2019 Ramaley Research Celebration

Program and Book of Abstracts

1:00 to 4:00 PM
April 17, 2019
East Hall of Kryzsko Commons
Poster Session I – 1:00 to 2:30 PM
Poster Session II – 2:30 to 4:00 PM

Note: Instructions for student presenters can be found on page 3 of this program.

Welcome to the 2019 Ramaley Research Celebration!

The week of April 8, 2019 has been designated as Undergraduate Research Week and Winona State University is participating by hosting our 13th annual Ramaley Research Celebration on Wednesday, April 17. The Ramaley Celebration is a highly anticipated event that features student presentations of their research accomplishments. At Winona State, undergraduate research is highly valued as an integral part of the educational process and the Ramaley Celebration is one way we recognize and affirm this. Furthermore, the wonderful diversity of the student presenters, the research projects, and the disciplines represented all provide a strong reminder of the distinctiveness and breadth of research across the entire WSU community.

For our purposes, we define "research" very broadly as "an inquiry or investigation that makes an original intellectual or creative contribution to the discipline" (Council on Undergraduate Research). Thus, we are pleased to note that in addition to the Research Celebration on April 17, numerous other presentations of students' creative scholarship are scheduled throughout the week. These include senior shows for Studio Art/Art Teaching/Design students and Music Department hosted performances and recitals. Please see the WSU Events Calendar for more information.

The Research Celebration Organizing Committee wishes owes thanks to Facilities Services for setup and breakdown of the poster session. We also thank Stephanie Smidt, Toni Zaborowski, and the Student Union staff for all of their help with logistics in Kryzsko Commons. The Celebration is made possible by funding provided by the WSU Office of Academic Affairs and we also thank the WSU Administration for its continuing support of student/faculty research through Research and Creative Projects grants to our students.

Thank you to the WSU Women in Science and Engineering (WISE) Club for their assistance with the logistics for the Celebration and for actively encouraging its members to participate. We thank them very much for their interest and support!

To all of our student presenters: Thank you very much for presenting at this year's celebration and congratulations on your accomplishments!

To the faculty mentors: Thank you for including students in your continuing research and creative scholarship!

To the rest of the WSU Community, please come and examine the work of our student/faculty research teams and help us acknowledge and celebrate their accomplishments!

Sincerely,

The Celebration Organizing Committee:
Alexander Jorgensen, Huh-Jung Hahn, Jing Han, John Holden, Laura Koenig, Kendall Larson, Thomas Nalli, Amy Olson, James Schul

Instructions for Student Presenters for the Ramaley Research Celebration

Poster Printing

You will need to have your poster ready for submission to the Digital Learning Commons in Krueger Library 105 **at least 24 hours** before the day of the celebration. However, we ***strongly encourage you to submit it earlier*** so as not to cause a traffic jam in DLC. Submitting your print job after that 24 hour period could result in the failure to get it printed in time. Please submit your poster (in pdf format) for printing by emailing it to mediaprojects@winona.edu or by bringing it to Digital Learning Commons on a flash drive. For more information see Poster Printing at http://www.winona.edu/technology/campus-printing.asp.

You should consult with your research mentor on how to pay for the poster. You will need to provide your Winona ID number or an academic department cost center number to get it printed.

Please note that the area allowed for posters is 36" high by 48" wide. You can set the size of your poster in MS PowerPoint or MS Publisher (ideally before adding any text or images) by entering the desired dimensions under "Page Setup" under the Design tab. The completed poster needs to be saved as a PDF (use the "save as" option) before submitting it for printing. Make sure the pdf is saved to the correct size you wish the poster to be because Digital Learning Commons prints exactly what they get.

Poster Presentations

You will be assigned a poster number in the program which indicates the location to set up your poster. There will also be a Check-In desk at the main entrance to East Hall, which will be staffed by WISE volunteers who will be able to assist you. **You should check in and put up your poster sometime between 11:00 am and 1:00 pm.** Clips, poster boards, and easels will be provided. Posters can be taken down any time after 4:00 pm and should be down by 5:00.

You will be assigned to either Session 1 at 1:00-2:30 pm or Session 2 at 2:30-4:00 pm. You are expected to be with your poster the entire 1.5 hours during your assigned session. All posters should be set up and available for viewing for the full 3 hours of the event.

This event is usually very well attended so plan on a lot of great interactions with other students and faculty.

Other

We strongly encourage you to check out other students' posters when you are not assigned to be presenting yours. Thank you for your participation and we look forward to seeing you at the Celebration!

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All posters should be set up before 1:00 PM and left on display for the entire three hours!

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Bacteria from roots of six drought-tolerant plant species inhibit growth of sensitive plant species: a molecular characterization

McKayla Becker, Katherine Godeen, Ashley Volk, Samantha Branson, Kelcie Kappes, and Catherine Pinter

Faculty Mentor: Kimberly Evenson

Bacteria were isolated from the rhizosphere of six drought-tolerant local plants after serial dilution and selection on M9 agar media containing 1.5% starch (as the selection agent for amylase activity), followed by selection on TSA medium containing ACC (1-aminocyclopropane-1-carboxylate). If ACC deaminase is present in root bacteria, it lowers ethylene levels by cleaving ACC (the precursor to ethylene, and the plant hormone that causes plant senescence). If root bacteria can break down ACC, they are classified as plant-growth–promoting rhizobacteria (PGPR) because they supply nitrogenous breakdown products to the plant. We were in search of PGPR. The six selected bacteria had amylase activity, but none grew on M9 + ACC medium, indicating a lack of plant-growth-promoting properties. The six bacterial strains were tested for their effect on the growth and root hair production of germinated *Arabidopsis thaliana* and *Brassica rapa* seedlings in sterile culture. While taproot production and total biomass were similar to the controls in the presence of all six bacterial strains, root hair production was inhibited dramatically. PCR and BLAST analysis were done to provide a preliminary characterization of the bacterial strains. DNA isolated from the six isolates was amplified by PCR using 16S rDNA sequences as primers (8Fclass and 533R primers). The PCR-products were further purified, sequenced, and analyzed by BLAST. All six isolates were showed 99.1% - 100% homology to 3 strains of *Bacillus megaterium* (strain 1481, NBRC 15308, or IAM 13418). Four of the six isolates showed 99.19% - 99.58% homology to *Bacillus aryabhattai* strain B8W22. In spite of the sequence similarity, the physiological properties of each of the six strains differ and have been characterized in a second poster.

Bacteria from roots of six drought-tolerant plant species inhibit growth of sensitive plant species: a physiological characterization

McKayla Becker, Samantha Branson, Katherine Godeen, Kelcie Kappes, Catherine Pinter and Ashley Volk

Faculty Mentor: Kimberly Evenson

The role of plant-growth promoting rhizobacteria (PGPR) is well documented, but little has been reported about root bacteria that play an antagonist role in plant development, outside of plant pathogenic bacteria. We have characterized six bacterial isolates from drought-tolerant local plant roots. When co-cultivated with seedlings of *Brassica rapa* and *Arabidopsis thaliana* under sterile conditions, the six isolates inhibited root hair production of the seedlings after 7 days for *Brassica*, and 3 weeks for *Arabidopsis*. We characterized the six bacterial isolates using Gram staining, motility assays, digestive enzyme production (amylase, lipase, caseinase), antibiotic production, and biofilm production. All six isolates were Gram-positive rods of varying size and arrangement. None had the enzyme ACC deaminase - which is common to PGPRs. As might be expected, our isolates did not stimulate plant growth. All six isolates had caseinase activity; five isolates produced the extracellular enzyme amylase, and one isolate - from *Monarda fistulosa:* (wild bergamot root) - had lipase activity. Isolates from *Monarda fistulosa, Agastache foeniculum* (anise hyssop root), *Verbesina alternifolia* (ironweed root), and *Platycodon grandiflorus* (balloon flower) root produced biofilms. Was the inhibition of *Brassica rapa* root hair growth by the six isolates due to a lack of ACC deaminase activity or due to an antagonism between native *Brassica rapa* bacteria and the 6 isolated bacteria from the drought-tolerant plants? To

answer this question, lawns of the six root bacterial isolates were tested against 12 native *Brassica rapa* bacterial isolates for antibiotic activity. Of the 12 native *Brassica rapa* isolates, several isolates exhibited antibiotic production against five of the six root bacteria. The production of biofilms and antibiotic activity might explain the inhibitory effects of the *Brassica rapa* native bacteria on the growth of the six isolates from the drought-tolerant plants. In a second poster we have done a molecular characterization of the six isolates.

Bat Monitoring by Echolocation for Upper Mississippi National Wildlife and Fish Refuge, US Fish & Wildlife Service

Amy Scherer

Faculty Mentor: Neal Mundahl

Determine if local bats used USFWS bat houses set at boat landings and determine what bat species frequented the area June through October. An Echo Meter Touch 2 Pro was used to record acoustic sessions at boat landings. Sessions began 30 minutes before and concluded an hour after sunset. Seven bat species were recorded during sessions from five locations along the Mississippi River. Bats were documented, as they left bat houses, by quantity of calls and time of day. Findings showed one of five bat houses was in use during sessions, seven bat species occupy the area including the federally endangered Northern Long-Eared bat recorded in two locations, indicating their presence.

Common Carp Abundance and Age Structure in East and West Lake Winona

Avery Schnaser and Chris Kluzak

Faculty Mentor: Neal Mundahl

The objective of this project was to determine if populations of Common Carp (*Cyprinus carpio*) in East Lake Winona varied from West Lake Winona carp populations in abundance and age/size structure. Field work included boat-electrofishing along shorelines of East and West Lake Winona, extracting 3-4 scales, weighing, and measuring length of each Common Carp caught. Lab work included aging each common carp caught using a dissecting microscope, fine-tip permanent marker, and calipers to determine the distance of each growth ring from the center of the scale. A total of 44 Common Carp were sampled during the study, 14 individuals from East Lake Winona and 30 individuals from West Lake Winona. West Lake had a Common Carp density of 26.25 fish per hectare and East Lake had a density of 10.00 fish per hectare. Age-size structure showed a difference in the common carp populations between East Lake Winona and West Lake Winona.

Comparing Failure to Thrive Rates of a Regional Hospital to U.S. National Rates Including Comparisons of CDC and WHO Growth Charts

Ashley Brommerich

Faculty Mentor: Sarah Lallaman

Failure to thrive (FTT) in infants has proven to be a difficult topic to study, due to FTT being multifactorial in the majority of patients diagnosed with it. This study was designed to determine if there is a high prevalence of failure to thrive patients at Winona Health in comparison to other hospitals, as well as to determine if failure to thrive statistics vary when using the WHO (World Health Organization) growth chart compared to the CDC (Center for Disease Control) growth chart. This was done by

conducting a retrospective analysis on patients 0-2 years of age from January 2017 to present and comparing charted data points between the WHO and CDC growth charts. Results are still being analyzed at this time. Currently Winona Health uses the CDC growth chart for patients 0-2 years of age. Therefore, results from this study could lead to Winona Health measuring growth using the WHO chart for infants 0-2 years.

Effects of Exercise on Glycemic Response after Consumption of Monster Energy

Bailey Sapa, Arden Heath, James Gronseth, and Kevin Leask

Faculty Mentors: Frances Ragsdale and Ted Wilson

Energy drinks have been anecdotally associated with deleterious cardiovascular health outcomes. These drinks contain ingredients, including but not limited to caffeine, which could affect glycemic response to the carbohydrate ingredients in the drink. Exercise alters insulin sensitivity and could be a factor related to the response to acute energy drink response. The aim of this study was to determine if acute exercise would alter the glycemic and physiological response to the consumption of Monster Energy ©. Following an overnight fast, human subjects (age 19.11±1.39; 30 female; 5 male) were randomized to exercise on a stationary bike at 33% of their predicted VO_2 max for 10 minutes with a five minute sitting rest after, or sitting (control) for five minutes prior to ingestion of Monster Energy. Blood glucose, heart rate, and blood pressure were measured 0-, 30-, 60- , and 90-minutes postprandially. Data is represented as LSM ± SE with significance analyzed using a t-test, or multiple comparison test. Significance is assumed when $P< 0.05$. Blood glucose (mg/dL) for control at 0-, 30-, 60-, and 90-minutes 91.58±1.2, 133.7±4.29, 96.3±4.17, and 82.4±1.82 mg/dL, respectively. For those receiving bike exercise prior to ingestion blood glucose was 92.2±1.2, 126.6±3.79, 92.5±2.27, 84.0±1.77 mg/dL. There were no significant blood glucose differences observed between groups across time, within group significance in both groups was observed between 0 and 30, 30 and 60, and 60 and 90, for control only. Heart rate for control at 0-, 30-, 60-, and 90-minutes was 78.0±3.06, 78.2±2.55, 78.6±2.6, and 74.4±1.85 respectively. For those receiving bike exercise prior to ingestion heart rate was 88.7±3.71, 85.5±2.69, 83.1±2.35, and 80.3±2.89. There were no significant heart rate differences observed between groups across time, within group significance in both groups was observed between 0 and 30, 30 and 60, and 60 and 90, for control only. Blood pressure for control at 0-, 30-, 60-, and 90-minutes was 86.8±2.05, 89.2±2.05, 89.2±2.5, and 87.6±2.6. For those receiving bike exercise prior to ingestion blood pressure was 90.6±3.07, 88.98±2.3, 88.2±1.97, and 86.98±2.08. There were no significant blood pressure differences observed between groups across time, within group significance in both groups was observed between 0 and 30, 30 and 60, and 60 and 90, for control only. In conclusion exercise probably does not alter the glycemic and physiological response to energy drinks.

Fall 2017 and Spring 2019 Winona bird populations: A comparison

Amanda Marquardt and McKayla Becker

Faculty Mentor: Neal Mundahl

This project's objective is to assess the bird community along the wooded shoreline of Lake Winona during winter and early spring of 2019, allowing for a comparison to be made with data previously collected from the bird community along the same area during fall and early winter of 2017, as well as the more constructed area on the opposing side of the lake. Bird species were observed, identified, counted, and recorded during multiple timed walks along the developed (parkland) and undeveloped (woods and wetland) shoreline areas of east Lake Winona from the months of February-April 2019.

Values recorded will be used in a comparative analysis between the undeveloped areas during 2017 and 2019 and between the developed and undeveloped areas during 2019. As of date, 102 birds representing 11 species have been observed, House Sparrows (31%) and Black-capped Chickadees (18%) being the most dominant of the species seen. Additional species include: Down Woodpecker (10%), Northern Cardinal (9%), American Crow (8%), Red-Wing Blackbirds (8%) and American Robin (7%), with White Breasted Nuthatches, Dark Eyed Juncos, Mallards, Geese, all ranging below 5%. More migratory species (e.g., various sparrows, red-wing blackbirds and warblers) are expected to expand the bird community diversity along the lake shorelines as spring returns. Results collected will give key information about the potential differences in bird species that reside in this area, which provides important insight on the changes in the health and stability of the ecosystem in the undeveloped area between the 2017 and 2019 years.

Genomic diversity and characterization of lungworms

Jada Terry, Janice Anoka, Kendra Kappes, Lorine Onwonga, and Shannon Moua.

Faculty Mentor: Kimberly Bates

Analysis of the genetic diversity of organisms plays an important role in research of related species and clinical applications. Lungworms (*Dictyocaulus* spp) have been identified in many species of ruminants. This study aimed to investigate the genomic variations of lungworms species, which could potentially lead to practical control methods and therapeutics in the distinct species of lungworms. To determine genetic relatedness, lungworm DNA was isolated from white-tailed deer (*Odocoileus virginianus*), New Zealand Red deer (*Cervus elaphus*), Louisiana cattle (*Bos taurus*), Mississippi cattle, and Wisconsin cattle and extracted, amplified through polymerase chain reaction (PCR), and then visualized using agarose gel electrophoresis. Currently, the PCR protocol has been unreliable and protocols are being designed to give more consistent results. At the moment, different approaches are being used to get the PCR to run and be able to get consistent results when amplifying. Once the PCR is fully functional, the next steps will be DNA cloning and sequencing for further investigation of the different species.

Key words: Lungworms, PCR, Genomic diversity, Agarose gel, DNA Cloning, DNA Sequencing, Electrophoresis.

The Identification of Unknown Tapeworms in Bobcats

Alexa Anderson, Shelly Whelan

Faculty Mentor: Kimberly Bates

Bobcats (*Lynx rufus*) have been found to be a popular host for several different species of tapeworms. As the population throughout the Midwest United States increases, the concerns regarding the number of available reservoirs for epizootic and zoonotic parasites, including tapeworms, also increases. One hundred bobcat intestines were collected in March 2012 from the Department of Natural Resources Facility in Madison, WI and analyzed for the prevalence and intensity of gastrointestinal parasites. Tapeworms were identified based on proglottid and scolex morphology, however, because the intestines were frozen and thawed multiple times before worms were collected, the morphology was often compromised. In order to definitively identify the tapeworms, our goal was to develop specific PCR primers for cestodes species found in bobcats. Based on previous research studies completed on tapeworms found within bobcats in the Midwest, the genus *Diphyllobothrium* and *Taenia* were likely to be present in our Wisconsin bobcats. Primers were developed for *Taenia* based on the published sequences of *Taenia solium*, a pork tapeworm that is transmitted to pigs. Extracted DNA from the

bobcat tapeworms were amplified along with DNA from previously identified museum samples to use as controls. Currently, amplified DNA using different sets of primers are being prepared for sequencing. This research is a continuing project and becomes somewhat complicated due to the fact that so few animal tapeworms have been sequenced, therefore having little information to compare to our findings.

Morphogenesis: Pharyngeal Arch Development in *Ambystoma tigrinum*

Madison Worke, Taylor Cooper, Emily Krahn, and Amy Broll

Faculty Mentor: Amy Runck

This study examines pharyngeal arch (PA) development in the eastern tiger salamander (*Ambystoma tigrinum*) during transformation. The PA is a series of six arches that give structure to the gills and is involved in feeding and moving water across the pharyngeal and branchial chambers. Proper remodeling of the PA during transformation is essential to ensure proper respiratory functioning and feeding in terrestrial salamanders. Salamander carcasses were obtained from salamanders that died before, during, or after transformation to a terrestrial state. The carcasses were cleared and stained with alcian blue (cartilage identification) and alizarin red (bone identification) to evaluate PA remodeling during transformation. The majority of salamanders exhibited abnormal PA remodeling. Based on current findings, we hypothesize that the abnormal ossification may be in part due to a changed morphogenesis process.

Physiological Basis of No-go Decay with Sod1Δ Saccharomyces cerevisiae

Amber Lobb, Emily Cianflone, Madison Champine, Lindsey Bailey, Lucas Seaberg, and Safa Aiyana Mahina

Faculty Mentor: Scott Segal

Chromium VI (Cr (VI)), a common byproduct of industry, induces oxidative stress in cells, resulting in altered gene expression, increased apoptosis, and cell death. Previous work has shown showed that Cr (VI) exposure results in the formation of 8-oxoguanines (8- oxo(G) bases) in mRNA. These 8-oxo(G) bases lead to ribosome stalls during translation and the activation of no-go decay. Upon ribosome stalls, no-go decay is activated. During no-go decay, the Dom34p/Hbsp1p complex acts to remove stalled ribosomes and promote endonucleolytic cleavage of the damaged mRNA at the stall site. Although oxidative agents and other non-physiological substrates have been used to activate no-go decay, very little work exists to elucidate the true physiological role of this pathway. Sod1p (superoxide dismutase 1) scavenges free oxygen species by catalyzing the partitioning of superoxide (O_2^-) into O_2 and H_2O_2. Cells that lack functional Sod1p have been observed to have increased oxidative stress resulting in increased P-body assembly, while leading only to an attenuation of global translation. To determine whether no-go decay is being activated in strains lacking Sod1p, double mutant strains were created in which SOD1 was knocked out in conjunction with one of the effectors of no-go decay. Consistent with no-go decay being activated in response to oxidation, the hbs1Δsod1Δ strain resulted in a decrease in Pbody assembly, as compared to wild-type strain, even in the presence of Cr (VI). To assess how effective Sod1p is as a deterrent to 8-oxo(G) base formation in the presence of Cr (VI), the SOD1 gene was overexpressed in yeast cells. The presence of high levels of Sod1p was hypothesized to limit the number of 8-oxo(G) in response to the Cr (VI) and affect P-body assembly. However, overexpression of Sod1p does not seem to compensate for Cr (VI) mediated oxidation. Instead, we will look under milder oxidative conditions. Interestingly, Stm1p is thought to potentially to aid in the dissociation and recycling of the ribosomal subunits. In the stm1Δ and wild-type strain, P-body assembly was mildly decreased when treated with

Cr (VI), which is consistent with Stm1p functioning to recycle ribosomes downstream of no-go decay. Additionally, stm1Δ can suppress sod1Δ growth defects on Cr (VI) containing media.

Prevalence of Lyme Disease in *Ixodes scapularis* Ticks in Southeastern Minnesota and West Central Wisconsin

Ashley Brommerich, Alexis Daly, Sydney Hastings, and Jennifer Myhre

Faculty Mentor: Kimberly Bates

Lyme Disease is a common, widespread disease in the U.S. that is transmitted to humans through the bite of an infected *Ixodes* tick. The majority of Lyme Disease cases are found in Minnesota and Wisconsin, as well as along the East Coast in states ranging from Maine to Virginia. It was hypothesized that the Mississippi River acts as a barrier against the spread of Lyme Disease between Wisconsin and Minnesota. *Ixodes* ticks were collected from both sides of the river during legal white-tailed deer hunts from 2005-2012. A PCR was developed that amplified *Borrelia burgdorferi* (Lyme Disease) in ticks. In order to determine if the DNA was intact and viable, a multiplex PCR was developed to amplify both tick and *Borrelia* DNA simultaneously. Results are still being collected and analyzed at this time. Once both *Ixodes* and *Borrelia* DNA consistently amplify in a single reaction, multiple samples of female *Ixodes* ticks will be tested to determine if the ticks are positive or negative for *Borrelia* DNA.

Size and Abundance of Brown Trout Associated with Under-Bank Cover and Mid-Channel Boulders in Garvin Brook's 2014 and 2017 Habitat Improvement Projects

Alicia Skolte

Faculty Mentor: Neal Mundahl

Stream habitat improvement (HI) projects are an integral part of management for Brown Trout in southeastern Minnesota, and this study examined the size and abundance of trout associated with various artificial cover structures in two improved sections of Garvin Brook. Both improved reaches (construction in 2014 and 2017) incorporated large, mid-channel cover boulders, but reaches differed in the type of under-bank cover structure used (LUNKERs [2014] versus skyhooks [2017]). Electrofishing was used to capture Brown Trout associated with individual or clustered cover structures (5 boulders and 5 bank covers per reach), with all trout then weighed (g) and measured (mm total length). Brown Trout catch per unit effort (CPUE) did not differ between boulders and bank cover in either section, but CPUE was twice as high in the 2014 HI section (6.7 fish/minute) versus the 2017 HI section (3.2 fish/minute). Greater number of fish were found associated with wooden structures and the 2014 HI reach. In contrast, trout were significantly larger and in better condition within the 2017 HI reach. Artificial cover structures were used by trout in both the 2014 and 2017 HI sections, with differences in trout size and abundance between sections possibly influenced by other habitat differences (e.g., pool size, log cover, riparian use) between HI reaches.

Small Mammal Biodiversity in Garvin Heights (Winona, MN)

MacKenzie Hanson, Mallorie Lynn, and Joey Coleman

Faculty Mentor: Amy Runck

Small mammal biodiversity is important for proper ecological functioning of savanna and prairie habitats. The Garvin Heights Natural Area (Winona, MN) is being restored to its native habitats of bur

oak savanna and dry bluff prairies by using goat browsing, prescribed fire, selective cutting, and chemical treatment of invasive plants. In order to document small mammal diversity, a mark-recapture method was used in 2017 and 2018 to survey the unrestored and restored prairie habitats, as well as the unrestored and restored savanna habitats of the Garvin Heights Natural area. Diversity was low, with only deer mice (*Peromyscus spp.*) and a single northern short-tailed shrew (*Blarina brevicauda*) observed. We used mitochondrial DNA barcoding on Peromyscus spp. hair samples to determine how deer mice in this part of the Driftless Region are genetically related to other North American populations.

The Distribution of Turtles on Lake Winona

Hannah Loken

Faculty Mentor: Neal Mundahl

The Lake Winona turtle population can be seen throughout a variety of locations around both East and West Lake Winona. This study was conducted to investigate the preferred location and habitat in which turtles live and bask. I observed the basking locations of the turtles for two months, also noting the species of turtles seen. Traps made of PVC pipes and mesh wiring were used to obtain samples of turtles, which were then weighed and measured, and promptly placed back into the lake. The datum I procured was used to create tables and graphs comparing the number of turtles seen to the location in which they were seen. I located approximately 54 fallen trees and logs as potential basking sites for turtles among the two lake basins, and observed 117 painted turtles, 2 false map turtles, and 1 snapping turtle using 13 of these basking sites. I captured four painted turtles; 2 females (average weight = 367 grams, average carapace length = 14 cm, average carapace width = 10.4 cm), 2 males (average weight = 285 grams, average carapace length = 12.9 cm, average carapace width = 9.7 cm), and 1 male false map turtle (weight = 112 grams, carapace length = 10.2 cm, carapace width = 8.3 cm) within 40 trap-nights of collecting effort. This information revealed the preferred location and habitat of the Lake Winona turtle population.

West-Nile virus replicon particle entry requires the C-terminal half of the carbohydrate-recognition domain of the Dendritic cell-specific ICAM-3 grabbing non-integrin related protein

Hannah Kunkel, Anika Ludwig, Brock Burmeister, Emin Budimlic, John Keilty, Wells Pollock, Madilyn Schmitz, Nicole Crowson, Nathan Leonard, Amanda Madigan, Victoria Schwarzinger, Alyssa Meyer, Mary Soderlund, and Jean Lim

Faculty Mentor: Osvaldo Martinez

West-Nile virus (WNV) is an arbovirus usually transmitted to humans via a mosquito vector. Infections commonly result in febrile symptoms while rare severe neuroinvasive cases may result in encephalitis or meningitis. Studies have shown that WNV infection efficiency is enhanced by expression of DC-SIGNR on target cells, which normally do not express DC-SIGNR. To investigate WNV tropism, we established 293T kidney epithelial cell lines that stably express vector, DC-SIGNR and mutants of DC-SIGNR that lack the entire carbohydrate-recognition domain (CRD) or lack the C-terminal half of the CRD. We demonstrate successful surface expression of DC-SIGNR and its mutants from stably-transfected 293T cells, but not vector-transfected 293T cells. Further, we show that monoclonal antibody 120604 which binds specifically to the DC-SIGNR CRD binds to DC-SIGNR expressing 293T cells, but not to vector nor any of the DC-SIGNR mutants expressing cells. Virus replicon particles (VRPs), replication-incompetent viral particles containing necessary structural proteins for infection and a viral plasmid including a GFP

reporter are used to safely and conveniently study viral entry. Entry assays using WNV (NY99) VRPs as well as a variant of WNV (NY99) which contains the beta-lactamase enzyme show significant entry into DC-SIGNR expressing cell lines, but not in controls that do not express DC-SIGNR. Additionally, we show that WNV VRPs do not enter DC-SIGNR expressing cells that lack the CRD or the C-terminal half of the CRD suggesting that the C-terminal half of the CRD is required for successful entry of WNV via DC-SIGNR. Future experiments may be able to shed light on which amino acids are required for entry.

Winterization of Langstroth Honey Bee Hives in the Midwest

Emily Hoffman and Ashley Olichwier

Faculty Mentor: Robin DeVinney

When people see a bee, there is often a frightening gasp or panicked running away that follows. When people hear the word bee, they can picture a wide range of insects including honey bees, bumble bees, wasps or hornets. Among pollinating insects, people have taken a special interest with modern honey bees. Honey bees are in the order Hymenoptera and part of the family Apidae. The most common species of honey kept in the United States is the *Apis mellifera,* known as the European honey bee. Due to their pollinating ability, they have become widely utilized for agricultural purposes. The increased productivity seen in growing even a simple vegetable or flower garden has led many people to pick up the hobby of becoming a backyard bee keeper.

During the fall of 2018, we assisted a merge involving Winona's East Rec Center's failing Langstroth honey bee hive in to a healthy Langstroth hive located in Winona. The East Rec Center's hive was without a queen bee and did not have enough honey stored up to survive the winter. The only way to fix a hive that has failed so badly is to merge it with a healthy and established hive. The fact that it was so late in the season also left this as the only viable option. This led us to our first hands-on experience with bee hives.

After the merge, we realized there was a bigger picture to think about, and that was how to get the hives successfully through the winter if the merge was effective. This interest we took in the bee's winter survival led us to want to study the variety of techniques regarding winterization of honey bees in the Midwest as our capstone project. This interest led us on a journey of speaking with several local bee keepers to learn their methods. By comparing the methods to each other we were able to pick out many significant differences. We did additional research and found out there are many techniques and we wanted to find the best technique to ensure the best chance of success over the winter. We focused on basic winterization methods paired with three specialized techniques which was the dry sugar method, addition of a moisture board, and making a moisture quilt. Initially, we wanted to narrow the best technique down to one, but we determined that all three methods were appropriate depending on each bee keeper's unique situation.

Business Administration

Attract-Motivate-Retain Millennials: A Job Design Perspective from Thern, Inc.

Emma Berlyn, Terra Radermacher, and Evan Veres

Faculty Mentor: Jing Han

The process of defining the way work will be performed, called job design, is one of the most important aspects of a running an efficient and effective business. Not only is job design imperative to the success of a business, but also to the overall satisfaction of employees. We will be focusing our research of job design on Thern Inc. To specify the aspect of the company's job design, we will be analyzing the company's employee retention, the balance between work and life, college recruiting the company does, and how the company appeals to the younger generation. We will be using theories such as the Job Characteristics Model to analyze the performance of Thern's job design methods. This performance will be determined by interviewing employees, communicating with the company's head of HR, and comparing this information we find to current industry trends.

Conflict in the Workplace: An Empirical Analysis of the Antecedents and Resolutions

Elizabeth Schamber and Anneliese Davis

Faculty Mentor: Jing Han

Various types of conflict can be identified in organizations, such as interpersonal conflict, team conflict, and inter-group conflict. Conflict resolution is crucial in the workplace to create a healthy and happy work environment employees want to work in. Without effective conflict resolution, it would be hard for people to get along, quality work wouldn't get done, and it would be difficult to communicate effectively between employees, teams, and departments. This report will focus on the different underlying causes of conflict at the individual level in the workplace and what strategies are used to solve these conflicts. The information collected for the report has been conducted through two surveys with employees from Fastenal. This study offers ways to find the best strategies to overcome interpersonal conflict in the workplace.

Employee Discrimination Training Program at Nike Inc.

Lauren Hunter, Emily Roach, and Nina Lovekamp

Faculty Mentor: Jing Han

Employee discrimination is one of many important issues that can take place in the workplace. In July 2017, the well-known sports apparel company, Nike, faced a major lawsuit for gender discrimination. A woman claimed that Nike has a culture of gender bias and sexual harassment. Due to the hostile work environment and not being treated equally with the men of the organization, the woman decided to leave her position as a director after being with Nike for four years. This study provides a potential solution to the issue of discrimination in the workplace by implementing a training program for all the employees. Our group will be using a plethora of resources including text books, scholarly articles, and surveys to enhance our research. This study uses the "Training and HRD Process Model" to create the framework for our training. First, we will conduct a needs assessment, then prioritize the needs. Then with the information collected through the needs assessment, we can design our training. After designing our training program, we will then evaluate the effectiveness of our training through

employee surveys and interviews. The training program will teach employees how to detect and prevent employee discrimination using tools such as role-playing scenarios to know how to handle these difficult and uncomfortable situations.

Job applicants as the new customer: Strategies for successful recruiting in Midwest manufacturers

Sarah Schake

Faculty Mentor: Jana Craft

The manufacturing industry is currently facing challenges on several fronts—of the most vital is the recruiting of new employees to fill vacancies. The purpose of this article is to understand current recruiting challenges facing the manufacturing industry and offer strategic solutions to best fulfill employer needs. Face to face interviews and electronic surveys were used to collect the most up-to-date information on recruiting challenges, tools, and resources in a mid-sized town in the Upper Midwest. Main findings focus on the need for varied recruiting strategies at different stages of the recruiting process; what has worked the past that is not working now; and specific resources used by employers that are producing successful results. A tension was found between published best-practices in recruiting for manufacturers and actual, on-the-ground, practical solutions--an important and valuable outcome of this research.

Mayo Clinic Employee Evaluation Process

Joselyn Hurlburt, Mikayla Wickersham, and Bailey Rye

Faculty Mentor: Jing Han

With the many tasks of a Human Resource manager, especially in a hospital setting, there are many responsibilities that each employee takes on. Our research topic is on how human resource professionals at Mayo Clinic Rochester, MN evaluate their employees work performance. The process of evaluating each employee's different responsibilities is known as the assessment and review of a worker's job performance, we are curious to learn what Mayo Clinic's employee evaluation process is. Further into our research, we will be finding out how Mayo Clinic evaluates their employees and comparing their methods to other companies.

A few questions we choose for our research question was, "How do Human Resource professionals evaluate their employees and what does performance management look like at Mayo Clinic?" We chose these questions because Mayo Clinic has many employees and a wide variety of specialties within those employees. Our sub-questions include, "How do Human Resource professionals evaluate board members? How do Human Resource professionals evaluate doctors, especially with all their different specialties? How-to Human Resource professionals evaluate nurses and doctors?" We are currently conducting interviews for our data collection.

Motivation in the Workplace: How and Why Organizations Seek to Motivate Employees

Trevor Duerr, Jeongwook Moon, and Jorgen Erickson

Faculty Mentor: Huh-Jung Hahn

There are many factors that contribute to employee performance. One of the important factors is motivation. In this article we investigated the motivational factors that affect employees in the workplace. The main topics explored in this article include the varying types of motivation, why they are

practical, and how they can be used in a professional setting. The study also included an interview with a HR representative in Samsung Semiconductor Department. In the interview, the representative was asked ten questions to obtain practical perspective regarding employee motivation and the roles of Human Resource department. This article supports the findings of previous research in that employees' motivation can directly and indirectly influence their company.

Work Life Balance for Working Parents

Nina Lovekamp, Krishan Chauhan, and Taylor Goins

Faculty Mentor: Huh-Jung Hahn

The importance of work life balance has changed over time. The baby boomer generation was not worried about finding a balance they were focused on making money and providing for their family. The generations coming into the work place now are much more concerned about the balance between family and work. According to the Bureau for Labor statistic 80.5% of families have someone employed which means that this topic will affect a large percent of the population.

Throughout the course of this paper we will look at what work life balance is, why work life balance is important to parents in specific, what practices organizations use that are successful to create a work life balance and what practices draw employees to a specific organization. First a look at the definition of "work life balance" will clarify what exactly the broad topic we are looking at means. Research of examples of benefits companies use to make work life balance possible led us to talk to a Human Resource Professional about what, in her opinion, works the best as a Human Resource Professional as well as a parent herself. It is important to look at this as a two-sided discussion because not only is work life balance beneficial to the parents and their family, but it is also pertinent to a successful company as well. This paper will then conclude with recommendations of what every organization should and should not do to create and continue work life balance.

Chemistry

A Fast, New Teaching Lab Protocol for the Preparation of Titanocene Dichloride

Taylor Bell

Faculty Mentor: Joseph West

Bis(cyclopentadienyl)titanium(IV) chloride (a.k.a. "titanocene dichloride") is a well-known metallocene complex with applications as a polymerization pre-catalyst and cytotoxic agent. The classic procedure, in use since the mid-1950s, returns respectable yields but is procedurally impractical for implementation in a teaching lab, requiring multiple, multi-hour steps and a long workup procedure. A procedure for the synthesis of the classic metallocene laboratory complex, ferrocene, has been modified enabling the complete synthetic process from distillation of cyclopentadiene precursor to isolation of the final product in two hours, while still returning a yield sufficient for teaching lab characterization. The target complex is characterized by ^{1}H and $^{13}C\{^{1}H\}$ NMR as well as melting point.

A Family Portait: 3D Printing the Enzymes of Glycolysis

Olivia Nelson

Faculty Mentor: Jonathon Mauser

For generations of students studying chemistry, the simple ball-and-stick molecular model set has been the gold standard by which to obtain tactile feedback and visually investigate chemical phenomena. While this time-tested approach has been proven to work well for small molecules, larger macromolecules are prohibitively expensive to build and difficult to model in a biologically consistent way. There is proof in the literature that 3D printing is an excellent pedagogical technique: many universities are using the technology, especially in the fields of anatomy and chemistry. 3D printing enables students to more readily associate and imagine multifaceted and unique structures that would typically be done using microscope images or improved 2D representations from a course reading. The utilization of 3D printed models has especially allowed noteworthy improvement on exam scores, with experimental groups performing better than traditional groups on several metrics. Of all the enzymes biochemistry students learn, the enzymes of glycolysis are perhaps the ones students come to the greatest familiarity with, therefore we have printed the 10 enzymes of glycolysis at a similar scale for both comparison and teaching purposes. From these models students will gain familiarity with what proteins actually look like and will be able to identify active sites, understand the concepts of general protein folds, and identify where noncompetitive and competitive proteins bind. Through the use of these models, students will be able to physically point out the positions of the amino acids within the active sites making the complex mechanisms easier to visualize and learn. Not only will this learning tool allow students to understand the concepts better, but it will also connect the students more to each other and the faculty of WSU.

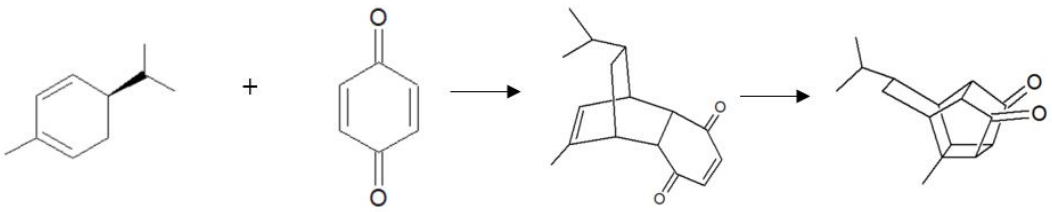
[2+2] Cycloaddition of a Diels-Alder Adduct Using UV Light or $Ru(bpy)_3^+$

Alison Henkemeyer and Jacob Wittenberg

Faculty Mentor: Thomas Nalli

The Diels-Alder reaction remains one of the most important and extensively studied syntheses in organic chemistry. The double bond in the resulting Diels-Alder adduct allows for further Diels-Alder reactions or

other reactions such as the [2+2] cycloaddition. At Winona State University, a Diels-Alder reaction that in use in the organic chemistry teaching lab is that of α-phellandrene (**1**) and p-benzoquinone (**2**) to form a tricyclic adduct (**3**). In accordance with molecular-orbital-based predictions, the product is expected to be the endo diastereomer rather than the exo, but students currently obtain no experimental evidence for this. Thus, the intramolecular [2+2] cycloaddition to form the cage compound (**4**) is an interesting possibility as an add-on for the teaching lab because it demonstrates the endo stereoselectivity of this compound unambiguously. The [2+2] cycloaddition requires photocatalysis, traditionally using UV light. However, another recently developed photocatalyst called Tris(bipyridine)ruthenium(II)$^{+}$ [$Ru(bpy)_3^{+}$] can also be utilized. The Diels-Alder reaction was carried out and the product (**3**) was purified via recrystallization then subjected to UV irradiation to obtain (**4**) which was characterized ^{1}H NMR. The next step will be to use $Ru(bpy)_3^{+}$ with an amine as a photocatalyst in place of UV irradiation to perform the [2+2] cycloaddition. The goal of this experiment is to determine whether the [2+2] cycloaddition can be carried out in the organic teaching lab without the use of UV light.



A More Expedient Route to Diphenyl Ditelluride and Its Development as an Inorganic Laboratory Experiment

Maggie Ludwig

Faculty Mentor: Joseph West

Herein we describe the development of a more expeditious route to the main group metal compound, diphenyl ditelluride. Conventional procedures require approximately 24 hours, but our simplified approach can be completed in less than 4 hours, including a necessary recrystallization step, with no significant loss in yield. The procedure has been written into a laboratory experiment for an upper-level inorganic chemistry class to be executed in a future term. As a laboratory experiment, heteronuclear NMR (specifically, ^{125}Te{^{1}H} and ^{13}C{^{1}H}) are highlighted, but additional characterization by MS, UV-vis and melting point are also discussed. Included in this laboratory experiment is a molecular modeling aspect with comparisons to experimentally obtained data.

An Analysis of Aromatic Imine Antioxidant and Antibacterial Properties

Julia Fogarty

Faculty Mentors: Emily Ruff and Joseph West

Reactive oxygen species are molecules that are byproducts of many cellular transduction pathways produced by oxidative phosphorylation. These reactive oxygen species have the ability to sporadically form single electron radicals that are dangerous in cellular function. Antioxidants are used to find these reactive oxygen species and neutralize them. This study is to find the antioxidative and potential

antibacterial properties of several aromatic imines (characterized by 300 MHz NMR, IR and melting point). The imines include 2-[(E)-{[4-(dimethylamino)phenyl] methylidene} amino] phenol (A), 2-[(E)-(phenylmethylidene)amino]phenol (B), 2-[(E)-[(4-chlorophenyl)methylidene] amino]phenol (C), 2-[(E)-[(4-fluorophenyl)methylidene]amino] phenol (F), {4-[(E)-[(2-hydroxyphenyl)imino]methyl]-phenyl}(oxido)nitroso (N), 2-[(E)-[(4-methoxyphenyl) methylidene]amino]phenol (O), and 2-[(E)-[(4-methylphenyl)methylidene] amino]phenol (T). The imines' antioxidative strengths were tested using DPPH and FRAP. Disk diffusion assays were also performed. Analysis is still in progress.

Effects of Anti-amyloidogenic Properties of Antioxidants on Bovine Gamma Globulin and Hen Egg White Lysozyme using Thioflavin T Fluorescence and Circular Dichroism Spectrometry

Samantha Skaar

Faculty Mentor: Myoung Lee

Alzheimer's disease is an age-linked disease which involves cognitive impairment secondary to neurodegeneration. The formation of beta-amyloid fibrils in between neurons is a major mechanism contributing to this disease pathology. The formation and degradation of these proteins have been a major target in research for this debilitating disease. Natural compounds have been shown to have anti-amyloidogenic properties and have gained popularity within certain niches. The following natural compounds were added in different concentrations to beta-amyloid fibrils formed in vitro, using bovine gamma globulin (GG) and hen egg white lysozyme (HEWL): Epigallocatechin-3-gallate (EGCG), a bioactive compound found in green tea extract; nordihydroguaiaretic acid (NDGA), an antioxidant found in the creosote bush; phloretin, an antioxidant flavonoid in apples; and ellagic acid (EA), a polyphenol and a natural dimeric derivative of gallic acid that is found in fruits and nuts like grapes, strawberries, raspberries, and walnut. Incubation of these solutions and fluorescence analysis using thioflavin T (ThT) fluorescence revealed a hyperbolic dose-dependent response for EGCG when fluorescence was plotted against concentrations of 0, 1, 2, 5, and 10mM EGCG. ThT, which is known to bind amyloid fibril to form a complex, resulted in an increase of ThT fluorescence without a lag phase. The excitation wavelength used was 440 nm with an emission wavelength of 482 nm. In 2 mg/mL GG, percent activation for 1, 2, 5, and 10mM EGCG when compared to the control (0mM) was 114, 186, 990, and 420%, respectively. For 2mg/mL HEWL, percent activation for 1, 2, 5, and 10mM EGCG when compared to the control (0mM) was 117, 134, 221, and 450%, respectively. Fluorescence was also noted to be less for HEWL than for GG as the average fluorescence for the first two hours of analysis for the control 2 mg/mL HEWL was 33.23 and was 989.52 for 2 mg/mL GG under the same conditions. This response appeared in both GG and HEWL. No relationships were observed for NDGA, phloretin, and EA. Circular dichroism (CD) data was used to show the composition of secondary structure in GG and HEWL. Both of these proteins with inhibitors of phloretin and EA indicated that most of GG's secondary structure has changed to random coil structure and most of HEWL's secondary structure has remained alpha-helical. The presence of phloretin and EA during incubation did not affect the secondary structure of GG and HEWL. There is no available CD data for EGCG and NDGA due to time constraints but may be explored in the future.

Co-imaging of polarity proteins during division of the *Drosophila melanogaster* central brain neuroblast

Grace Jacobs and Sadie Spaeth

Faculty Mentor: Jonathon Mauser

The fruit fly, *Drosophila melanogaster,* is a widely used model system with which to study asymmetric cell division (ACD). ACD is a process within the neuroblast stem cell that results in the formation of polarized cell domains and eventually to two daughter cells of different fates – one cell becoming a neuron/glial cell, while the other self-renews as a stem cell. During ACD, errors in protein polarization along the apical/basal cortex of the cell can occur, leading to cell proliferation and the formation of tumor cells. So far, the pathway leading to polarization is largely understood, but the precise temporal dynamics are not well documented. Here, we propose to sort out the molecular pathway leading to apical domain formation in *Drosophila* neuroblasts by imaging two putative upstream components, Bazooka (Baz) and Inscuteable (Insc) at the same time in living cells in order to determine which protein localizes first to the membrane. To show sufficiency, we also propose to image the polarization dynamics of the two players under RNAi conditions where the other player is absent to determine whether wild type behavior is maintained or lost. With these tools in hand, a more precise understanding of the assembly of these large complexes can be gained with clear implications in understanding the development of intractable cancers such as neuroblastoma and glioblastoma.

Concentration of Mestranol in Wastewater using High-Performance liquid chromatography

Lauren Sperling

Faculty Mentor: Jeanne Franz

A prevalent estrogen found in oral contraceptives, such as birth control, is the estrogen mimic mestranol. Mestranol has been found to have a negative impact on the environment and is causing an increase in the feminization of fish. It has also been found to have adverse health effects on humans such as endocrine disruption. In this study, mestranol was analyzed using UV detection. Mestranol absorbs UV light efficiently at 274 nm. The high-performance liquid chromatography (HPLC) is an ideal method for non-volatile compounds. Reverse phase liquid chromatography and polar solvents were used in order to determine the specific concentration of mestranol in wastewater samples. The specific concentration of mestranol has still yet to be determined. Work is underway to find a reliable approach for quantification.

Degradation of Acetaminophen in Water and Bleach

Nicole Ruhland

Faculty Mentor: Jeanne Franz

Acetaminophen is the main active ingredient in Tylenol, a medication taken by over 75 million Americans weekly as a pain reliever. While this medication is important and impacts the lives of many, acetaminophen is also one of many harmful chemicals found in lakes and streams. Due to the nature of the drug and the fact that so many people use the medication, a method was devised to test if acetaminophen could be degraded by bleach. This could be further tested to find if common household toilet cleaning products containing bleach could degrade acetaminophen fast enough in toilets directly to avoid the drug entering the water table, as some of the drug is excreted in urine by people taking the medication. Using HPLC with UV vis detection, acetaminophen in water was analyzed at a wavelength of

248nm. The first trial obtained results with symmetrical tall peaks near 3 to 4 minutes. Unexpectedly, the acetaminophen in HPLC grade water formed multiple peaks as samples were tested over the course of 3 weeks, which could be a sign of degradation. At two weeks, two peaks were present in HPLC both with peaks close to 4 minutes. After three weeks in a separate trial, three peaks were obtained around the 3 minutes time. The results obtained focus primarily on the degradation of acetaminophen in the HPLC grade water, as well as degradation of acetaminophen in bleach.

Design and Testing of a Mercury-free Schlenk Line Bubbler

Sara Johnson

Faculty Mentor: Joseph West

The Schlenk line (air-free vacuum manifold) is a staple of modern synthetic organic and inorganic labs, enabling the relatively easy handling of air- and moisture-sensitive materials. A necessity of these systems is the ability to provide an environment of inert gas, such as N_2 or Ar, that is above atmospheric pressure. This "overpressure" is enabled by use of a mercury bubbler. Given mercury's high cost and deleterious health and environmental effects, we have sought to design a new bubbler system as a replacement. We have developed a mercury-free bubbler system from simple and common laboratory glassware that provides as much or more overpressure than a commercial mercury bubbler and uses inexpensive and environmentally benign mineral oil. Our apparatus has been successfully implemented for use in both research and teaching lab settings.

Determination of phytosterols in mycorrhizal “burn” morel mushrooms by GC-MS.

Chun Wa Chu, Natalie Walker, Sumar Quint, and Alix Overgard

Faculty Mentor: Thomas Nalli

The focus of our research is analyzing the phytosterol content in dried morel mushrooms (Morchella). Morelsare thought to be mycorrhizal and or saprotrophicdepending on the environment. Mycorrhizal fungi have mutualism with plants such as elm and poplar trees whereas saprotrophic fungi grow on dead organic matter. We hypothesized that this variable can affect the amounts of phytosterols present in the morel fruiting bodies. Thus, for this project we studied “Burn” morel mushrooms with the assumption that they are to a large degree mycorrhizal. After a forest fire, morel mushroom harvests usually increase greatly and these specimens are referred to as “burns”. We extracted the phytosterols from ground dried mushrooms with petroleum ether, saponified the extract with NaOH/EtOH, and then derivatized the sterols as TMS ethers, which were analyzed by Gas Chromatography-Mass Spectroscopy (GC-MS). Cholesteryl stearate was used as an internal standard. All morels have large amounts of ergosterol and brassicasterol but the burns we analyzed also show a large peak (7-10% of total sterol content) of a previously unreported phytosterol thought to be ergosta–5,22,24,(28)-trienol. Other, morels we have analyzed in the past sometime showed this peak but sometimes did not, so it is possible that this compound is associated with mycorrhizal morels exclusively.

Development of a quantitative general chemistry experiment based on the hexaaquacobalt(II)-tetrachlorocobaltate(II) equilibrium demonstration

Hannah Tima

Faculty Mentor: Joseph West

The visually appealing aqueous equilibrium between hexaaquacobalt(II) ion and tetrachlorocobaltate(II) ion is a common general chemistry demonstration. The transition from a pink species to a blue species makes it easy for students to observe Le Chatelier's Principle in action as external "forces" applied to the equilibrated system cause a clear, observable result. We have taken this demonstration and modified and expanded it in an unprecedented direction to allow it to become a full laboratory experience with quantitative measure of reaction thermodynamics via spectrophotometric concentration measurements. With these new additions, students are able to explore in greater depth both conceptual and mathematical equilibria concepts.

Duloxetine metabolism in the presence of cytochrome P450 inhibitors

Astyia Golden

Faculty Mentors: Myoung Lee and Emily Ruff

Cytochrome P450 (CYP) enzymes are important for drug metabolism. They chemically modify drugs to make them more soluble, which allows the drugs to be excreted from the body. Of the 30 CYP enzymes, 6 (CYP1A2, 2C9, 2C19, 2D6, 2E1, 3A4/5) are of clinical interest because these enzymes are the key players in drug metabolism. Differences in genetics lead to individuals of the same species expressing different CYP enzymes. The different combination of CYP enzymes may affect the rate of drug metabolism or produce metabolites that may cause adverse side effects. Predicting drug metabolites and drug-drug interactions is important when designing and prescribing new drugs because other drugs can act as CYP activators or inhibitors. Duloxetine is an antidepressant mainly metabolized by CYP1A2 and CYP2D6 isotypes. In this experiment, Duloxetine was metabolized using rat microsomes. The metabolism in the presence and absence of inhibitors was measured using HPLC-MS.

Estimating Energy with the Generalized Many-Body Expansion Method for an Atmospheric Nucleation System

Alex Einck

Faculty Mentor: Hannah Leverentz-Culp

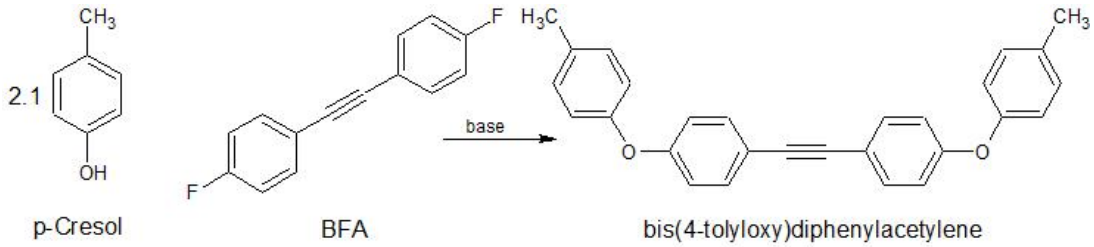
Fragment-based estimation methods are very useful for determining the energy of chemical systems, because it gets increasingly less possible to calculate the actual energy of a system as it increases in size. The many-body expansion method accomplishes this by combining sums of energies of smaller fragments of a system into terms which account for the energy of fragments, and the energies of the interactions between fragments. In this project, 2 variations of the many-body expansion method were performed on a $NH_3(H_2O)_3$ system undergoing several proton transfer reactions. The 3-body method was able to estimate the energy of the $NH_3(H_2O)_3$ system being studied with a mean absolute error of 1.21 kcal/mol. This estimate appeared to follow the same trends as the actual energy of the system. The 2-body method was able to estimate the energy of the system with a mean absolute error of 9.123 kcal/mol and did not appear to follow the same trends as the actual energy. The 2-body estimate appears to perform worse when atoms are close to being between multiple fragments while it is not clear what causes the variance in performance for the 3-body method.

Exploration of alternative mild conditions for S_NAr substitution reactions of bis(4-fluorophenyl)acetylene

Micah Alman

Faculty Mentor: Thomas Nalli

Our lab is investigating the synthesis of acetylenic poly(aryl ether)s using mild conditions. For example, we are interested in the preparation of poly(oxy-1,4-(phenylene)ethynyl-1,4-phenylene) (POPEP) (-O-Ph-C≡C-Ph-)$_n$, which is a novel material prepared by S_NAr A2B2 or AB polymerization that was patented in the 1990s, but to our knowledge was not characterized. To find milder conditions for the preparation of POPEP than those normally used for S_NAr reactions (180 °C, K_2CO_3, N-methylpyrolidone), we utilized 2.1 equiv of p-cresol and 1 equiv of the A2 monomer bis-4-fluoro(phenyl)acetylene to form a "trimeric" version of the polymer, bis(4-tolyloxy)diphenylacetylene. These reactions use the ethynyl bond to activate the phenyl rings for nucleophilic aromatic substitution, which is slow due to the weak electron-withdrawl provided by the C≡C. The conditions we have explored are 100 °C in the ionic liquid solvent, 1-octyl-3-methylimidazolium bromide (OmimBr), with K_3PO_4 as the base, as well as K_2CO_3, 18-crown-6 ether, and dry toluene, at 111 °C. We also used standard S_NAr conditions to prepare the trimer, which was characterized by NMR and mass spectroscopy.



p-Cresol BFA bis(4-tolyloxy)diphenylacetylene

Exploration of hydrolysis pathways of alkyl and aryl phosphites

Isaac Viss

Faculty Mentor: Joseph West

Alkyl and aryl phosphites have been modeled using the B3LYP DFT functional and the 6-31++G** basis sets for all atoms. Energies of the reactants are compared to the intermediate and product structures to determine the thermodynamic favorabilities of the different hydrolysis pathways. Hydrolysis mechanisms under acidic, basic, and neutral conditions are explored. Substituent effects on pathway preferences and energies are described. Bronsted base properties of the modeled phosphites have been explored concurrently.

Exploring Traces of Caffeine in Drinking Water

Alexander Holm

Faculty Mentor: Jeanne Franz

Nearly 90% of all Americans consume caffeine on a daily basis. As a result, trace amounts of caffeine and its metabolites have been detected in the water supply at alarming rates. This is due to not only excess amounts of caffeine being used by consumers but also their persistence in water. The extent of the

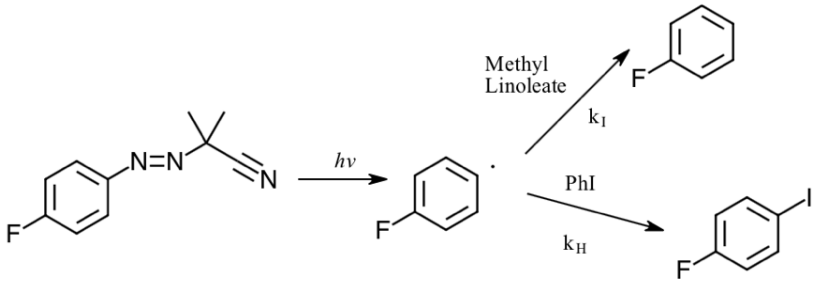
persistence of caffeine has stretched to caffeine contaminated coastal waters harming the aquatic ecosystem. In this study, ultraviolet-visible spectroscopy was used to identify wavelengths of absorbance for target molecules. Then HPLC was used to separate and identify caffeine and metabolites from sample solutions at 275nm for 7 minutes with a mobile phase of 50% acetonitrile and 50% HPLC grade water. Implementing a product or process to reduce reintroduction of caffeine into the environment would be beneficial to the cause. By eliminating caffeine before it reaches the water supply, the unknowing consumption of this stimulant can be reduced before dangerous levels are reached and harm aquatic organisms.

F-19 NMR Determination of Relative Rate Constants for Hydrogen Abstraction by *p*-fluorophenyl Radicals from Fatty Acid Methyl Esters

Breanna Murray, Rick Dorn, and Kevin Plaisance

Faculty Mentor: Thomas Nalli

Phenyl radicals are known to rapidly abstract hydrogens and add to double bonds; H-abstraction in particular is known to have biological significance. However, rate constants for H-abstraction by neutral phenyl radicals from biomolecules are largely unknown. The present research uses *p*-fluorophenyl radicals generated by the photolysis of fluorophenylazoisobutyronitrile (FPAIN), which allows for product yields to be measured using F-19 NMR. DFT calculations validate this method by showing very similar SOMOs for the unsubstituted phenyl radical and the *p*-fluorophenyl radical, as well as nearly identical Mulliken charges on the radical carbon. Reported rate constants for phenyl radical iodine abstraction from iodoarenes (iodobenzene and *m*-trifluoroiodobenzene) ($k_I = 1 \times 10^8\ M^{-1}\ s^{-1}$) were used as kinetic reference points for determining k_H for hydrogen abstraction from fatty acid methyl esters as models for organic lipids. Preliminary results for methyl linoleate show that $k_H = 8 \times 10^7\ M^{-1}\ s^{-1}$.



Investigating Chemotherapeutic Resistance: Why is Glioblastoma So Deadly?

Annie Christensen, Thomas Cameron, and Evan Meagher

Faculty Mentors: Jonathon Mauser (WSU) and Atique Ahmed (Northwestern University)

Glioblastoma multiforme (GBM), a malignancy of the glioblast stem cells of the brain, is one of the most aggressive and untreated forms of brain cancer. When an individual is diagnosed with GBM, depending on the location of the tumor, there are three treatment options including surgery, radiation, chemotherapy or the combination of these treatments. Many patients choose chemotherapy, however most GBM cases show little to no response to Temozolomide (TMZ), which is a common chemotherapy drug used for this type of cancer. In some recent studies, researchers have noticed an elevated amount or over production of an enzyme, Inosine 5'-monophosphate dehydrogenase (IMPDH). This enzyme

helps with DNA repair but in many GBM cases, due to its over production, it repairs at such a fast rate it does not allow TMZ to terminate the cancerous tumors. In our research we have been investigating whether the chemotherapeutic agent causes the increase in expression directly or whether it is a unique property of this cell type. Future directions involve: determining a molecular pathway that could lead to IMPDH expression at such high levels under chemotherapeutic stress and whether co-administering IMPDH inhibitors with TMZ can improve prognosis for those suffering from GBM.

Investigation of DFG-Motif Activation of Aurora A Kinase

Emily Dunham

Faculty Mentor: Emily Ruff

Aurora A kinase (AurA) belongs to the Serine/Threonine protein kinase family and found in all eukaryotic organisms. To succeed at the job of activating G2 phase of the cell cycle for cell growth and preparing for mitosis, AurA is activated by autophosphorylation, TPX2, and ADP. TPX2 and ADP change the conformation to the kinase's active state. In particular, the DFG motif is of interest for research. A catalytic triad that consists of aspartate-phenylalanine-glycine residues. The regulation of activation for AurA is based on interchanging conformations of DFG-in and DFG-out. When AurA is considered in DFG-in state, the aspartate reside faces inward which is favored when ADP binds. This allows for the interaction of the aspartate residue and magnesium ions associated with ATP. In the inactive state or DFG-out conformation, the aspartate rotates outward away from the magnesium ions. This study is focused on this major activation motif and how it functions when a residue in the activation loop is mutated to a different residue. In this case, the glycine residue was mutated to an alanine residue to investigate whether the DFG-motif will still be activation when ADP is present or if the added sterics inhibit AurA's activation. A wild-type AurA protein as expressed in *E.coli* and purified using a His tag NiNTA affinity column. Intrinsic fluorescence assay was used to measure ADP binding and was compared to results of a G276A mutation of AurA intrinsic fluorescence assay for measure of ADP binding. The AurA protein was characterized using gel electrophoresis and circular dichroism spectroscopy to test if the protein was properly folded.

Investigation of PdNi/MWCNT and Pd/MWCNT Nanocomposites Towards Supercapacitor Applications

Frank Beissel

Faculty Mentor: Tamanna McFarland

Energy demands continue to grow with a rapidly increasing demand for portable energy sources that exceed the current standards that are in circulation with every new electronic device on the market in an ever-growing global economy. A method commonly investigated are materials with supercapacitance capabilities towards energy storage. Supercapacitors surpass normal fuel cells with a significantly higher number of charge and discharge cycles, the ability to reach a high charge density rapidly, and more readily transferring stored energy. To the end of investigating potential supercapacitor materials, two binary metal nanocomposites were constructed with varying ratios of nickel (10%, and 15%) and a fixed amount of palladium (20%) dispersed in multiwalled carbon nanotubes (MWCNTs) support material in a one-pot synthesis before being reduced with a large excess sodium borohydride. 20% palladium nanomaterials on the MWCNTs were also synthesized for comparing the effect of adding the earth abundant and cost-effective nickel with the palladium. Scanning electron microscopy (SEM) was utilized to observe the resulting surface texture of the nanocomposites that demonstrates the uniform dispersion of the nanomaterials on the MWCNTs. The capacitance of the materials was tested using a

modified glassy carbon working electrode (GCE). A cyclic voltammogram (CV) analysis elucidated the super-capacitative activity and stability of the synthesized PdNi/MWCNT nanocomposites in a 0.10 M potassium nitrate (KNO3) electrolyte solution with a constant material load of 0.025 mg/cm2 GCE. The nanocomposites were compared to the commercially available 20% Pd/C Pearlman catalyst. Cyclic voltammograms have shown promising super-capacitative behavior of the PdNi/MWCNT nanocomposites v. Pd/MWCNT.

$K_3[Co(CN)_6]$ as an instructional laboratory exercise to train for selection of proper characterization tools

Bethany Palen and Emily Landgreen

Faculty Mentor: Joseph West

Potassium hexacyanocobaltate(III) ($K_3[Co(CN)_6]$) is a classic coordination complex that has been previously used in introductory inorganic lab experiments. While instrumental characterization is used throughout synthesis-based teaching labs as a means of identification, the logic behind selection of certain methods over others is not often built into the curriculum. Many inorganic complexes cannot be unambiguously identified by methods introduced in prerequisite courses. The development of a laboratory experiment to teach selection in characterization tools prompts students to independently make justified characterization decisions and consider the type of data obtained from each instrument and its usefulness in distinguishing the targeted product from starting materials, byproducts and side products. Instrumental methods including $^{13}C\{^1H\}$ and $^{59}Co\{^1H\}$ NMR, IR, UV-Vis, and mass spectrometry. Molecular modeling is also introduced as a supplementary tool to be compared to experimental data to aid in characterizing this complex.

Methane Uptake and Storage Via Metal Organic Frameworks

Keir Kristiansen

Faculty Mentor: Jeanne Franz

Highly porous materials have the potential to greatly increase storage efficiency of gaseous materials. Methane is a molecule of interest since it serves both as a commonly used fuel and as a pollutant that has a large greenhouse effect. In the past, methane has been stored either at very low temperatures, where the gas condenses to a liquid, or at very high pressures where the energy density of the gas becomes very high. These methods impose both safety hazards as well as a high cost when implemented. Metal organic frameworks (MOFs) can be utilized in order to greatly increase storage efficiency of methane while requiring much lower pressures. MOFs facilitate individual molecules of methane to remain closer to each other than that of bulk methane as a result of the MOFs porosity. The pores of the MOFs are highly tunable with the use of organic linkers, so methane specific pores can be synthesized. One challenge facing researchers is optimizing working capacity. A high working capacity implies that not only does the MOF have a high adsorption capability at reasonably high pressure, it also must have high desorption potential at reasonably low potential. Without the ability to evacuate the methane from the MOF, the fuel would be inaccessible. Adsorption isotherms can be measured using a High-pressure volumetric analyzer (HPVA).

Monophosphonium Salts of Bisphosphines as Facile Precursors to Bisphosphine Monoxides

Kacey Davitt

Faculty Mentor: Joseph West

Bisphosphine mono-oxides (BPMOs) are hemi-labile ligands useful for stabilizing metals for a variety of applications including inorganic synthesis, metal complex catalysis, pharmaceutical development, and analytical chemistry. Current synthetic routes are limited since normal oxidizers such as hydrogen peroxide produce a mixture of unoxidized, mono-oxidized, and bis-oxidized phosphines. Current methods used include selective oxidation via a Pd-catalyzed reaction, which is expensive and air-sensitive, and mono-reduction of bisphosphine dioxides using an anhydride, a thiol, and N,N-diisopropylethylamine. We are developing a simpler method to produce mono-oxidized bisphosphines in high purity by preparing a monophosphonium salt using the well-established Wittig reaction to selectively oxidize one phosphorus center. $^{31}P\{^{1}H\}$ NMR is used as the primary means to characterize the products and their ratios in our attempts to optimize the protocol.

Nucleotide Binding Investigation of WT and I698R Non-canonical Haspin Kinase

Mitchell Maw

Faculty Mentor: Emily Ruff

The mitotic spindle protein kinase family is home to complexes that are active regulators of spindle formation cascades during metaphase and anaphase of mitosis. Of the proteins, non-canonical Haspin kinase has a unique structure allowing active site binding without phosphorylation of the activation loop motif. It is theorized that the unique formation of a β-sheet in the activation loop is responsible for the stabilization of Haspin in an active conformation. The mutation I698R was hypothesized to induce electrostatic repulsion between itself and residue R695 to destabilize the activation loop. Characterization of WT and I698R Haspin was achieved via SDS-PAGE and a Guanidinium protein unfolding assay. Nucleotide binding was monitored through intrinsic fluorescence at varying ADP concentrations. The binding constants, K_d, of the ADP for WT and I698R were determined by further derivation of the λ_{max}'s of the fluorescence scans. Analysis of binding constants revealed that I698R Haspin kinase does not decrease binding affinity to ADP within error. Structural confirmation of disruption of the β-sheet is warranted. The function of the β-sheet in the activation loop can be further investigated by substrate binding assays with WT and I698R Haspin kinase to Histone 3 (H3). Greater understanding of Haspin kinase activation and regulation mechanisms may lead to a new class of cancer drugs with increased specificity.

Selectivity of Wohl-Ziegler Bromination of 4-Bromo-2-hexene

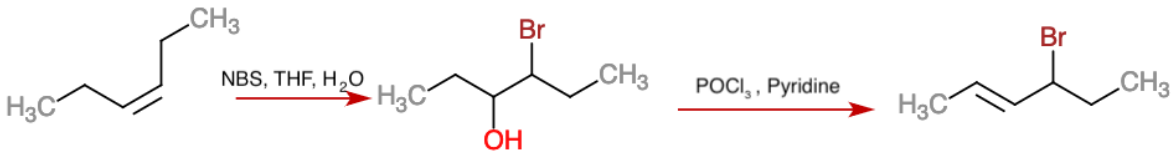
Yousef Sakor

Faculty Mentor: Thomas Nalli

N-Bromosuccinimide (NBS) is a convenient source of bromine used in organic synthesis. One example is Wohl-Ziegler bromination which utilize NBS to substitute bromine for a hydrogen in an allylic position. This project focused on the NBS bromination of bromoalkenes such as 4-bromo-2-hexene. This relates to the products of the reaction of two equivalents of NBS with 2-hexene because 4-bromo-2-hexene is a major product of the monobromination. Thus, the goals of this project were to synthesize pure 4-bromo-2-hexene so that the NBS bromination could be performed and conduct theoretical calculations

of the allylic radical intermediates that form when NBS is reacted with 4-bromo-2-hexene such as the 4-bromo-2-hexen-4-yl radical ($CH_3CH=CH-C^{\bullet}Br-CH_2CH_3$).

Our lab's previous synthesis attempts to make 4-bromo-2-hexene have been unsuccessful, resulting in mixtures of the desired compound plus its allylic rearrangement product, 2-bromo-3-hexene. Therefore, my synthesis uses a new approach by forming the double bond in the last step. 3-Hexene was reacted with NBS/THF/H_2O to form 4-bromo-3-hexanol which will be dehydrated with $POCl_3$/Pyridine to form the desired product.



Synthesis and Application of an Air-stable Trifluoromethylating Agent as an Advanced Inorganic Chemistry Laboratory Experiment

Der Vang

Faculty Mentor: Joseph West

Trifluoromethylated aromatic compounds are continuously finding use as active ingredients of various modern pharmaceuticals and agrochemicals . A previously reported synthesis of $(Ph_3P)_3CuCF_3$, a robust, air-stable trifluoromethylating agent, was modified for an undergraduate laboratory followed by a trifluoromethylation of an aryl iodide. This multiweek undergraduate laboratory experiment introduces students to multi-step synthesis under air-free conditions to create an air-stable metal-CF_3 complex, 79-86% yield. Trifluoromethylation was performed in an NMR tube with the utilization of a fluorinated chemical as an internal standard, which illustrated full conversion. Both targeted molecules were characterized via NMR (^{19}F, ^{31}P, ^{13}C, ^{1}H), and IR.

Synthesis and bioactivity of bis(curcuminioid)oxovanadium(IV)

Emily Landgreen

Faculty Mentors: Joseph West and Emily Ruff

Various derivatives of curcumin, curcuminoids, were applied as ligands for the oxovanadium(IV) moiety. Curcumin has been previously shown to have many beneficial, medicinal properties like anti-inflammatory, antitumor and antimicrobial. These curcuminoids vary in their substituents in the characteristic terminal aryl rings. These new vanadium complexes have been characterized by melting point and IR spectroscopy were collected for these new complexes. DNA binding assays were then performed to assess interactions at various concentrations. The vanadium complexes antioxidative abilities were tested using DPPH and FRAP assays.

Synthesis and Characterization of Novel Fatty Acid-Based Polymers

Mitchell Maw

Faculty Mentor: Robert Kopitzke

Conventional plastics in production are petroleum-based thermosets. Petroleum-based plastic is responsible for 12 % (w/w) of solid waste each year, part of which is incinerated releasing 2.8 kg of carbon dioxide per 1.0 kg into the atmosphere. Bio-based polymer features of biodegradability and compostability have become desirable in the past decade to combat the environmentally harmful effects of polymers derived from petroleum. The versatility of fatty acids derived from plant oils have been displayed in the production of polyamides, polyurethanes, and polyesters. Previous studies have investigated esterified di-oleic and di-10-undecenoic acid derivatives as a monomer for polymerization. We hypothesize that modification of monomer to tri- as well as tetra-oleic and 10-undecenoic acid monomers will increase the glass transition temperature and thermal stability of the residual polyester due a high degree of cross-linking. A three-step reaction, shown in Scheme 1, of saponification; transesterification oligomerization; and ADMET polymerization was investigated.

Synthesis and Electrochemical Characterization of Co/GO and Co/MWCNT Supercapacitors

Matthew Evenson

Faculty Mentor: Tamanna McFarland

As the postindustrial revolution world continues to phase out the use of carbon-based energy sources, it is imperative that work continues to develop improved green energy technologies. To mitigate the energy storage demands of the 21st century, supercapacitors are one of the promising candidates due to their robust nature with a high energy density. Hence, this study extensively investigates the super-capitative behavior of cobalt oxide on two different scaffolds, graphite oxide (GO) and multiwalled carbon nanotubes (MWCNTs). Four nanostructures were prepared with varying amounts of cobalt (0.44:1, 1:1, 10:1 of Co:GO, and 1:1 Co:MWCNT) utilizing a modified, simple, and fast microwave irradiation (MWI) process. During the MWI method, the cobalt oxide was dispersed into the highly conductive substrate. The morphology of the synthesized materials was characterized utilizing scanning electron microscopy (SEM). The resulting materials display porous sponge-like surface with an agglomerated texture. The electrochemical performance of the synthesized materials was then studied using the cyclic voltammetry (CV) technique. A glassy carbon working electrode (GCE) was modified with a fixed amount of material loading (0.025 mg/cm^2 GCE) and tested towards the properties of a supercapacitor in 0.1 M KNO_3 electrolyte. The super-capitative behavior of all the materials was demonstrated by the symmetrical rectangular shapes of the cyclic voltammograms.

Synthesis and Electrochemical Characterization of PdCo/MWCNT towards Formic Acid Fuel Cells

Jakeline Morataya

Faculty Mentor: Tamanna McFarland

A growing global population, the technological advances being made, and the greater push towards greener energy bring a great need for alternative sources of energy. In order to keep up with ever increasing demands for energy, direct formic acid fuel cells (DFAFCs) show great promise. However, the need for a cost effective, robust and efficient anodic catalyst towards DFAFCs is still imminent. Therefore, this study aims to investigate the efficiency, conductivity, and stability of palladium and cobalt binary nanocomposites on multiwalled carbon nanotubes (MWCNTs) substrate. Three

nanocomposites were synthesized with varying amounts of cobalt (0%, 10% and 15%) and a fixed amount of palladium (20%) on MWCNTs using a simple one pot synthesis utilizing sodium borohydride as a reducing agent. This allowed the palladium and cobalt nanoparticles to disperse along the carbon nanotube surface to provide greater catalytic surface area. The morphology was characterized by scanning electron microscopy (SEM) imaging technique showing the binary nanocomposites were dispersed along the carbon nanotube surface. Cyclic voltammetry (CV) was then employed for the electrochemical characterization of formic acid oxidation (FAO) using the nanocomposites in a 0.50 M HCOOH with 0.10 M H_2SO_4 electrolyte. A glassy carbon working electrode (GCE) was modified with a fixed amount of the nanocomposites (0.025 mg/cm^2 GCE) to enable correct comparisons of the catalytic effect of various amounts of cobalt. The nanocomposites have demonstrated the direct formic acid oxidation pathway facilitated by a bifunctional effect. This along with all other electrochemical data was compared to a standard commercially available 20% palladium on carbon Pearlman catalyst.

Synthesis of Luminescent Materials for Solar Energy Usage

Chloë Bieda

Faculty Mentor: Jeanne Franz

The duck curve is a problem in which states, such as California, produce a notable excess supply of solar energy during the sun's peak during the day but have a period of rapidly falling generation and a spike in consumption in the evening. Since California is known to experience high levels of solar input, the state benefits from solar energy. As a result, a production versus demand curve follows a curve that somewhat looks like a duck and is known as the duck curve. This rapid change in demand versus generation is a problem for the stability of the electric grid. This research seeks to solve this problem with the synthesis of luminescent materials. A series of complexes were tested for their fluorescence and phosphorescence. The wavelength as well as the intensity and duration of several materials were analyzed for their suitability in the solar spectrum. Initially, all solutions were tested for the determination of optimum wavelengths and analyzed to identify a basis of fluorescence and phosphorescence data. With the initial data collected, the initial values were utilized in the data collecting process of optimum lifetime of the solutions. Each solution was analyzed for up to 75 minutes with the phosphorescence intensity measured every nine seconds. Further observations of intensity values and research on optimum wavelengths of capturing solar energy and photovoltaic cells were utilized for the research. With finalizing the research, the optimum luminescent solution for the use of solar energy when solar energy demands are the greatest and when the duck curve issue arises will be discussed.

Vitamin content between grass-fed and commercially fed beef

Brittany Whittington

Faculty Mentor: Emily Ruff

Although grass-fed and commercially fed beef may look very similar, the compositions are very different. Grass-fed beef is thought to have more vitamin content than commercially fed beef but is not as common due to it being more expensive. The grass-fed beef used in this experiment came from Earth-Be-Glad Farm and the commercially fed beef came from Kwik Trip. Our experiment looked at the different vitamin concentrations, specifically niacin, between grass-fed beef and commercially raised beef. This was done by hydrolyzing the sample, denaturing the proteins, and filtering to get a final product. The final product was analyzed using high-performance liquid chromatography (HPLC) and

absorbance was measured at 470 nm. We have also analyzed the fatty acid methyl esters (FAMEs) using a GC-MS between the same beefs. We found that the grass-fed had about 20% more saturated fats than the commercially fed beef.

Computer Science

Converting Natural Language Phrases in Lambda Calculus to Generalized Constraint Language

Matthew Dill

Faculty Mentor: Nina Marhamati

This study explores one aspect of bridging Computing with Words with Natural Language Processing, to connect the extraction capabilities of Natural Language Processing with the inference capabilities of Computing with Words. Computing with Words uses Generalized Constraint Language to show the logical proposition of a given expression. A program was written to convert a logic-based lambda calculus representation of any English natural language expression into Generalized Constraint Language. The scope of this project is set to tagging parts of speech in simplistic expressions and is a foundation for expanding upon more complex lambda calculus expressions into Generalized Constraint Language. This program tags the parts of speech from the lambda calculus expression and outputs the Generalized Constraint Language of the expression, showing the constraint on an idea in the original sentence. This project establishes an entry point and is designed with further improvements and modifications in mind. The output from this project is useful in providing an understanding of bridging Natural Language Processing and Computing with Words, as the program creates a baseline of extracting parts of speech from a sentence to highlighting significant meaning of the given sentence.

Keywords: Natural Language Processing, Generalized Constraint Language, Computing with Words, lambda calculus

Data Protection and Secure Encryption using RSA and DES with IOT Devices

Steven Granquist

Faculty Mentor: Computer Science

This paper examines different methods of Encryption and Data Protection on Internet of Things Devices (IoT). As IoT devices become more popular, they need to be properly secured. Specific comparisons are made between RSA and DES encryption and how those methods handle information and data on different types of devices. The goal of the paper is to determine which method would be the most efficient and computationally effective to be used with IoT devices. An IoT device is imitated using a Raspberry Pi, a Laptop, and a Desktop PC. This allows for a wider variety of results due to the different hardware and software constraints. OpenSSL and Python are utilized to make use of the encryption on these devices. The experiments done on these devices allow comparisons to be made with runtime, computation intensity and other analytics.

Evaluation of JavaScript Photo Animation Applications.

Sean Joyce

Faculty Mentor: Shimin Li

Graphics Interchange Format (GIF) is an image format used to create and display a series of images to form an animation. GIF displays are used via memes, social media, texts, and emails. The popularity of this format has contributed to a surge of online JavaScript based animation applications.

We present an evaluation of JavaScript photo animation applications that can ascertain the most usable, effective, and strongest applications. The evaluation is designed to test each aspect of several JavaScript applications to fully determine the strengths and weaknesses. Aspects used for evaluation included execution time, photo quantity limit, photo quality limit, file support, downloaded file types, usability, cosmetics, and animation quality. The results were analyzed to identify the strong and weak software with respect to these aspects.

Initial experiments conducted using a variety of images suggests that there may not be any strong differences between the applications in terms of execution time, or animation quality. There seems to be significant differences in usability, and file support.

Human to Instrument Audio Conversion

Cameron Pelzer

Faculty Mentor: Barry Peratt

Each musical instrument makes distinct sounds, caused by harmonics particular to that instrument. Harmonics are the waves produced by an instrument that aren't the original tone. By altering the harmonics around a target frequency, we can digitally produce sounds similar to that of various instruments. The first step in doing so is to understand the math behind the separation of the harmonics. The function known as The Fourier Transform uses an input signal to output data that can display graphically the breakdown of the signal's harmonic frequencies. This data can then be stored as a template for the breakdown of different instrument's sound. The application outlined in this paper was created to build, save, and use these templates. Using this application, templates for Trumpet and Violin were created by saving the ratio of the base note to the harmonics. Using this template and the inverse Fourier Transform, the application can alter a simple string of notes to sound like the templated instrument.

Integrated Server Documentation and User Monitoring

Marshall Halleck

Faculty Mentor: Sudharsan Iyengar

A lack of detailed server documentation affects performance of employees managing server and services thereof. Proper and relevant documentation can help reduce resolution time. Extensive support for documentation in software development is common, however there remains a lack of such for servers. Accumulated and properly collated documentation from services provided can be a great repository for future use and can help streamline services.

To support the aforementioned accumulation, we propose the implementation of a required justification of services/work done on exit time. This can be achieved via a number of open-source tools, including sysdig for user monitoring, mySQL for database management, and JDBC for simplifying Java

interfacing. Implementation will occur on a series of Debian-flavored Linux virtual machines. Success will be measured quantitatively through user retention, and qualitatively through user surveys.

IOT Security Analysis in Raspberry Pi's Communication and Networking for Interfacing, Authentication, and Data Protection

William Diedrick

Faculty Mentor: Gerald Cichanowski

Internet of Things (IoT) technology has changed the way data is collected and used – in this new wave of the digital industrial revolution. IoT technology currently has critical importance in manufacturing, service, transportation, and educational industries. Stakeholders focus on he infrastructure and information systems of IoT, leaving security to be less explored and developed. Lack of security leaves systems vulnerable to attacks from outside influence. Attackers invade company networks through vulnerabilities, costing millions of dollars in damages.

In this study, we aim to develop a secure Raspberry Pi communication system to help expand the understanding of effective and economic IoT solutions. Security tests oriented toward interface design, authentication, and data protection were used to find how secure a Raspberry Pi based IoT communication system is, and how to improve it. The purpose of this study is to improve the design of current IoT systems by designing Raspberry Pi IoT system oriented toward a secure connection for communication. The results of testing the system were compared to an effective device already available on the market – like Tangle. The design and use of a Raspberry Pi based IoT system was shown to be as effective in its security design as Tangle.

Education

Free Dress Codes

Chrysandra Simek

Faculty Mentor: James Schul

This research analyzes the essential issue of dress codes in schools. According to research, the "halo effect" is prominent in many schools in which teachers make conclusions about the competence of their students based on the way they dress. However, student's abilities to freely choose their clothing has little to no impact on their social, psychological or academic success. Moreover, free dress codes do not have an effect on school attendance or out-of-school suspension rates. Throughout my investigation, I interviewed two teachers, one administration member, two school board members, and two parents of students currently enrolled in school. The findings indicate that guidelines and policies regarding the implementation of free dress codes are necessary and should coincide with the school climate. Implications refer to the idea that it is important for the teacher to consider the rights of the students, the policies of the school, and their own perspective when analyzing the topic of free dress codes.

School Safety

Kim Becker

Faculty Mentor: James Schul

School is believed to be one of the safest place for a child to be, yet one researcher found the 24 % of students felt unsafe. This study employs interview data with school stakeholders on issues of bullying and communication in the school experience. Findings suggest that having police liaison on the school grounds opens a relationship between authority and the students. The findings of this study also show that some parents feel safer with this added protective measure. Interviewees also shared that schools are responsible for taking certain measures to have enough safety drill and materials to deal with certain safety situations. Implications are discussed revolving how school safety can be properly addressed.

Technology in Class

Hailey Horstmann

Faculty Mentor: James Schul

This research study analyzes the use of technology in the classroom and what kind of benefits and negatives are associated with technology use in the classroom This study employs interview data that inquire into how technology is being used in classrooms by teachers and students. The findings indicate that technology can be useful in the classroom if utilized at the correct time and for the correct purposes – but cannot be useful if used incorrectly. Implications will be discussed.

Engineering

Design and Assembly of Carbon Fiber Professional Scooter

Austin Houska, Tyler Ross, Reese Sager, Nicole Tincher, and Maria Wrage

Faculty Mentor: Keith Dennehy

After reviewing the current professional grade scooter market, it was concluded that there is a definite need for weight reduction. The current market consists of rigid aluminum and titanium structures. This design is made primarily of unidirectional carbon fiber in an epoxy resin system. The deck of the scooter will be made with a high density foam core. Using carbon fiber to replace metal will provide a substantial weight reduction in the final assembly. Testing will be done to ensure that the scooter meets all required safety and dimensional requirements.

The Hybrid Hanger: A lightweight, portable hang-on tree stand with high durability and ease of use.

Micah Callies, Parker Holmstrom, Aaron Servais, and Connor Theisen

Faculty Mentor: Keith Dennehy

The Hybrid Hanger is a fully carbon fiber-epoxy composite hang-on tree stand. This 12-pound tree stand design allows a hunter to carry the stand further without fatiguing, which is perfect for public land hunters. In order to support the weight of a person and the harshness of hunting environments, the Hybrid Hanger will need to be strong and weather resistant. It has been tested to 600 pounds and the carbon fiber is an improvement upon the current metal stands of today's market. Other qualities of the Hybrid Hanger that improve upon current tree stands in the market include: noise reduction, corrosion

resistance, and the compact and sleek design. The Hybrid Hanger will also be foldable with backpack straps to easily carry on a hunter's back as they walk to their hunting location.

Making a Model for orientation of Fibers in Injection Molded Parts Using Solidworks, Wolfram Mathematica, and 3D printers

Casey Cooper

Faculty Mentor: Fariborz Parsi

Properties of a polymer can be engineered by the addition of chopped fibers, additives, and fillers. Typically, an extrusion process mixes chopped fibers with molten thermoplastic material, manufacturing small pellets. The pellets are then molded into a final product using the injection molding process. When subjected to flow, mechanical and hydrodynamic interactions between the fibers and the polymer result in an anisotropic distribution of orientation in the fibers of the molded part. The final orientation state of the fibers is influenced by part design, mold design, material properties and processing parameters. The attained structure greatly affects the properties of the composite material.

SOLIDWORKS® (a CAD software) and WOLFRAM MATHEMATICA® (a math software) were used to model the orientation of fibers in molded parts on a macroscopic scale. After completion of this step, physical models were created using MARKFORGED® MARK TWO DESKTOP 3D printer. SOLIDWORKS® proved cumbersome to use for this application and MATHEMATICA® was the preferred tool. Normal distribution was used to define the degree of anisotropy within the constructed model. The mathematical model was evolved over time to render a close-to-real model (compared to 3D images obtained by μ-CT technique) which was 3D printed and used as an explanatory tool.

The main objective of this project was to create a 3D printed model to demonstrate the microstructure of an injection molded part.

The Carbon Sound: Travelling Acoustic Composite Guitar

Matthew Barrett, Collin May, Jace Pink,and Matthew Rogers

Faculty mentor: Keith Dennehy

The Carbon Sound is a travel-oriented acoustic composite guitar that will offer a high quality sound coupled with the peace of mind that your guitar will withstand the stresses of day-to-day life, especially when travelling. Our design features a hand-manufactured carbon fiber and epoxy material, and will allow for robust mechanical properties like durability, as well as strong environmental resistances such as low moisture absorption and resistance to temperature changes that can cause damage to traditional wood guitars. This product will enable the user to enjoy the outdoors or a fast-paced schedule without compromising sound or safety of the guitar. The Carbon Sound will be a guitar that will withstand the world you travel in and be a joy to travel with.

The Enabler: Design and Fabrication of an Assistive Walking Device with Wheels

Ryan Bruesewitz, Grant Fick, Jon Hasan, Chelsi Her, and Kirstin Nelson

Faculty Mentor: Keith Dennehy

The enabler is a device that provides a person in need of walking assistance the ability to walk fluidly and independently without having to lift the device off of the ground. The use of carbon fiber/epoxy

composite allows the device to maintain a high strength to weight ratio. It can adjust to a range of heights with an ergonomic handle and braking system. CAD modeling including SolidWorks and Fusion 360, aided in the 3D modeling of parts and in the development of CNC tool paths. Three wheels attached to the base plate provide fluid mobility and stability. The composite handle is designed with comfort in mind and allows the user to handle the device with ease. The sleek design is meant to portray a low profile to not draw attention to the user while maintaining an aesthetic appeal. Relevant mechanical and weather testing were performed to ensure strength requirements were met in a wide variety of environmental conditions.

Thunder Arm Carriers

Wenxu Duan, Donavon Johnson, Kyle Johnson, and Jordan Langness

Faculty Mentor: Keith Dennehy

A Thunder Arm Carrier is a lightweight, composite frame designed to transport a two-wheeled vehicle. The frame is to be mounted to the hitch receiver and is capable of holding up to 600 pounds. The main frame will be two filament wound tubes made from carbon fiber and an epoxy system. The braces that hold the two tubes together will be fabricated using a wet lay-up process with cross-ply carbon fiber fabric. The braces will be bolted down to a square, steel tube that will insert into the receiver of a vehicle. Specimens will be prepared to test the carrier's properties after exposure to water and UV light.

Vessel Guitar: A carbon fiber dreadnought guitar

Zach Heinkel, Greg Rooney, Nathanial Smith, and Kelson Titus

Faculty Mentor: Keith Dennehy

A Vessel Guitar is a composite guitar constructed out of carbon fiber. Built for the adventurous guitar player to allow the ability to play in a variety of environments. Many traditional guitars cannot withstand changes in humidity or the natural wear and tear of a busy artist. By designing the body entirely out of carbon fiber this eliminates the risk of potential damage and provides a unique sound that only carbon fiber can produce. This guitar will be tested by dropping it from the third story of the Science Laboratory Center. This will demonstrate its resistance to wear and tear.

English

Blake's Homoerotic Sensualities - Exploring Masculine Desire in His Illuminated Prints

Leigh Mark

Faculty Mentor: Chuck Ripley

This essay explores William Blake's use of homoerotic imagery both within his poetry, and his art. William Blake (1757-1827) was an English Romantic poet, painter, and engraver; he is now best known for his innovative technique of engraving called, "illuminated printing." For Blake, this method was one that "combined the Painter and the Poet" (692). It is my plan to present my research accompanied with a power point presentation so that I could display each image to my viewers and explain them in more understandable detail. With that I mind I have drawn designs from two of Blake's major works (*Milton*

and *Jerusalem)* and one of his commercial projects (*Night Thoughts)* to argue a pattern in which Blake uses homoeroticism to become spiritually interconnected with others.

Language(s) in American Education

Ryanne Mikunda

Faculty Mentor: April Herndon

The topic of what languages are used to provide educational instruction in the United States is highly debated. Increasing populations of students with diverse language backgrounds contribute to the discussion of English-only versus bilingual education. When these students attend public schools in the country, they are affected by national and local legislation and assessment standards, of which a brief and recent history is outlined in this paper. Additionally, this paper explores some research that shows benefits of bilingual education, along with parental perspectives on their children's bilingual education programs and a study of student perspectives on their intensive English program. Finally, the English-only movement is addressed relative to the ethical issues it raises regarding equality across languages and ensuring stable family environments for students who speak a language other than English in the home.

Making Men into Monsters: Frankenstein and the Incel Movement

Kendra Devine-Pringle

Faculty Mentor: Chuck Ripley

This paper explores the depiction of masculine values and a man's entitlement to female companionship in Mary Shelley's Frankenstein. Other scholars have outlined the discourse surrounding masculinity studies as a subset of gender and sexuality studies as well as its relation to British and American literature. Frankestein's monster has also been subject to intense critical inspection to the point of exhaustion. However, the parallels of the monster's thought process to the pervasive ideology of subsets of male youths in modern culture is dangerous to ignore. In noting the similarity in the reasoning given for recent attrocities such as the Toronto Van Attack and Frankenstein's monster's murders, we may begin to unravel the arguments and raise a generation of men with different aspirations and mindsets.

Geoscience

Easing into Reality – Experimental Impacts into Slopes and Layers

Jordan Ebel and Leah Dechant

Faculty Mentor: Jennifer Anderson

Co-authors: Mark Cintala, NASA Johnson Space Center and Jeffrey Plescia, Johns Hopkins University

Impact cratering is the dominant geologic process affecting the surfaces of solid bodies throughout our solar system. Because the impact cratering process is (luckily) rare on Earth, it is studied through experiments, numerical modeling, and theory, all of which make the simplifying assumption that the target surface is horizontal and uniform with depth.

To investigate crater formation in more realistic targets, we conducted two separate suites of impact cratering experiments into sloped targets and layered targets at the Experimental Impact Laboratory at NASA Johnson Space Center. Experimental impacts were performed in a near-vacuum, with aluminum projectiles moving at 1.5 km/s. The targets consisted of a fine-grained sand either at a known slope angle or with a stronger subsurface layer slightly below a thin layer of sand. A 3D scanner was used to record the topography of the original target surface and the final impact crater allowing us to compare the pre- and post-impact topography in detail using ArcGIS.

Sloped-target analysis shows little to no crater rim on the upper slope, substantial slumping within the crater, and a shift in the deepest point of the crater in the downslope direction. Layered-target analysis shows visible change to the crater morphology with the addition of even a relatively deep substrate layer when compared to the uniform target, resulting in a shallower and wider crater. These results have implications for how craters on sloped targets or potentially layered targets are interpreted on planetary surfaces such as the Moon.

Preliminary Assessment of Metals Partitioning in Soil and Vegetation in a Subalpine Wetland (Bismark Mine, southwest Montana)

Trey Jonas, Kacie Stolzman

Faculty Mentor: Candace Kairies-Beatty

Co-author: Erika Elswick, Indiana University Bloomington

The Bismark Mine is located near the headwaters of the South Boulder River in Madison County, Montana. The bedrock of the area is predominantly metamorphic rocks of the Archean Pony series, intruded by a tongue of the Cretaceous quartz monzonitic Tobacco Root batholith. The gneiss and the granite are both weakly fissured and mineralized near the contact. The mine is located on several of these fissure veins near the granite-gneiss contact. Additionally, numerous small veins of pyrite, chalcopyrite, and molybdenite with quartz are present. During its operation, over 58,000 lbs of copper, more than 7,000 lbs of lead, and almost 1,200 oz. of silver and smaller amounts of gold were removed between 1913 and 1917. The mine was abandoned by 1963.

During the mining process mine tailings were discarded downslope from the mine adits. A wetland naturally developed on top of the tailings due to diffuse seepage of seasonal snowmelt from the surrounding area and discharge from the lower adit of the mine. Multiple unmapped seeps contribute flow to the wetland. The water emerging from the adit and seeps has a pH between 6.78 and 8.05 and contains measurable concentrations of trace elements, including lead (up to 17.4 µg/L), zinc (15 – 36

µg/L), copper (up to 116.7 µg/L), arsenic (up to 3.66 µg/L). The purpose of this study was to investigate metals retention and accumulation within the wetland soils and vegetation and is part of a more extensive wetland characterization study.

Soil trenches were dug at various location across the wetland during the summers of 2014 – 2017. Samples were collected from each horizon and from any interesting features observed in the pit. Texture, color, pH, loss on ignition, organic matter content and total metal concentrations were determined. Wetland vegetation samples were collected during the summer of 2018, digested and analyzed for total elemental concentrations. Preliminary results indicate the accumulation and concentration of metals in the soils with concentrations of trace elements 10 to more than 1000 times greater in the soils compared to the water. Higher concentrations in the soil appear to be associated with the presence of organic matter and/or iron oxides in the soils. Preliminary results also indicate the accumulation and concentration of certain elements within the vegetation samples.

Using Customizable Open Source Technology to Develop a Network of Stream Monitoring Stations

Carlton Folz, Cole Weaver, and Anthony Aufdenkampe

Faculty Mentors: Dylan Blumentritt and Neal Mundahl

This study aims to assess the impacts of water quality during large runoff events on trout populations in the Whitewater River in southeastern Minnesota. To achieve this, open source technology was developed and implemented to collect continuous water quality data and automate water sample collection. The Mayfly motherboard is an Arduino product that allows the user to create code specific to their application. As open source code, it can be accessed by anyone and manipulated to the specifics of their own project. This allows others to have unique water monitoring stations specific to their needs for a fraction of the price.

The hardware consists of three major components; weather station, in-water sonde with water quality sensors, and an automated sampler. Each weather station contains a tipping bucket for precipitation, a thermometer for air temperature, a hygrometer for relative humidity, and a barometric air pressure sensor. The in-stream sensors consist of a Keller Acculevel pressure sensor to detect the water height and a multisensory sonde. The sonde is a Yosemitech Y4000 multi-sonde, which allows for probes to easily be swapped out. Our sondes are outfitted with turbidity, dissolved oxygen, specific conductivity, and pH probes. The automated sampler is a Teledyne ISCO that is controlled directly from the Mayfly, allowing us to trigger a sampling event based on a threshold of any sensor.

We have deployed six of these monitoring stations throughout the Whitewater River, a 830 km2 river in the karst landscape of southeastern Minnesota, with a noted trout fishery and with significant agricultural land use in the headwater regions. Sampling events are being triggered based on turbidity in hopes of sampling pollutants that are bonded to sediments transported by the stream during high-flow events. Once we collect water samples from a turbid event, we use the gauge height to create a hydrograph and determine which water samples warrant further chemical testing. Through the chemical analysis, we will estimate the concentrations of the pollutants moving through the river system, possibly having a negative effect on aquatic organisms. Our water quality study is paired with an ecological study assessing the pollutants' impacts on stream health that these washout events might have.

Global Studies

Globalization: How it has impacted Venezuela and Chile

Erin O'Connell

Faculty Mentor: Yogesh Grover

People around the world have very different perceptions of globalization; in the developed world, the idea is that globalization has failed, whereas the developing countries have had a different experience with globalization. In the developing countries, their economic growth has been supported by foreign direct investment, which has helped to create a middle class. But ultimately, even between the developing countries, globalization has had a different impact on the countries and their respective economies. Chile is one of the countries that has taken advantage of globalization and benefited from it. Meanwhile, Venezuela has cut itself off from globalization and this has led to many disasters for the country. The research for this paper shows how globalization has been a positive aspect in Chile, while Venezuela has avoided globalization and faced many consequences. This paper compares the role of globalization in Chile and Venezuela.

Health, Exercise & Rehabilitative Sciences

Anterior Cruciate Ligament Reconstruction: Allograft or Autograft?

Halle Simons

Faculty Mentor: Nora Kraemer

Clinical Scenario: An Anterior Cruciate Ligament rupture occurs when extenuating forces on the tissue create tears. When this happens, surgical intervention can be used to rectify the damage. This leads to the decision of the patient on whether to use an allograft (tissue from a cadaver) or an autograft (tissue from their own bodies) to replace the damaged ligament. **Focused Clinical Question:** In patients with ACL ruptures, what is the effect of allografts versus autografts on post-operative laxity? **Search Strategy:** Inclusion criteria were patients >18 years of age with an ACL rupture confirmed on MRI. Exclusion criteria were multiligamentous injuries, previous knee surgery on either knee, or bilateral knee injuries. The databases included PubMed and ProQuest Nursing Collection. Twelve original research studies were found initially and 9 met the inclusion criteria for this critical appraisal. **Evidence Quality Assessment:** The PEDro scores ranged between 4/10 to 8/10 and Oxford 2011 Level of Evidence scores ranged between 2 to 4. The SORT score was B. **Results and Summary of Search:** In all nine of the studies the results were not significant enough to derive a definitive "best choice". Data was compiled from various tests of laxity including Lysholm scores, graft failures, Lachman's test, Anterior drawer, and the International Knee Documentation Committee (IKDC). The p-values ranged from 0.594 to 0.0006 with no continuity in results across the studies. IKDC scores in one study were significant (0.0006) as well as the graft failures for autograft versus allograft in another (0.031). However, the rest of the results were nonsignificant (0.594 to 0.06). Some weaknesses in the studies included lower number of participants in one of the groups as well as variant follow up times between the groups. **Clinical Bottom Line:** Although no significant difference was found between the two graft types, the gold standard remains to be the use of autografts due to the fact that it is coming from the patient's own body. However, it is important to note that both of these graft types are viable options when deciding which to use for repair of the

ACL. **Implications:** Patients should be informed on these grafts when in need of ACL surgery and should have the understanding that both graft types are viable options. When making the decision between the two, it may be important to note that the autograft is the gold standard but that both options will have similar long-term results.

Bankart Repair remains the Gold Standard over the Latarjet procedure for Anterior Glenohumeral instability

Julius Henry

Faculty Mentor: Nora Kraemer

Clinical Scenario: Anterior glenohumeral shoulder injuries are common in the active population and often can keep patients from participating in activates. Anterior glenohumeral shoulder injuries usually present in athletes that participate in throwing and overhead sports. Common signs and symptoms include pain, decreased range of motion (ROM), and decreased strength during throwing. **Focused Clinical Question**: In patients with anterior glenohumeral instability, what is the effect of Bankart procedure compared to Latarjet surgery on ROM and patient reported outcomes (PROs). **Search Strategy**. Inclusion criteria: studies published after 2000, first time surgery on same arm, ages 12-60 years old, previous dislocations/subluxations, SLAP lesion, glenoid bone loss, open or arthroscopic Bankart repairs. Exclusion criteria: no previous shoulder surgeries, ages below 10 years and older than 61 years, fractures, and epilepsy. Studies were found using CINAHL Complete, Cochrane Library, ProQuest, ProQuest Nursing Collection, PubMed, and SAGE Journals. Search terms include: Bankart repair, Arthroscopic Bankart repair. Latarjet procedure, open shoulder surgery, arthroscopic shoulder surgery, shoulder instability, and anterior glenohumeral instability. Nine studies met the inclusion criteria for this critical appraisal. **Evidence Quality Assessment**: The range of the PEDro scores 5/10-7/10 and Oxford Levels of Evidence scores ranged between 2 to 3. **Results and Summary of Search**: Bankart repair obtained better results in terms of return to sport (SPORTS score: 8 vs 6; P = .02),ROM in the throwing position (86 degrees vs 79 degrees; P = .01), and better Subjective Shoulder Value(SSV: 86% vs 75%; P = .02), clinical ROM preoperative for Bankart external rotation in abduction (77.1± 8.2)and final follow-up (65.5±6.7) clinical ROM for Latarjet external rotation in abduction preoperative (79.2 ± 8.3) and final follow-up (68.8± 7.3).Patients ages range from 12-60 years old. The primary strength of the studies were that subjects varied among level of activity from sedentary to high competition. The primary strength of the studies were that subjects varied among level of activity from sedentary to high competition. Weakness is this critical appraisal include that a majority of the subjects in this article were male patients, the studies were mostly retrospective, inconsistent mechanism injuries can cause anterior glenohumeral instability, and return to play varied due to sport levels. **Clinical Bottom Line:** Patients who underwent Bankart surgery showed better overall outcomes than patients who underwent the Latarjet surgery. The Bankart procedure remains the gold standard when treating anterior glenohumeral instabilities. The SORT score is B. **Implications**: Findings should be used to give the patent options when looking for a surgical procedure for anterior glenohumeral instabilities.

Chronic Upper Extremity Injuries: Iontophoresis Versus Phonophoresis

Daniel Appleton

Faculty Mentor: Nora Kraemer

Clinical Scenario: Chronic issues of the upper extremity are very common. Two forms of treatment for these issues include iontophoresis and phonophoresis. **Focused Clinical Question:** For patients with

chronic upper extremity issues, how does iontophoresis compare to phonophoresis on pain? **Search Strategy:** Inclusion criteria were: chronic upper extremity injuries, iontophoresis, phonophoresis, unilateral or bilateral injuries. Exclusion criteria were: lower extremity injuries, acute injuries, surgical intervention needed, subluxations, dislocations, and fractures. The databases that were searched include PubMed, Proquest Nursing Collection, CINAHL Complete and Cochrane Library. The search terms included; iontophoresis, phonophoresis, sonophoresis, ultra-sonophoresis and electrophoresis, epicondylitis, carpal tunnel, adhesive capsulitis. For this critical appraisal there were eight studies used. **Evidence Quality Assessment:** The PEDro scale scores ranged between 7/10 to 10/10. The Oxford 2011 Levels of Evidence scores ranged between two to three. **Results and Summary of Search:** The studies ranged from 18 to 90 patients from active college aged athletes to retirees. All studies included the VAS pain scale as a patient-reported outcome. The VAS scores in two studies found that iontophoresis was more effective, were between 6/10 and 8/10 with significant difference ($p<0.05$). After the interventions there was a decrease of 2 points binging it down to between 4/10 and 6/10. Two of the eight studies found that phonophoresis was more effective than iontophoresis with VAS scores at the beginning of treatment between 6/10 and 8/10 and ending with scores between 4/10 and 6/10 with significant difference ($p<0.05$). Four studies showed no significant difference between the two interventions ($p>0.05$). **Clinical Bottom Line:** Overall, iontophoresis and phonophoresis had similar impacts on pain reduction, with a SORT score of B. **Implications:** Since iontophoresis and phonophoresis have similar effects on pain reduction athletic trainers may use both interventions to the benefit of the athletes. With these results, athletic trainers will be able to educate their patients why these methods are effective and how they can help with their specific case.

Double-Bundle versus Single-Bundle ACL reconstruction: Effects on

Ian Shields

Faculty Mentor: Nora Kraemer

Clinical Scenario: Anterior cruciate ligament injuries are common in the active population. Two common surgical reconstruction techniques include double-bundle and single-bundle ACL reconstruction. **Focused Clinical Question:** In patients with ACL injuries, what is the effect of single-bundle reconstruction compared to double-bundle reconstruction on stability? The pivot shift test and IKDC index scores showed more stability in the double-bundle ACL reconstruction. **Search Strategy:** Patients include competitive and recreational athletes who have experienced an ACL rupture and qualified for reconstructive surgery. Exclusion criteria were patients with graft failures, history of a contralateral knee injury, severe osteoarthritic conditions, multi-ligamentous injuries, or any skeletal immaturity including open epiphyses. Databases included PubMed, CINAHL Plus, ProQuest Nursing Collection, and Cochrane Library. Search terms used on these databases included: single bundle, double bundle, reconstruction, repair, ACL, anterior cruciate ligament, and surgery. Nine total studies were critiqued for this critical appraisal. **Evidence Quality Assessment:** The Oxford 2011 Levels of Evidence were 2 and PEDro scores ranged between 7/10 to 8/10. **Results and Summary of Search:** Double-bundle ACL reconstruction technique showed the most joint stability in comparison to the single-bundle technique, based on the pivot shift test and IKDC index. In four studies, the double-bundle technique was significantly better ($p<0.05$) than the single-bundle technique; but it was not found in any studies that the double-bundle technique provided any less stability than the single-bundle technique. The five remaining showed no difference ($p>0.5$) in the pivot shift test or the IKDC scores between the two reconstruction techniques. **Clinical Bottom Line:** Overall, the double-bundle ACL technique has shown better results on the pivot shift test and the IKDC index scores. The SORT score of this critical appraisal was B. **Implications:** These finding can be used in the clinical setting to inform athletes and patients as to the differences in

effectiveness of each technique, as well as the major role that knee stability plays in athletic performance.

Effects of time restricted feeding on metabolism, depression, and circadian rhythms

Andrew Kezar, Marquel Fleischacker, Emma Masiulewicz, Corbyn Bendtsen, Megan Coyle, Cassie Fileccia, Lauren Kaminski, Megan Lind, Eric Norman, and Nicole Schweitzer

Faculty Mentor: Justin Geijer.

Introduction: Time restricted feeding (TRF) is a form of intermittent fasting limiting the time to intake calories throughout the day. TRF has been shown to affect substrate concentration and utilization at rest and exercise. Changing patterns in substrate availability and utilization can have effects on metabolism, cognitive functioning and circadian rhythms. **Purpose:** The purpose of this study was to evaluate the effects of TRF on overall physiological functioning, specifically sleep, resting energy expenditure (REE), resting respiratory quotient (RQ), and likelihood of depression. **Methods:** A longitudinal design was used to examine physiological changes associated with four weeks of TRF among 34 healthy adults between the ages of 18-60 years. Sleep was evaluated via self-report logs given to participants at testing sessions. REE and RQ were measured using a metabolic cart while subjects were in a fasted state. The Brief Anxiety and Depression Survey was administered, and each subject was given a score indicating their likelihood of depression at each testing session. Variable differences within subjects were determined using a repeated measures ANOVA or a paired samples T-test. **Results:** A significant decrease in total sleep ($p = 0.034$) and BADS scores ($p=.046$) occurred between non-TRF and TRF. Analysis revealed that resting RQ values experienced a significant increase ($p=.002$) between testing non-TRF and TRF testing periods ($p=.034$) and pre-test and TRF testing sessions ($p=.008$). Direct correlations were found between BADS, total sleep and resting RQ. **Conclusion:** TRF may influence glucose utilization during rest. Past studies have shown that different forms of intermittent fasting, such as TRF, enable an organism to create more regulated circadian rhythms, allowing less reliance on glucose, resulting in benefits in prevention and treatment of various diseases. The results of the present study are in opposition of previous literature and may provide insight into how glucose utilization affects other physiological processes. Increased glucose utilization may have been a factor in the decrease in total sleep and depression in the patients in the study. Future research is needed to verify if increased utilization of carbohydrates at rest influences changes of circadian rhythms and depression occurrence.

Impact of Time Restricted Feeding on Muscular Strength Within a Healthy Adult Population.

Eric Norman, Nicole Schweitzer, Corbyn Bendtsen, Megan Coyle, Cassie Fileccia, Marquel. Fleischacker, Lauren Kaminski, Andrew Kezar, Megan Lind, and Emma Masiulewicz,

Faculty Mentor: Justin Geijer

Time restricted feeding (TRF) has been shown to produce several health benefits. Muscular strength and nutritional intake have been strongly researched prior to this study. Little research exists investigating the impacts of TRF on muscular strength in human subjects. **PURPOSE:** This study was to identify the potential impacts of TRF on muscular strength. **METHODS:** Participants tracked caloric intake, sleep duration, sleep quality, exercise, and medications for two, four-week periods. Statistical analyses quantifying within subject effects were performed with a repeated measures ANOVA. Post-hoc analyses were performed to elicit differences between testing periods. **RESULTS:** Mean torque flexion at 60 degrees/second (MTF 60) (83.92 Nm ± 29.53Nm vs. 95.63 Nm ± 28.95 Nm) and mean torque flexion at 180 degrees/second (MTF 180) (66.75 Nm ± 25.9 Nm vs. 69.01 Nm ± 21.29 Nm vs. 75.55 Nm ± 23.9 Nm;

F = 7.920 Nm) had an increase from pre-test to TRF, and non-TRF to TRF. Post-hoc testing revealed differences between pre-test and TRF MTF 60 increased (p-value=0.001). Similar results were found for MTF 180 as well (p-value=0.037). When observing respiratory quotient (RQ) at rest (0.716±0.077 vs. 0.73 ±0.077 vs. 0.08±0.79; F = 8.352) showed increase from pre-test to TRF (p-value=0.008), and non-TRF to TRF (p-value=0.034). Analyzing total strength training days from non-TRF to TRF (8.11 days ± 1.18 vs. 5.22 days ± 1.48), **CONCLUSION:** Post TRF, participants showed an increase in muscular strength and resting RQ despite a decrease in strength training. Future studies are needed to identify physiological mechanisms behind these findings.

Impacts of Time Restricted Feeding on Peak Volume of Oxygen Uptake and Substrate Utilization

Corbyn Bendtsen, Megan Lind, Megan Coyle, Eric Norman, Andrew Kezar, Marquel Fleischacker, Lauren Kaminski, Cassondra Fileccia, Emma Masiulewicz, and Nicole Schweitzer

Faculty Mentor: Justin Geijer

Time Restricted Feeding (TRF) is a type of Intermittent Fasting, which refers to the finite time to intake calories during the day. TRF has become a dietary approach that is used for weight loss and overall health. Individuals that partake in TRF may experience a decrease in peak volume of oxygen uptake (VO2peak) due to minimization of glycolytic stores. To date, few studies have compared the impact of TRF on VO2peak. PURPOSE: The current study aimed to further investigate the metabolic impact of TRF. METHODS: Twenty one participants, ages 18-60, completed an eleven week longitudinal study to examine differences in VO2peak, substrate utilization crossover, and resting substrate utilization. Participants self-reported diet, exercise, sleep, and medications over two separate four week periods. The first four weeks were without TRF and the following four were with TRF. A maximal exercise test and a resting metabolic test were performed three times, four weeks apart from each other. A repeated measures ANOVA was performed to determine within subject differences. A post-hoc analysis was performed to determine the time effect. RESULTS: VO2peak was significantly lower after implementing TRF ($p<0.001$). The mean pre-test VO2peak was 2.95±0.59 L/min and the non-TRF testing was 3.14±0.68 L/min. During TRF, the mean was 2.76±0.54 L/min. There was a significant difference between the pre-test and TRF ($p=0.012$). Also, there was a significant difference between non-TRF and TRF ($p=0.002$). Resting RQ showed a significant increase ($p<0.004$). The pre-test mean for resting RQ was 0.716±0.071. Non-TRF resting RQ had a mean of 0.736±0.082 and the TRF resting RQ was 0.802±0.097. There was a significant difference between the pre-test and TRF ($p=0.010$). Substrate utilization crossover showed a significant decrease ($p<0.03$) in fat usage after TRF implementation. There was a significant difference between the pre-test (123.9±30.1 watts) and TRF (98.8±30.1 watts; $p=0.05$). CONCLUSION: An earlier crossover of substrate utilization implies a decrease in fat usage and an increase in carbohydrate usage, therefore significantly lowering fat oxidation and VO2peak. Future studies are needed to examine the physiological mechanisms that may lead to shifts in substrate utilization during TRF.

Optimal Treatment for Meniscus Tears: Meniscectomy versus Meniscal Repair Surgery

Chyann Schmidt

Faculty Mentor: Nora Kraemer

Clinical Scenario: Meniscus surgeries are one of the most common surgical procedures performed in orthopedics. Since this procedure is so common, finding the most beneficial type of meniscus surgery will provide more positive patient reported outcomes (PROs). **Focused Clinical Question:** In patients who have sustained a meniscus tear, what is the effect of meniscectomy versus meniscal repair on

PROs? **Search Strategy:** Inclusion criteria were meniscus tears, with or without concurrent anterior cruciate ligament tears, and patients of all age ranges and activity levels. Exclusion criteria were associated bone fractures in the knee and previous knee surgeries. The search for studies was done through databases such as PubMed, ProQuest Nursing Collection, CINAHL Plus with full text, and Cochrane Library. Some search terms used were meniscal repair surgeries, meniscus tear treatment, meniscus tear treatment options, meniscus tear, and meniscus tear studies. Nine studies were critically appraised. **Evidence Quality Assessment:** PEDro scores for the studies were 5/10-6/10 and the Oxford Centre for Evidence-Based Medicine scores were 2-3. **Results and Summary of Search:** The evidence was mixed on which surgery had better PROs. Four of the nine studies concluded that meniscal repair provided significantly better PROs in patients compared to meniscectomy (P>0.1). Two studies concluded that meniscectomies provide better PROs than meniscal repair (P>0.7). The remaining three studies concluded that there was no significant difference (P>0.09) between the two surgeries when comparing PROs. Although meniscectomies and meniscal repairs are similar, there are many benefits associated with both meniscectomies and meniscal repairs. Meniscectomies were associated with a better functional score, such as the Lysholm, Knee Injury and Osteoarthritis Outcome Score (KOOS), and the International Knee Documentation Committee (IKDC), since the meniscus is still intact, whereas meniscal repairs remove the meniscus and often led to poorer functional scores. Some strengths the studies included testing multiple functional scores within each study. The studies lacked in patient selection diversity regarding activity level and didn't include much detail about the patient selection. A weakness that several studies indicated was that a longer follow-up was needed in order to evaluate the full effect of the surgeries, especially since the consensus wasn't clear from the majority of the articles. **Clinical Bottom Line:** Since the evidence is mixed, more research needs to be conducted to determine the better option between a meniscectomy and a meniscal repair when comparing PRO's on patients who have sustained a meniscal tear. The SORT score was B. **Implications:** These findings should be used to determine which meniscus surgery would benefit the athlete more. Since meniscus surgeries are one of the most common surgical procedure performed, it is important to understand which surgery predicts more positive PROs. These PRO's, either positive or negative, may affect the athlete's personal and athletic abilities. Of course, we want the best outcome for our athletes which we can provide if we determine the surgery that yields the best outcomes.

Optimal Treatment for Achilles Tendon Rupture Surgical versus Non-Surgical

Stephanie Morgen

Faculty Mentor: Nora Kraemer

Clinical Scenario: Determining the optimal treatment for a complete achilles tendon rupture to return the individual to their normal activities with the lowest re-rupture rate is a commonly discussed topic in the active population. **Focused Clinical Question:** With patients who have sustained an achilles tendon rupture, what are the differences in re-rupture rate for of surgical versus conservative treatment? **Search Strategy:** Inclusion criteria consisted of the injury needing to be a complete rupture, no previous history of ankle surgeries on the affected ankle and a positive Thompson test on each patient. Exclusion criteria were a history of chronic ankle instability, previous surgery on the affected ankle, and patients over older than seventy years of age. Databases searched included CINAHL complete, ProQuest Nursing Collection, PubMed and Cochrane Library. Search terms included achilles tendon rupture, surgical treatment, conservative treatment, operative treatment, and non-operative treatment. Nine articles were selected after the search was complete. **Evidence Quality Assessment**: All studies received either a 6/10 or a 7/10 on the PEDro scale. The studies were rated a level 2 or level 3 on the 2011 Oxford Centre for Evidence-Based Medicine levels of evidence scale. **Results and Summary of Search**: The number of

study participants range between 30 to 72 and were 18-65 years of age. There were no significant differences (p>.19) between the surgical and conservative treatments on re-ruptures rate. Re-rupture rates ranged between 2% to 9.5% for the surgical group and 4.2% to 14% for the conservative treatment group. Even though surgical treatment proves to be a better option, all studies considered conservative treatment as a viable option when treating an achilles tendon rupture. The main benefits associated with operative treatment included the reduction in the duration of cast immobilization and overall lower re-rupture rate. However, the main drawbacks include the potential of surgical complications and wound infections. Eight out of nine studies concluded that although there were no statistically significant differences between groups, there were fewer re-ruptures in the surgical repair group. One major strength of the research was having similar number of participants in the operative and conservative treatment groups. The primary weakness included wound infections in the open surgical repair groups up to 8.4%. Within the research there was a lack of follow-up which made it difficult for to see how the treatment in the long term benefited individuals. **Clinical Bottom Line:** Overall, there were fewer re-ruptures in the surgical group compared to the conservative group. The study received a SORT score was A. **Implications:** Athletic trainers commonly work with lower leg injuries and may encounter achilles tendon ruptures throughout their careers. Athletic trainers need to be able to recognize the injury and determine the best possible treatment for achilles tendon ruptures.

Patellar Instability Patterns After MPFL Reconstruction Post-Traumatic Patellar Lateral Dislocations

Sydney Ernst

Nora Kraemer

Clinical Scenario: Traumatic lateral patellar dislocations are sustained frequently due to twisting of the knee on a planted foot with a valgus overload force occurring from an outside source. The relocation of the patella often leads to disruption of the medial patellofemoral ligament (MPFL). **Focused Clinical Question:** In patients who have sustained a traumatic lateral patellar dislocation, what is the effect of surgical compared to conservative treatment of the MPFL on patellar instability patterns? **Search Strategy:** PubMed, CINAHL Complete, Cochrane Library and ProQuest Nursing Collection were searched using the terms MPFL reconstruction, MPFL reconstruction surgery, Conservative AND surgical treatment MPFL, and Conservative MPFL. A range of 4 – 23 studies were found with 11 studies meeting full inclusion criteria. Nine studies were used for this critical appraisal. Inclusion criteria were acute traumatic lateral patellar dislocation, positive MRI findings indicating MPFL damage, and a need for a reduction procedure. Exclusion criteria were chronic dislocations, previous knee surgery, lower limb disabilities such as neurological disruptions or musculoskeletal conditions such as Multiple Sclerosis, and patellar fractures. **Evidence Quality Assessment:** All studies evaluated for evidence had to be qualified by use of the Physiotherapy Evidence Database (PEDro) scale and the Oxford 2011 Levels of Evidence. The total number of points able to be earned with the PEDro scale is 10 with a score of 6/10 being necessary for critical appraisal. All studies found received a 6/10 and were level 2 studies using the Oxford scale indicating randomized or controlled clinical trials. **Results and Summary of Search:** The studies ranged between 33 – 125 participants. There were statistically significant differences in re-dislocation rates or instability patterns measured subjectively between the treatment groups in two of the nine studies (p=.03 to .047) with no statistical differences (p > .05 to .479) in the remaining seven, although subjective responses indicated significant differences. On average, 7.14 to 71% of patients receiving conservative treatment experienced redislocation patterns with 0 to 65% of patients experiencing redislocation or patellar instability in the surgical group. The primary strength of the studies was the 100% follow-up rate and weaknesses included lack of blinding of the study participants and physicians administering the intervention. **Clinical Bottom Line:** Patients who undergo surgical

reconstruction of the MPFL showed lower patellar instability patterns than those who undergo conservative treatment. Therefore, MPFL reconstruction is a viable treatment option in comparison to conservative treatment. Strength of Recommendation Taxonomy (SORT) Score: B. **Implications:** Athletic trainers should consider the subjective measurements of instability associated with conservative treatment in terms of recurrent dislocation patterns in athletes as well as surgical risks such as extended return-to-activity time and infection.

The Effects of PRP and CS Injections on Clinical Outcomes in Lateral Epicondylitis

Alyssa Allard

Faculty Mentor: Nora Kraemer

Clinical Scenario: Lateral epicondylitis ("tennis elbow") is an overuse injury that affects the extensor muscles which originate on the lateral epicondyle, and may cause them to swell and produce pain along the lateral part of the forearm at the elbow. Pain and tenderness of the lateral epicondyle may occur and worsen during or after activity. Other symptoms include decreased range of motion or pain with resisted wrist extension. **Focused Clinical Question:** In patients with lateral epicondylitis, what is the effect of platelet-rich plasma (PRP) injections compared to corticosteroid (CS) injections on pain? **Search Strategy:** Inclusion criteria were patients with lateral epicondylitis who had no previous treatment for the condition, and had no history of arthritis or similar diseases. Exclusion criteria were patients who had been previously been treated for the condition or had bilateral symptoms, a history of carpal tunnel syndrome within the previous 6 months. The following databases were searched: PubMed, Cochrane Library, CINHAL Complete, ProQuest Nursing Collection, and EBSCOHost databases for studies published between 2002-2018. Common search terms included lateral epicondylitis, tennis elbow, platelet rich plasma, PRP injections, corticosteroid injections, autologous blood. The total number of initial hits was 1,783 when searching "lateral epicondylitis," and was narrowed to nine studies that met the inclusion criteria. **Evidence Quality Assessment:** Studies were analyzed using the PEDro scale and Oxford Level of Evidence scores. PEDro scale scores ranged between 6/10 to 9/10. All studies received a score of 2 on the Oxford 2011 Level of Evidence. **Results and Summary of Search:** Initially, CS injections were seen to effectively decrease pain short-term in patients with lateral epicondylitis. However, when analyzing long-term pain relief, PRP injections were more effective than CS ones. VAS scores for PRP injection group ranged between 21.3 to 70.1 ($p<0.001$). VAS scores for CS scores ranged between 42.0 to 66.2 ($p = 0.104$). Six studies included patient follow-ups between 4 weeks and 12 months, most commonly were 6 months. The studies ranged between 40 to 100 physically active patients. Strengths of the studies involved no serious adverse effects, no infections, and low dropout rates. A weakness was having no true saline placebo for CS or PRP injections. Additionally, eight out of nine studies did not blind the therapists administering therapy, and only five blinded the subjects. **Clinical Bottom Line:** PRP injections were more effective in terms of pain relief in patients with lateral epicondylitis compared to CS injections. The SORT score is B. **Implications:** Patients with lateral epicondylitis should be made aware and educated of all treatment options, including the different injection types for lateral epicondylitis. Patients should realize CS injections provide effective short-term pain relief, but have a may have higher rate of pain recurrence. PRP injections provide a longer lasting and efficient pain relief.

Political Science

Affirmative Action: Students Attitudes toward Anti-Discriminatory Policy

Luis Lepe

Faculty Mentor: Kara Lindaman

Affirmative Action is a set of policies adopted by universities to establish equal opportunity and close the enrollment gaps. Affirmative Action is a hot topic in recent decades. Critics of Affirmative Action think that the policy is no longer needed to even out the playing field while advocates for Affirmative Action think it is needed to close the enrollment gap and correct past racial discrimination and injustice. This research surveys attitudes of Winona State students on Affirmative Action, and if they agree with the anti-discriminatory policy or if they reject Affirmative Action. This study surveys 100-150 students at Winona State to find the determinants of student's attitudes toward Affirmative Action. This research is important to measure the contemporary support of college students of Affirmative Action policy.

An Analysis of Rising Hate Crime in the Trump Era

Jorge Almaraz

Faculty Mentor: Kara Lindaman

In recent years, reported hate crimes in the United State have significantly shifted. The current polarizations among racial groups, liberals, conservatives, Democrats, Republicans, right/left wings and President Trump's divisive political approach have significantly contributed to these shifts. This study tests whether the increase in number of reported hate crimes is caused by Trump's divisive rhetoric. This explanatory online investigation examines hate crime trends in relation to the Trump era. This research observes reported hate crimes in the 50 U.S. States in relation to Trump voters, presidential approval ratings, before and during Trump presidency. The objective of this study is to determine if the current political polarization in the United States effects hate crime rates. These findings are important to our sociopolitical environment and social well-being.

Condoms and Conservatives: Support for Planned Parenthood in Reference to Political Ideology by State

Zachary Listner

Faculty Mentor: Kara Lindaman

In recent years, Planned Parenthood funding is subjected to culture wars and dysfunctional partisan polarization. This research looks at the relationship between support, in terms of funding, for Planned Parenthood clinics by state, in reference to political ideology by state. By looking at the fiscal year budgets of 2018, this research examines the effects of politics on Planned Parenthood funding. Looking at the patterns between state budgets in terms of dollars and percent of the budget, tests whether politics are involved in deciding the amount of access to reproductive healthcare clinics. By examining a state by state level of political ideology in to funding, historical political views on Planned Parenthood's practices are used to determine if there is a pattern amongst funding choices. The pattern shows how each of the state's budgets incorporate funds for these kinds of organizations, specifically Planned Parenthood. By examining statistical significance between funding for Planned Parenthood and political ideology by state, decisions are made to change funding and support of these facilities.

Do GOTV Organizations on college campuses increase voter turnout for students and first time voters?

Christina Melecio

Faculty Mentor: Kara Lindaman

There has been a heavy push on getting people actively involved in civic engagement, specifically to increase voter turnout of college students and new voters. It is important to consider a variety of factors on the determinants of voter turnout. This study expands the research to include the study of GOTV and voter organizations. The number of non-profit organizations, which mobilize people expend tremendous efforts and resources in hopes of making a significant different. Through a survey this study tests whether these organizations affected voter turnout of WSU students in the 2018 midterm election. The findings support an active role for GOTV organizations on college campuses to increase voter turnout and civic engagement.

Does Personality Determine Partisanship and Political Behavior?

Shannyn Chesley

Faculty Mentor: Kara Lindaman

Political Psychology is concerned with the characteristics of individuals and situations that are most conducive to a successful political system. Psychology is the study of people and behavior, while politics is the study of voting behavior. Psychologists have joined with political scientists to study the factors of voter turnout and vote choice. Cross cultural research shows consistent themes to people's moral judgments across different cultures. This study helps people understand why people with equally strong moral convictions may disagree on political issues such as abortion, capital punishment and flag burning. This study shows how psychology and political science complement each other in explaining the direction, stability and strength of personality on party identification and voting behavior. This study provides new insights into the relationship between personality and party identification. It is demonstrated that the study of political behavior benefits from the inclusion of psychological models – especially when attempting to answer classic, but still highly relevant, questions on the antecedents and stability of partisanship.

Does Teamwork Make the Dream Work? Fire Service Consolidation in Minnesota's Eighth Congressional District

Jacob Skluzacek

Faculty Mentor: Kara Lindaman

Local governments consider consolidation as an answer to providing more cost-efficient services. Since 1815 when New Orleans merged with Orleans Parish, Louisiana, many different governments have experimented with consolidation. The research shows that consolidation does not lead to lower costs or higher efficiency. This study applies this framework to Minnesota's Eighth Congressional District's 180 fire departments, some of which are consolidated, to determine if the consolidated districts spend less while also improving efficiency. Minnesota's Eighth Congressional District is selected to provide a large sample size for data analysis. It also provides opportunities for comparative analysis between urban and rural departments and differences in budget size and response time. Departments are evaluated based on their reported budgets and average response times. The departments which are not consolidated serve as a control and are used to compare the figures collected from the consolidated departments.

The findings allow decision-makers to determine if consolidating fire services is a better option for communities within Minnesota's Eighth Congressional District.

Easy as 123: Making Votes Count in the United States

Christianne Hill

Faculty Mentor: Kara Lindaman

The implementation of rank choice voting (RCV) systems is increasingly salient in the United States. This voting system may result in significantly different outcomes compared to the commonly adopted plurality voting system. This research examines how requiring citizens to rank candidates by preference may impact voter turnout in an election. The RCV system also shows to reduce polarization between the two major political parties in the United States. The tone of campaigning in RCV systems is also addressed as a factor that may encourage higher voter turnout. Voter turnout data from cities with similar characteristics, in demographics, population, and size, but with different voting systems are analyzed to examine the statistical significance between voting system and voter turnout. Data are collected through official Secretary of States government websites, and from cities using RCV systems. Since US politics is at a pivotal point, the findings have significant effect to increase voting and determine outcomes of important elections.

Locked Out of Democracy: How Race Effects Attitudes Towards Felon Disenfranchisement

Adam Thompson

Faculty Mentor: Kara Lindaman

In the United States more than 5 million people, equal to 1 in 40 adults or 2.5 percent of the U.S. voting age population, are disenfranchised due to a felony conviction. The population is disproportionately Black, with 1 in 13 Black Americans disenfranchised. This study tests whether an individual's race effects their attitudes towards voting rights for felons. Through the use of the General Social Survey (GSS) data from 2014, the research examines whether race and party identification effect attitudes towards the voting rights of felons. It is important to consider how race effects policy making, and especially in policies with racial disparities.

The role of government: Students attitude towards bureaucratic involvement.

Holden Brandon

Faculty Mentor: Kara Lindaman

The controversial conversation of the role of government has led to many questions in the political realm on what jurisdiction the government has in assisting their citizens. Supporters of bureaucratic involvement in government programs believe that the free market disregards regulation whereas supporters of the free market involvement believe that competition promotes cheaper and efficient solutions to programs. This study intends to collect the opinions of 100 - 150 Winona State students in order to determine if race, gender, age, and location matter in their decisions on government. Determining such results will help understand the ideological roots of students and their opinions on the role of government.

Women vs Men; The Influence of Gender on the Wage Gap

Jenell Robasse

Faculty Mentor: Kara Lindaman

The purpose of this study is to explore the wage gap. Besides gender, wage gaps may exist by geography, by education, and by demographics. In different geographical locations, there are different types of economies. In different economic systems, there are different labor markets with different pay rates. Education may also have an effect in determining a wage gap. For example, the more education someone has increases their pay rate. Demographics also may determine a wage gap. For example, race is hypothesized to effect differences in wages. The findings show gender is a statistically significant determinant of the wage gap.

Psychology

A Research Study of Personality Traits and Eating Health Behaviors Among College Students

Hannah Kunkel, Theodore Mickelson , Abby Teply, Trevor Gibson, Alexa Jo Schafer

Faculty Mentor: Trisha Karr

The relationship between personality and health has important implications for preventative medicine. Previous research has shown that personality traits are linked to different health choices. One study addressed the personality traits that affect fruit and vegetable consumption and another study addressed the effect personality has on consistent eating patterns. However, to further investigate the effects of personality and eating health outcomes of college students, a variety of health factors were addressed. The purpose of the present study is to identify specific personality traits among college students that contribute to positive or negative health behavior choices. The research design included multiple surveys, such as a demographic questionnaire and the Big Five. Participants were 86 undergraduate students obtained from the psychology study pool. The data was analyzed using independent samples t tests. Participants groups were identified as high or low for each personality trait using the median split technique. Participants who scored higher on conscientiousness also reported a greater frequency of eating breakfast and lunch weekly compared to other participants. No significant findings were found for other personality traits. These findings could have important implications for adapting personality traits to prevent later health problems by addressing healthy eating habits earlier in young adults.

Continuity Information and Etiological Explanations: Influences on Mental Health Stigma

Marissa Schneider and Molly Thomforde

Faculty Mentor: Laura Koenig

The current study attempted to assess how the type of etiological explanations for symptoms and the belief of continuity of mental illness affected the rates of reported stigma scores in

Winona State University students. Participants were assigned to read one of four vignettes describing a fictional character that had depression. Each was as similar as we could make them while differing in the etiological explanation (caused by biogenetic factors or psychosocial factors) of the mental illness as well as describing the character as being on a continuum or having a dichotomous experience. All the participants took the Community Attitudes Towards the Mentally Ill scale (CAMI) to assess levels of stigmatized attitudes after reading the vignette. The CAMI measured for four facets of stigma (authoritarianism, benevolence, social restriction and community mental health ideology). Two-way factorial ANOVAs indicated that there were no significant effects found for either the etiological explanation or the belief of continuity of the four stigma facets. There was also no interaction found between the belief of continuity and the etiological explanations that affected rates of stigmatized attitudes in participants.

Eating Behaviors and Cultural Influences on Appearance: What is the Experience of College Women?

Alexa Jo Schafer, Theodore Mickelson, Hannah Kunkel, Abby Teply, and Trevor Gibson

Faculty Mentor: Trisha Karr

Previous research has shown that people who suffer from eating disorders are likely to engage in unhealthy eating behaviors and cultural pressure toward appearance. The purpose of the present study was to replicate previous studies examining unhealthy eating behaviors and cultural values of appearance among college women. It was hypothesized that approximately 50% of college women at WSU engage in unhealthy eating behaviors and college women who report unhealthy eating habits will also note greater awareness of cultural values toward appearance. Seventy-nine undergraduate women participated in a series of online surveys through Qualtrics. Variables examined for this project came from a demographic questionnaire and the Sociocultural Attitudes Toward Appearances Questionnaire-4-Revised (SATAQ-4R). Participants self-reported a range of BMI scores between 16.5 and 42. An independent samples T-test was conducted in order to identify group differences on unhealthy eating behaviors (some or none) and cultural influences. Approximately 50% of participants reported engaging in at least one unhealthy eating behavior. Women who reported engaging in some unhealthy eating behaviors also reported greater internalization of thinness, general attractiveness, and pressure from the media, compared to those who reported none. Campus efforts to improve health among women may be benefitted by interventions that reduce cultural influences on expectations for appearance.

Effects of Caffeine on Prospective and Retrospective Working Memory in Rodents

Erin Seabright, Nick Wobig, Nora Freetly, Angela Gifford, Rowan McGlasson, and Whitney McShane

Faculty Mentor: John Holden

Caffeine is a substance that many people now consider to be a necessary part of their daily routines due to its desired effect of keeping us awake and functional. It's been subject to much

debate over the years as to how it affects performance in terms of memory and cognitive ability. In our study, we examined the performance of 15 male rats in a delayed matching-to-position task (delayed from 1-20 seconds) after administering intraperitoneal injections of caffeine (10 mg/kg) to assess their levels of working memory and compared them to a control group that was similarly injected with saline. Each group of rats were trained in this task prior to experimental trials using methods of either differential outcomes (DO) or non-differential outcomes (NDO) and their performance measured as using prospective and retrospective working memory respectively. Pairwise comparisons using Fischer's LSD showed a significant decrease in performance of those injected with caffeine at the 5 and 10 second delay in the DO group and at the 5 second delay in the NDO group when compared with those in the control groups in each condition. The results show that more can be learned about caffeine's effects on working memory and that further research with a larger subject pool would be a promising way to do so.

Feminist Attitudes of Non-labelers

Janelle DeRubeis, Grace Stanley, Emma Odiet, and Gabrielle Dose

Faculty Mentor: Elizabeth Russell

Recent studies on those who label themselves as feminists and non-feminists have become a popular topic of research. Past research has found that many women hold feminist values, but don't label themselves as feminists. Those who identify as feminists have been found to have higher levels of well-being than those who do not identify as a feminist (Zucker & Bay-Cheng, 2010). Other benefits have been found such as empowerment, resilience against sexism, and improved body-image (Zucker & Bay-Cheng, 2010). Yet, many women continue to not identify with labeling themselves as feminists (Fitz, Zucker, & Bay-Cheng, 2012). In the current study, we examined the phenomenon of "I'm a feminist, but…" through the relationship between feminists, non-labelers, and non-feminists. Specifically, we analyzed how they differ on feminist identity attitudes via the Feminist Identity Composite Scale consisting of five attitudes: passive acceptance, revelation, embeddedness-emanation, synthesis, and active commitment (FIC; Fischer et al., 2000). We collected usable date from 337 female undergraduate students from two universities. They were asked to indicate agreement with core feminist beliefs (Zucker, 2004), indicate whether they identified as a feminist, and complete a survey regarding feminist identity questions. A multivariate analysis of variance (MANOVA) was ran to test the multiple dependent variables. Preliminary results indicate a significant difference among non-labelers, feminists, and non-feminists. This suggests that researchers and practitioners in psychology should consider non-labelers to be a unique group of women separate from clear feminists and non-feminists.

Personality Traits and Exercise Motivation Among College Students

Theodore Mickelson, Hannah Kunkel, Abby Teply, Trevor Gibson, and Alexa Jo Schafer

Faculty Mentor: Trisha Karr

Exercise and its benefits have been studied for a long period of time. Something that has gained interest is identifying what influences individuals to exercise, and if personality has any impact. The purpose of this study was to understand if conscientiousness and neuroticism influenced different exercise motivations. Participants (*N*=97, Males= 39, Females= 58) were recruited from academic and athletic clubs at Winona State University. The participants filled out multiple inventories using paper and pencil. This study is looking in particular at the Big Five Inventory (BFI) and Exercise Motivation Inventory-2 (EMI-2). Bivariate correlation analyses were conducted in order to examine the relationship between variables, using SPSS, version 25. Significant positive correlations were found between conscientiousness and ill health avoidance, positive health, and stress management. A significant negative correlation was found between neuroticism and positive health. The results indicate that those who are higher in conscientiousness engage in healthy exercise habits, while those lower in neuroticism may be exercising to improve health. These findings can be useful in identifying personality traits to help motivate individuals to exercise.

Predicting Physical Activity: The Role of Social Support and Self-as-Doer Identity

Sydney Bendtsen and Calvin Hanson

Faculty Mentor: Amanda Brouwer

The self-as-doer identity is a motivational identity that describes oneself as the doer of a behavior, such as physical activity. Social support, including emotional, instrumental, and financial assistance from friends, family, and significant others, can also influence health habits like physical activity. However, there is limited research on the relationship between social support, self-as-doer identity, and their effects on physical activity. Therefore, we hypothesized that there will be a positive relationship between social support for exercise and physical activity rates, specifically that support from significant others will be associated with greater physical activity rates. We also hypothesized that a self-as-doer identity will predict physical activity over and above social support for exercise.

Participants (N=126, Mage=20.40, SD=2.86) completed a survey with questions assessing the self-as-doer identity for physical activity, and the role of family, friend, and significant other social support for physical activity. Correlation coefficients and hierarchal linear regression analyses were computed.

Physical activity was not correlated with family involvement support (r= .04, p=.65) or family reward support (r= .12, p=.17), but was positively correlated with friend support (r=.18, p = .04) and significant other support (r=.25, p = .05). In addition, the self-as-doer identity was positively correlated with physical activity (r= .30, p=.02). In hierarchical analyses, all types of social support accounted for 17.1% of the variance in physical activity (R2=.17, F(4,23)=1.19, p=.34), but this was not significant. The self-as-doer identity predicted an

increase of 30.6%, (ΔR2=.306, F(1,22)=12.88, p=.002) of the variance in physical activity above and beyond all types of social support.

Significant other support and friend support are associated with physical activity. The lack of family support may be because college students are living away from home and have less frequent interactions with family. That the self-as-doer predicted physical activity above and beyond social support suggests that individual, motivational factors account for more variance in physical activity behaviors than does the support of others. This research grants insight into the psychology of motivation, specifically how factors such as identity and social support affect exercise habits. That is, seeing oneself as the doer of one's physical activity behaviors is likely to promote more engagement in physical activity. Furthermore, the significant correlations between significant other and friend support and physical activity would suggest that having a significant other or associating with a group of friends that are physically active is associated with increased levels of physical activity. Future researchers could focus on the self-as-doer identity in an experimental setting and how it impacts individuals' decision to exercise as well as exploring social support in different age groups as the role of family and friends may change depending on age.

Sleep, Caffeine and BMI: What is the Experience for College Students?

Trevor Gibson, Hannah Kunkel, Theodore Mickelson, Alexa Jo Schafer, and Abby Teply

Faculty Mentor: Trisha Karr

Sleep among college students has been studied for a long time. Something that has gained interest is the variables that effect sleep including BMI, caffeine, and academic standing. Data for the study was gathered over the course of five weeks with a demographic survey via Qualtrics. A group of five researchers collected the data in person. Seventy-nine women participated in the research, with ages ranging between 18 and 26 years old. Respondent anonymity was ensured by the researchers recording each participant based off the last four digits of their phone number. This correlational study examined BMI, caffeine, and sleep. All hypotheses were supported in that significant effects were not found for associations between BMI and caffeine, and caffeine and sleep. Academic standing was positively associated with sleep in that more years of education was related to more hours of sleep. These results seem to counter previous beliefs about healthy behaviors among college students. Other motivations not examined within this study may influence college students' health behaviors.

Spatial Working Memory Under Differential and Nondifferential Outcomes I: Effects of Nicotine

Nick Wobig, Nora Freetly, Angela Gifford, Rowan McGlasson, Whitney McShane, and Erin Seabright

Faculty Mentor: John Holden

Previous studies have demonstrated the potential for nicotine to enhance cognitive ability including learning, attention, and memory in both animal and human models. The effects of

nicotine were examined while subjects performed a discrimination task under delayed conditions. Subjects were trained under nondifferential outcomes (NDO), or differential outcomes (DO) procedures. While subjects that were trained under (DO) did exhibit performance gains across delays indicative of the differential outcomes effect (DOE), no evidence of significant performance gain as a function of nicotine exposure were found under either condition. We are currently engaged in a follow-up study using a wider range of doses in which we investigate the effects of ethanol, scopolamine, MK-801, and dextromethorphan.

Spatial Working Memory Under Differential and Nondifferential Outcomes II: Effects of Scopolamine

Rowan McGlasson, Whitney McShane, Angela Gifford, Erin Seabright, Nick Wobig, and Nora Freetly

Faculty Mentor: John Holden

This project examined the effects of drugs associated with working memory on the accuracy of subjects completing tasks under differential outcomes (DO), that utilize a unique outcome after each stimulus and response sequence, or tasks with non-differential outcomes (NDO) where the two available outcomes randomly occur after each stimulus and response. Such drug can indicate neurochemical differences and similarities between these tasks, and insight into working memory. Tasks that administer differential outcomes are linked to prospective memory (foreseeing future events), while tasks with non-differential outcomes and common outcomes are associated with retrospective memory (memory of past events). Scopolamine, an acetylcholine antagonist, is prescribed to treat nausea and motion sickness, and is also a muscarinic cholinergic antagonist. Depending on the effect of scopolamine on memory performance at different doses in tasks that utilize differential and non-differential outcomes will indicate acetylcholine's role in prospective and retrospective memory. Subjects were required to complete delayed matching to position tasks with specific or randomized outcomes for each stimulus and response. Results suggested that acetylcholine mediated prospective and retrospective memory, with scopolamine effecting tasks that utilized differential outcomes less than tasks that utilized non-differential outcomes. This indicates that acetylcholine is linked to the accuracy in performance of tasks that utilize differential and non-differential outcomes, or prospective and retrospective memory.

Spatial Working Memory Under Differential and Nondifferential Outcomes IV: Effects of Dextromethorphan

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Pairing each stimulus-response in a conditional discrimination task (called *differential* outcomes or DO) has been shown to improve learning and working memory in performance situations, relative to procedures using just one outcome or random outcomes (called *nondifferential*

outcomes or NDO). Though research has shown that DO is strong enough to overcome amnestic drug effects, little work has been done to understand the why of this statement. We propose that DO is successful because DO and NDO result in the use of different memory systems (retrospective memory under NDO, and prospective outcome expectancies under DO). We believe that by utilizing certain cognition-impairing drugs we can showcase the difference of the two systems. In this study, dextromethorphan (DXM) was used to investigate working memory under DO and NDO conditions. 15 male Sprague-Dawley rats were trained in a matching-to-position lever task under NDO and DO conditions and drug administration was counterbalanced between groups. Results showed a significant effect of delay for subjects in both the DO and NDO groups, and a significant effect of drug for the DO group. These data suggest that NDO and DO procedures go through different memory systems, and that DXM may interfere with performance by disrupting formation, use, and recall of outcome expectancies through antagonism of the glutamate NMDA receptor.

Spatial Working Memory Under Differential and Nondifferential Outcomes III: Effects of Ethanol

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When each stimulus-response (S-R) sequence in a biconditional discrimination task is followed either with the same outcome *(common outcomes* or CO*)* or unique outcomes *(differential outcomes* or DO*),*subjects trained under DO typically learn choice tasks faster and perform significantly better across delays than subjects trained under CO or non-differential outcomes (NDO; where two outcomes are used but presented randomly after either S-R sequence). This improvement in performance is referred to as the *differential outcomes effect* (DOE). Our laboratory has conducted a series of pilot studies examining how a number of drugs linked to memory influence behavior under DO and NDO in the hopes of establishing neurochemical similarities and differences between the two systems. Subjects were 15 male Sprague-Dawley rats, aged approximately 4 months old, reduced to 85% of the free-feeding weights through food restriction. Subjects were trained in operant chambers equipped a with pellet feeder, two retractable front levers and one fixed lever at the back, run off of a Med Associates interface connected to a Hewlett-Packard computer. Subjects were trained in either a DO or NDO version of the task. Once subjects learned this task to criterion (3 consecutive days at 85% accuracy or above), they were switched to a delayed version of the task, where the delay period between the illuminating of the back wall light and the time when the trial could be advanced was set to 1, 5,10, or 20 seconds on any given trial. Order of drug/control administration was counterbalanced across subjects. Subjects were first administered an intraperitoneal injection of ethanol dissolved in saline, at a dose of 2 g/kg, or saline alone, 30 minutes before testing in the delayed-version of the task. After an approximately 48-hour interval, the second treatment was administered (e.g. if saline was administered on the first testing day, ethanol was administered 48 hours later, or vice versa). Pairwise comparisons using Fisher's LSD showed that, under saline, subjects in the DO group performed at a significantly higher level than the

NDO group at the 5, 10, and 20 second delays, *t*(13, 6, and 6.248)= 1.908, 2.185, and 2.625, *p*= .04, .036, and .019, respectively. Under ethanol, the DO group performed at a significantly higher level than the NDO group at the 5, 10, and 20 second delays *t*(13, 13, and 6.864)= 4.829, 2.204, and 3.807, *p*<.001 and *p*=.023 and .001, respectively. For the DO group, performance was significantly lower under ethanol at the 1, 5, 10 and 20 second delays, *t*(7)=-3.13, -3.742, -3.326, and -8.275, *p*=.009, .004, .007, and *p*<.001, respectively. For the NDO group, performance was significantly lower under ethanol at the 1, 5, and 10-second delays, *t*(6)=-3.357, 3.959, and 2.027, *p*=.008, .004, and .045. Our original hypothesis has been proven and we plan to test various amounts of this drug in our future laboratory.

The Effects of Social Exclusion and Personality on Social Connectedness

Melissa Martin

Faculty Mentor: Laura Koenig

The current study examined the effects of social exclusion and personality on social connectedness. Past research has shown that social exclusion leads people to feel less social connection to other people in their lives. In addition, experimental studies have shown that participants who are socially excluded, in turn participate in less prosocial behaviors. Finally, past research presented has exhibited personality traits as a mediator of this relationship, specifically, extraversion. Research suggests that participants who are more extraverted are less likely to be as affected by the manipulation of social exclusion and its effects. The current study consisted of participants enrolled at Winona State University. The participants were given a writing task that either assigned them to the social exclusion or control group. After the writing task, the participants were asked to fill out a questionnaire. The questionnaire consisted of demographic information and various scales. The scales included were of mood, personality, and social connectedness. The mood scale was used in the questionnaire to make sure that the results yielded were due to the manipulation of social exclusion and not negative mood. Data collection is still taking place for analysis. The study was a 2x2 factorial design that will be analyzed with a between subject's ANOVA.

The Relationship Between Ageism and the Pursuit of a Youthful Appearance Among College Students

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Faculty Mentor: Trisha Karr

It has been found that ageism occurs to create a barrier against death anxiety, or in other words death anxiety is a cause of ageism. Research also shows that death anxiety leads to health promoting-behaviors in young adults because they are attempting to avoid aging. Related to this idea, the present study explored the relationship between the pursuit of youthful appearance and hostile and benevolent ageism. A sample of (N=79) Winona State University female undergraduates completed a questionnaire using *Qualtrics*, an online survey tool, consisting of demographic questions, the Ambivalent Ageism Scale (AAS), and the

Sociocultural Attitudes Towards Appearance Questionnaire-4-Revised (SATAQ-4R). Using the median split technique, participants were categorized as either high or low in benevolent ageism and hostile ageism. Independent samples *t*-tests were conducted to assess group differences at the mean level between high and low scorers on hostile ageism and benevolent ageism on the appearance variables from the SATAQ. Results showed that participants who scored higher on hostile ageism scored higher on internalization of general attractiveness than those who scored lower on hostile ageism. Participants who scored higher on benevolent ageism scored lower on pressures from family than those who scored lower on benevolent ageism. Implications of this study indicate that those who are more concerned with the pursuit of a youthful appearance may be more likely to have hostile ageist beliefs, however, it also suggests that more research needs to be conducted on the relationship between social pressures and benevolent ageism.

Sustainability

Energy Use in University Resident Halls and Behavior Change

Jennifer Doyle

Faculty Mentor: Jeanne Franz

It is estimated that Winona spends more than $100,000 annually on electricity and water. Given the high cost of tuition as well as concerns about climate change, this study wanted to change student behavior as it relates to energy and water usage. The goals were three-fold, understand how students receive messages most effectively for behavior change, assess what their state of knowledge on conserving energy and water is, and cause behavior change to help students be more aware of how conserving energy can affect our planet. Residents of campus housing were surveyed at various points in the study and some combination of TV monitors and posters were used to convey the message to students in their respective resident halls. Overall, there does seem to be an increasing awareness of how individual actions can make a difference in overall energy use. Building on that, during an energy contest, there was evidence of a decrease in energy use in some residence halls. The students have more knowledge now on how to conserve energy and will be able to help make our campus a greener place. Continuing work will identify strategies to convey this message to the rest of campus.