there have been multiple targets of this rhetoric, there is no denying that much of it focuses specifically on undocumented immigrants, including students brought to the US as young children and those seeking refugee status along the US southern border. Drawing on the work of Bhatia and Jenks (2018), the purpose of this study is to analyze Trump's tweets from 2015-18 through the lens of historical authenticity, linguistic and semiotic action, and social impact to explore the effects of the words on public opinion and policy actions that impact schooling for undocumented immigrants, specifically those receiving Deferred Action for Childhood Arrivals (DACA). The study uses mediated ethnographic discourse analysis to search Trump's twitter feed. Mediated Discourse Analysis (MDA) has been used to study popular media as a force in influencing opinion and belief. MDA is used in this study to examine the link between policy text/discourses and micro-level language, e.g. data in the form of tweets from @realdonaldtrump. These were gathered from an online archive that includes more than 34,000 tweets, including deleted tweets since 01/27/2017. The analytic approach looked at three specific discursive characteristics: fact construction, social action, and rhetorical appeals. We used line-by-line open coding, followed by axial coding, to look for relationships between the three factors. Preliminary findings speak to the notion of politics as performance rather than the exchange of substantive information related to politics or political agendas – with the targets of the tweets being ignored as individuals. Trump's tweets on immigration consistently attempt to construct de-facto policy texts by emphatically pointing to "truths" that fall outside of faculty knowledge.

**Ashley Trapp**

Explicit and Implicit Aspects of Dietary Behavior  
Mentor: David Osmon, Psychology

We investigated the relationship of explicit and implicit thoughts in dietary behavior such as eating behavior, food choice, and dietary intake using questionnaires about dietary behavior as well as biologic measures (weight, height, caliper measure of body fat). Dietary behavior has been investigated using only explicit measures of thoughts and actions using self-report dietary practices. Recent implicit cognition work suggests that we create explanations for our actions only after the behavior has occurred. Frequently, there is a mismatch between these explanations, our actual thoughts, and actions prior to behaviors of interest. We expected a similar mismatch regarding dietary behavior and believe that the greater the mismatch the more likely the participant is to engage in unhealthy dietary practices. Therefore, we wanted to examine both explicit and implicit aspects of dietary behavior. There were 40 participants which were divided into a high BMI (>24) and low BMI (<25) groups. The 6-Factor Questionnaire was administered which includes Convenient Diner, Fast Pacer, Easily Enticed Eater, Exercise Struggler, Self-Critic, and All-or-Nothing Doer. High scores indicate how unhealthy the participants' lifestyle is. The Impact of Weight on Quality of Life-life questionnaire was used as an overall measure of quality of life. It was found that the relationship between BMI, quality of life, and lifestyle variables was complex. Cluster analysis found five groups with differing patterns of these variables. It was concluded that a college sample isn't a great representation of the population as a whole and that a community sample would be more ideal to represent adult relationships between BMI, quality of life, and lifestyle patterns.

**Hannah Ullberg**

Casting of Magnesium Foam for Bone Regrowth  
Mentor: Pradeep Rohatgi, Materials Science & Engineering

Large-scale bone damage can be mended by bone replacements. The porosity of bone can be artificially reproduced with foam structures, which can then be placed in the body to form a scaffold for the bone cell growth. Magnesium (Mg) will degrade on account of corrosion due to the environmental conditions in the human body, thus the degradation of a magnesium foam leaves a newly grown bone. In this work, a low-cost pressure infiltration casting technique was developed which enables synthesis of magnesium foams which can be used as scaffolds. Foam and mold shapes were designed then 3D printed using PLA material, then covered in plaster to form the mold shape. After sintering, plaster molds were pressure infiltrated with AZ91E (Mg alloy) to form the magnesium foams, which have mechanical properties similar to human bone. Compression tests of the porous foams and the solid block exhibited improvement. Magnesium foams with porosity were compression tested and metallographically studied. These results show that a magnesium foam can be created with a controlled porosity viable for bone regrowth.

**Zachary Uttke**

Structure-Function Relationships in the MppP Family  
Mentor: Nicholas Silvaggi, Chemistry & Biochemistry

The rare nonproteinogenic amino acid L-enduracidine (L-End) is a building block of some naturally occurring antibiotics like mannopeptimycin. Antibiotic-resistant pathogens are an imminent threat to public health. Studying the biosynthetic pathways by which natural antibiotics are formed by bacteria and fungi can provide valuable information for drug design. L-End biosynthesis involves one particularly interesting enzyme, a pyridoxal-5-phosphate (PLP) dependent L-Arg oxidase, called MppP. MppP is unique in that it is the first PLP-dependent enzyme to perform a 4-electron oxidation with just molecular oxygen and PLP. This is highly unusual in that this sort of chemistry typically uses metals or more exotic organic cofactors. A number of MppP homologs have been identified and this small family actually contains two different groups. One catalyzes the reaction that results in the hydroxylated arginine product, while the other has a fundamentally different reaction mechanism that results in the product 4,5-dehydro-2-ketoarginine. Our studies aim to identify the structural differences between these two groups of enzymes that result in their having different catalytic mechanisms. So far, the active sites of these homologs seem to have completely conserved amino acid sequences and thus likely very similar structures. Here we describe the first complete structure of a dehydrating MppP homolog from *Pseudoalteromonas luteoviolacea* (PIMppP). This structure is compared to the prototypical hydroxylating MppP from *Streptomyces wadayamensis* (SwMppP). We also report on the expression and purification of several other dehydrating MppP homologs, the structures of which will eventually allow us to refine and extend our analysis. The structural data we are generating will have implications for adapting MppP-like enzymes to be used as biocatalysts for the synthesis of potentially novel life-saving antibiotics.

**Erin Vandebosch**

Chemotherapy-Related Cognitive Decline is Detectable via the Attention Network Test  
Mentor: Adam Greenberg, Psychology

Chemobrain, the cognitive decline associated with chemotherapy, is a common ailment in cancer patients; however, there is currently no accurate method for chemobrain diagnosis. We examined the effects of chemotherapy on cognition using self-report questionnaires, neuropsychological assessments, and a precise reaction time paradigm called the Attention Network Test (ANT). By employing a combination of measurements, we aimed to determine whether one form of assessment is more sensitive to the effects of chemobrain. We used four neuropsychological tests designed to measure working memory, sustained attention, processing speed, and executive functioning. The ANT quantifies three sub-processes of attentional control: alerting, orienting, and filtering distracters. Each patient was tested twice: once just prior to the beginning of their chemotherapy treatment, and a second time after chemotherapy treatment had ended. Our results showed that four out of our eight participants

experienced changes in both distracter filtering and alerting from the pre-chemo timepoint to the post-chemo timepoint. These data are consistent with other studies comparing chemotherapy patients to control participants: either cancer patients without chemotherapy, or healthy volunteers. These four participants also exhibited increased levels of Perceived Cognitive Impairment, through the self-report questionnaire, from pre-chemo to post-chemo assessments. The correspondence between ANT and questionnaire data suggest that these four participants experienced symptoms of chemobrain following chemotherapy administration. Neuropsychological test results for these four participants showed no significant differences between pre- and post-chemo timepoints. Thus, neuropsychological testing, the most common form of assessment in clinical settings, may be an inferior means by which to accurately identify chemobrain symptoms. Furthermore, our ANT data suggest that chemobrain may stem from a selective deficit in attentional alerting and distracter filtering caused by targeted neurotoxicity of chemotherapy drugs used in battling cancer.

### **Elyzabeth Veu**

Speech-Language Pathologist Providing Inclusion Services  
Mentor: John Heilmann, Communication Sciences  
& Disorders

Children with communication disorders are significantly limited in their ability to participate in the classroom fully. Provision of speech-language pathology (SLP) services in an inclusive setting, specifically in the classroom, can be an effective way to improve students' classroom functioning. There are many known barriers, but less known factors in leading successful inclusive service delivery. The purpose of this research is to identify factors that facilitate successful inclusive services delivery. We conducted interviews with 13 SLPs in the schools who do use inclusion with the same leading questions. Completing qualitative analysis leads to the discovery of systematic general trends. The trends can be generalized to Speech-Language Pathologists who have not used inclusion. Preliminary analyses have revealed several factors that promote successful inclusive service delivery. One example is the need for support from the school's administration board. With the administration support, the SLP can overcome obstacles such as any teachers who oppose inclusion and allowing more time to coordinate their curriculum. A second example is the SLP's professionalism. If they can be confident in themselves and can demonstrate self-efficacy, they are sure to succeed. Further analysis will result in a comprehensive model of successful inclusive service delivery. Inclusion services provide many different benefits and are possible with the right combination of factors. With the right combination of factors, an SLP can overcome many obstacles and help kids excel in the classroom setting.

### **Nicole Vigon**

Evaluation of Joint Dynamics During Gait in Children with Hypermobile Ehlers-Danlos Syndrome  
Mentor: Brooke Slavens, Occupational Science & Technology

Hypermobile Ehlers-Danlos Syndrome (hEDS) is an inherited connective tissue disorder caused by a defect in the protein collagen. This disorder affects as many as 1 in 5000 people

worldwide. Symptoms include excessive range of motion, dislocation, and instability in joints, which leads to early-onset osteoarthritis. There is currently a lack of knowledge on the functional effects of these symptoms on gait in children with hEDS. This study aims to quantify gait, in an effort to contribute to defining the biomedical phenotype of hEDS. Eight children with hEDS (mean age of 14 years) were recruited from the Genetics Center at Children's Hospital of Wisconsin. The subjects underwent three-dimensional motion analysis using a 15-camera Vicon T Series system with 14 retro-reflective markers. The subjects completed multiple walking trials at a self-selected speed along a 30-ft walkway. Data was labeled, filtered, and modeled using Vicon Nexus software and the lower extremity Plug-in Gait model for five gait cycles per subject. The group mean for stride length, walking speed, stance duration, and cadence were  $1.27 \pm 0.156$  m,  $1.24 \pm 0.067$  m/s,  $37.78 \pm 1.94\%$  and  $59.46 \pm 7.19$  strides/min, respectively. For the ankle, the group mean for sagittal plane range of motion and peak dorsiflexion moment were 38 degrees and 1.41 Nm/kg, respectively. While the temporal spatial parameters were within normal ranges, as reported in the literature, inspection of subject specific metrics were found to be different. Identification of differences between those with hEDS and healthy individuals may provide insight to determine the underlying mechanisms of pain and injury, to mitigate the risk for early-onset osteoarthritis. Quantitative gait analysis findings will provide rehabilitation engineers, therapists, and physicians with a better understanding of pathological human movement. This work will lead to improved diagnosis and rehabilitation for children with hEDS.

### **Nathaniel Wagner**

The Impact of Interspecies Interaction on Adult Male Treehoppers Signaling Behavior  
Mentor: Rafael Rodríguez Sevilla, Biological Sciences

We focused on *Enchenopa binotata*, a species of treehopper that communicates through vibrational signals on a plant medium. While most species of treehoppers each inhabit a specific host plant, some species may share the same niche. However, while species may live on the same plant, different species communicate at different frequencies which discourages interspecies interaction. We decided to study the impact that mixed versus single species groups have on their communication signals as adults. Does being exposed to signals of other species affect the calls of other individuals and if so, how? By creating mixed and single species groups of nymphs, and then recording their signals with laser vibrometry when they reach adulthood, we were able to measure any change in their signaling behavior due to interspecies interactions. We focused on measuring duration, frequency, pulse rate, and quantity of calls, and compared the two treatments. We expect that being raised in multi-species groups will have an impact on signaling behavior of adults. Our findings give us more information on how separate species of treehoppers communicate and interact in the wild and how that interaction may affect their signaling behaviors.

**Mikayla Walker**

Flora and Fauna of the Pleistocene Oak Creek Formation  
Peat Deposits  
Mentor: Scott Schaefer, Geosciences

Late Pleistocene Oak Creek Formation deposits dated to 45,000 to 35,000 years old are exposed at Sheridan Park in Cudahy, Wisconsin. Sediments from this formation include strata of ancient bog material known as peat which contains potentially identifiable flora and fauna that predate the last glacial advance. Leaves, twigs, seeds, and insect fragments recovered from the peat will help characterize the lesser known paleoecology of this ecosystem essential to Wisconsin's geological history. Samples of peat were processed by disaggregation to recover previously uncounted for flora and fauna. Because this bog represents one of the earliest phases of the Oak Creek Formation, understanding its biota enhances the narrative and continuity of this fossil deposit for geoscience students. This field locality is frequented by regional underrepresented minority students; therefore, this research will provide a more complete and captivating narrative to further inspire future generations of scientist.

**Eric Wendt, Brittany Larson & Yael Greenberg**

Motivation is Deficient in the Spontaneously Hypertensive Rat (SHR)  
Mentor: Rodney Swain, Psychology

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most commonly diagnosed childhood neurobehavioral disorders. ADHD is characterized by three core behavioral deficits (hyperactivity, inattention, and impulsivity) that significantly hinder the daily functioning of those diagnosed. Furthermore, children with ADHD have problems with motivation and often require larger, more frequent rewards in order to complete a task. The etiology of this disorder is largely unknown, but human imaging research has demonstrated that various areas of the brain, including the cerebellum, display abnormalities. In this study, we used the Spontaneously Hypertensive Rat (SHR), a rodent model of ADHD that exhibits the core deficits of the disorder. The goal of the current study was to further validate the SHR as a model of ADHD by training rats in an operant conditioning breakpoint paradigm to assess motivation. Male SHR and WKY control rats were trained on a Progressive Ratio schedule that increased in difficulty until the rats reached their breakpoint, which was defined as the point at which the animals stopped working. The breakpoint served as a measure of motivation and the higher the breakpoint, the more motivated the animal was. The SHR animals had a significantly lower breakpoint compared to the WKYs, indicating that the SHRs gave up working on the task much sooner, strengthening the reliability of the model. Previous research has demonstrated that the dentate nucleus, one of the three deep nuclei of the cerebellum, is involved in motivation. In this study, histological analyses of the cerebellum revealed that the dentate nucleus was smaller in the SHRs compared to the WKYs. To examine this volumetric difference of the dentate nuclei, unbiased stereology was conducted and revealed no differences in either large neuron area fractions, or large neuron surface area between the SHR and WKY animals.

**Austin Wesner**

The Role of Activated Mesenchymal Stem Cells in Bone Regeneration After Injury  
Mentor: Priyatha Premnath, Biomedical Engineering

Bone has the ability to regenerate completely after injury, but diseases like osteoporosis and diabetes impair this healing cascade, sometimes causing non-union of bone after injuries. Stem-cells, specifically mesenchymal stem cells (MSCs), based therapies have been proposed to improve the regenerative capacity of bone in such instances. Yet, these therapies have not proven successful owing to quiescence of these stem cells once injected in vivo. Consequently, endogenous stem cell therapies have been garnering interest where resident stem cells are activated to enhance regeneration. Chemokines and growth factors have been used with some success to improve healing; other genetic approaches are also sought. We recently demonstrated that systemic activation of cell cycle by inhibiting p21 enhances bone regeneration. While we showed that MSCs played a role in regeneration, the exact mechanisms remain unknown. This project aims to examine the specific role of MSCs in regeneration through constitutively activating cell cycle in the MSCs. Since p21 is involved in several signaling pathways, E2F1 is chosen to activate cell cycle as E2F1 acts directly on the transcription of genes. A genetically modified mouse has been engineered for MSCs (PRX1+ cells) to be activated by overexpressing E2F1. Burr-hole injuries were performed on mice, and mice were sacrificed at various stages post injury (3, 7 and 10 days). Samples were then fixed, decalcified, processed and embedded in paraffin wax. The samples were cut into 10µm thick slices and mounted on glass slides. Histology was performed by staining with Safranin-O and fast green, for cartilage and bone respectively. Experiments to stain samples and analyze them are still ongoing. immunofluorescence staining is also proposed to assess number of chondrocytes and osteoblasts present at site of injury temporally. Through this project we will be able to tease out the role of activated MSCs in bone regeneration after injury.

**Nicole Wicker**

The Starvation Sensing Protein RspB Alters *pel* Expression in High C-di-GMP Condition in *D. dadantii*  
Mentors: Ching-Hong Yang & Biswarup Banerjee,  
Biological Sciences

*Dickeya dadantii* is a phytopathogenic bacterium with a wide host range. PelD, an endopeptidase enzyme secreted by *D. dadantii* through the type II secretion system, degrades the cell wall in host plants. The second messenger cyclic diguanylate monophosphate (c-di-GMP) has been reported to regulate the expression of virulence genes in *D. dadantii*. EcpC is a phosphodiesterase that hydrolyzes c-di-GMP in *D. dadantii*, thus lowering the intracellular c-di-GMP concentrations. A low *pelD* expression is observed under the ecpC mutant background (high c-di-GMP). In order to elucidate the c-di-GMP effectors that regulate *PelD* production, a transposon library was made under ecpC mutant background. Mutants were screened by analyzing the expression of PelD. Those with an increased *pelD* promoter activity were selected for further investigation. One of the genes mutated by the transposon was identified to be *rspB* by sequencing. The *rspB* supposedly

is starvation sensing protein as per annotation. Probably *rspA-rspB* operon functions together for regulating downstream gene expressions. In *Escherichia coli* K12 strain this gene has been reported to regulate multiple virulence factor genes. Future work will explore the role of *RspB* in regulating type II, type III secretion systems and connect the role of c-di-GMP in these regulatory pathways.

**Mary Widener, Casey Phipps, Meghan Berger, Peter Green, Ava Hager & Hope Glassel**

The World After Us: Imaging Techno-Aesthetic Futures  
Mentor: Nathaniel Stern, Art & Design

By some estimates, China produces more than 9 million mobile phones per day. India recently surpassed China, meaning that this incredible rate of production generates more than 10 billion mobile phones per year. Add chargers, watches, tablets, and computers, and a global problem looms. Our research asks “what will—and what can—happen to this technology over time?” It exhibits a range of possibilities for our electronic waste. We have created sculptures, prints, photographs, and experiments that encourage viewers to consider their relationship with technology and nature. Combining plant life and scientific experimentation with electronic waste, the artwork is a timely provocation that will leave viewers contemplating how we might change our ecological trajectory.

**Taylor Wilcox**

Development of New Treatments for Neuropathic Pain  
Based on Imidazodiazepines  
Mentor: Alexander Arnold, Chemistry & Biochemistry

Currently, 7% of the US population has been diagnosed with neuropathic pain (NP). NP is mediated by inflammation of the associated peripheral sensory endings and is commonly associated with diabetic neuropathy, HIV infection, post-herpetic neuralgia and chemotherapy treatment for cancer. Opioids are currently one of the leading NP therapeutic choices, but their use is controversial. Additional treatments include tricyclic antidepressants, serotonin-norepinephrine reuptake inhibitors and anti-epileptics, which are often followed by second-line opioids and topical drugs or third-line strong opioids. Patients often see minimal benefit but high addiction potential from these drugs. Less than one-fourth of patients have experienced significant pain relief with these treatment options. Neuroinflammation is facilitated by activated microglia, the resident CNS macrophages. They have been implicated in many neuro-inflammatory diseases such as Alzheimer's disease, Parkinson's disease, and multiple sclerosis as well as neuropathic pain. Novel imidazodiazepines have been identified that reduce NO production of microglia, a key inflammatory modulator that causes extensive cell damage. Current compounds of interest to decrease painful neuropathic stimuli are GL-IV-03 and MP-IV-010. We have applied a combined Greiss assay to quantify the amount of produced NO and a cytotoxicity assay that quantifies the amount of intracellular APT to test hit compounds in a concentration dependent manner. Furthermore, we have used antagonists of several pathways that include gamma amino butyric acid A receptors, opioid receptors, the peripheral benzodiazepine receptor and sigma receptors to further evaluate the mode of action of the lead compounds. The application of a murine formalin pain model showed significant analgesic effects of these compounds in vivo.

**Tamia Williams**

Does Deletion of *chpC* Cause a Loss of Swimming Phenotype or is There a Hidden Secondary Mutation?  
Mentor: Sonia Bardy, Biological Sciences

*Pseudomonas aeruginosa* is an opportunistic pathogen that is able to live in a wide range of environments. The capacity to live in this breadth of habitats is aided by its swimming motility mediated by a single flagellum and its twitching motility mediated by Type IV pili (TFP). These motility structures are controlled by chemosensory systems that allow bacteria to respond to their outside environment. The Chp system is the chemosensory system in *P. aeruginosa* that controls TFP mediated twitching motility and regulates intracellular levels of adenosine 3', 5'-cyclic monophosphate (cAMP). This system allows response to the cell's outside environment based on communication with methyl-accepting chemotaxis proteins (MCPs). ChpC is an adaptor protein involved in twitching motility environmental response. ChpC connects with the MCP and is a homolog of CheW protein (found in *Escherichia coli*'s flagella chemotaxis system). Deletion of *chpC* ( $\Delta chpC$ ) is known to reduce twitching motility responses to environmental signals, but was not expected to have an effect on swimming motility. However, recent studies in our lab have unexpectedly shown that  $\Delta chpC$  might be affecting flagellum formation and function. I have verified this phenotype by testing a lineage of our strains to determine when this altered phenotype first occurred. I will generate a fresh *chpC* deletion to determine if this deletion is truly responsible for loss of flagellation biogenesis and/or function, resulting in swimming motility flaws. If  $\Delta chpC$  is responsible, complementation of *chpC* should restore swimming motility. Understanding the relationship between *chpC* and swimming capability can either confirm or deny relations between twitching and swimming motility systems in *P. aeruginosa*, leading to better understanding of the Chp system and regulation of different motility systems.

**Ryan Williamson**

Energy Harvesting with Nanocellulose Terfenol-D Composite  
Mentors: Rani Elhajar & Chiu Law, Civil & Environmental Engineering

Piezoelectric Ceramics have been shown to generate electricity when mechanical stress is applied. Using a shaker, mechanical stress can be applied at varying loads and high frequencies. The purpose of this project is to test this method on a nanocellulose Terfenol-D composite. Terfenol-D is a magnetostrictive alloy, which means that applying a magnetic field causes the material to change shape. Inversely, applying a mechanical stress causes a change in magnetic flux inside the material. A continuously changing applied stress leads to a continuously changing magnetic flux, which is how power is generated. We tested different samples of nanocellulose Terfenol-D composite at varying weight percentages of Terfenol-D and varying frequencies to optimize power generated.

**Danielle Zube**

Exploring Behavioral Response to Behavioral Play Therapy in Children with Williams Syndrome

Mentors: Bonita Klein-Tasman & Brianna Young, Psychology

Williams syndrome (WS) is a rare genetic disorder caused by a microdeletion of genes on chromosome 7q11.23. Previous research has found that fears and anxiety are significant characteristics of children with WS (Dykens, 2003), often resulting in distress, dysfunction, and interruption to daily routines. This study is part of larger exploratory treatment development research, in which the goal is to develop and disseminate a play and humor-infused exposure therapy to address fears and phobias in children with WS. This Behavioral Play Therapy (BPT) approach is an outgrowth of the approach described for use clinically (Replays; Levine & Chedd, 2007) which our lab is currently empirically validating. In the current study, we are using a single case study to investigate relations between therapist approaches and child behaviors, including the moderating effect of type of exposure to the feared stimulus. Child and therapist behavior during three video-recorded therapy sessions at UWM will be coded using Noldus Observer XT. Although measurable change in child behavior was not expected after three therapy sessions in the larger study, pilot data from parental ratings of child fear and anxiety indicated the measurable improvement following the intervention weekend. Based on these previous findings, in this study we expect the BPT approach to result in a decrease in negative child behaviors and an increase in positive child behaviors over the course of the study, and for exposure infused with play and/or humor to be followed by decreases in negative child behaviors and increase in positive child behaviors. This case study has the potential to further support the approach of BPT for use with children with WS to address fears and anxiety and will be used as a model for coding the sessions from additional children in the sample.

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