Undergraduate Research & Creative Achievements Forum
Spring 2018

Schedule of Events
Tuesday, April 17, 2018

12:00 - 1:00 pm: Showcase of Film & Theatre, Monsanto Auditorium

1:00-2:10 pm: Session A, McQuinn Atrium, Bond LSC
2:20-3:30 pm:  Session B, McQuinn Atrium, Bond LSC
3:40-4:50 pm: Session C, McQuinn Atrium, Bond LSC

Abstract book prepared by:
Office of Undergraduate Research
Director: Dr. Linda Blockus
Assistant Director: Jenn Brown
Office Support Specialist: Katie Hays
Student Workers: Emma Mazza and Jessica Welsh
Student/Mentor Recognition and Student Showcase of Film and Theatre Schedule

Tuesday, April 17, 12:00 - 1:00 pm
Monsanto Auditorium, Bond LSC

**Student/Mentor Recognition**

*Welcome*
Linda Blockus, Director, Office of Undergraduate Research

*Mentor of the Year Awards*
Jim Spain, Interim Provost

*University Libraries Undergraduate Research Awards*
Ann C. Riley, Director, University of Missouri Libraries

*Acknowledgement of Student Ambassadors*
Linda Blockus, Director, Undergraduate Research

**Student Showcase of Film and Theatre**

*Willie Baronet*, documentary film
Suzy Le Bel, Documentary Journalism, senior, Dallas, TX
**Faculty Mentor**: Stacey Woelfel, Journalism

*Bananas*, documentary film
Matt Swing, Documentary Journalism, junior, Bartlett, IL
**Faculty Mentor**: Stacey Woelfel, Journalism

*daddy*, short fiction film
Taylor Stone, Film Studies, senior, St. Charles, MO
**Faculty Mentor**: Kamau Bilal, Film Studies

*Preparation Fate*, digital storytelling video
Amanda Battmer, Digital Storytelling and English, senior, Kansas City, MO
Hannah Overman, Digital Storytelling, senior, Overland Park, KS
**Faculty Mentor**: Katina Bitsicas, Digital Storytelling

*Glass People*, 10-minute play
Written by Amy Taylor, Theatre and English, senior, Branson, MO
**Faculty Mentor**: David Crespy, Theatre
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<td>Christopher Zachary</td>
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### 2017-2018 Undergraduate Research Ambassadors

- **Amanda Blythe**, Biochemistry
- **Alex Clarke**, Biochemistry
- **Emily Coonrod**, Biological Sciences
- **Caroline Dunn**, Biological Sciences
- **Sai Gajagowni**, Biological Sciences; Psychology
- **Romanus Hutchins**, Physics
- **Harper Leach**, Biological Engineering
- **Nathan Mahloch**, Biochemistry
- **Al McClelland**, Biological Sciences
- **Sarah Pribe**, English; International Studies
- **Madeline Simon**, Biomedical Engineering
- **Alexa Thein**, International Studies; Spanish
- **Maddie Willis**, Biochemistry
- **Alec Wilken**, Biological Sciences
Student Presenters

undergradresearch.missouri.edu/forum
Prior research has demonstrated that there is a deficit in associative long-term memory in older adults relative to younger adults (Old & Naveh-Benjamin, 2008). It is unclear if the associative memory deficit of older adults also features in short-term/working memory (STM). Previous studies have used a continuous recognition paradigm in order to test for evidence of age-related deficits in STM (Chen & Naveh-Benjamin, 2012). A more refined version of continuous recognition, using a fine-grained recall task, may be more sensitive to age differences in STM. Twenty-five undergraduate students (18-24 years) and twenty-five older adults (67-79 years) were recruited from a Midwestern institution and central Missouri, respectively. Participants study object-location pairs and memory tests are mixed with study events at different lags, allowing us to look at short and longer-term memory. At test, participants re-locate the presented object to its remembered location. Measuring the distance between the studied and recalled locations allows us to categorize errors as due to memory noise, random guessing, and misassociation (recalling objects in the incorrect location of another object). We also use neuropsychological measures of medial temporal and frontal functioning to predict different sources of error on the main recall task in younger and older adults. We predict that older adults will exhibit a greater degree of error in recalling the location of objects, compared to younger adults and that degree of error will get larger as the delay between study and test gets longer. Also, the greater degree of error will be driven by misassociation in older adults, compared to younger adults. Through tracking the three different sources of error we will be able to determine how the associative memory deficit of older adults emerges over different delays. This will help in resolving discrepancies in the literature regarding whether the deficit is present in STM.
Human phosphoglucomutase 1 (PGM1) is a crucial metabolic enzyme involved in glycogen metabolism and protein N-glycosylation. Disease-causing variants of PGM1 associated with inherited metabolic disease have previously been identified and studied within the lab. Although much is known about enzyme structure, details of the interactions between the enzyme and its substrate, product, and intermediate have not been characterized. This information is important for understanding the key residues in the active site and catalysis. Here we describe crystallization and structural analysis of PGM1 with glucose 6-phosphate (G6P), the first enzyme-ligand complex to be characterized for this protein. X-ray crystallographic studies reveal conformational change within the active site of PGM1, which is associated with the binding of the ligand. Key residues involved in contacting the phosphate group of G6P were identified. Several of these residues are from an active site loop in domain 4 (D4) of the protein, which is affected by known disease-associated variants. The structure also helps us understand how the enzyme changes throughout its reaction mechanism, which is critical for function. This structural data may be helpful in developing therapies that can restore function to disease-variants of PGM1.
The effect of congenic myostatin inhibition on a mouse model of Osteogenesis Imperfecta (OI)
Ashley Aguillard, Victoria Gremminger, Salah Daghalas, Youngjae Jeong, Kristin Lenz and Charlotte Phillips

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Large icy grains in cometary comae
Amrit Bal and Aigen Li

Comets are thought to be the most pristine bodies in the solar system and to have preserved the original interstellar materials out of which the solar system was formed. Large icy grains could be present in cometary comae and survive against sublimation. The size, composition, and mass loss rates of large, micron-sized icy grains could probe the origin and evolution of cometary nuclei. We explored the optical properties of icy grains in cometary comae by applying different inputs to a code, written in Fortran by Dr. Aigen Li, that models coating on a homogeneous sphere. Our inputs to the code were indices of refraction for ices, silicates and organics. Our results can be tested through observation by the soon-to-be launched James Webb Space Telescope.

This project was completed to fulfill a Capstone requirement.
Uric acid concentrations after two weeks of fructose loading in adolescents
Liam Bal, Y. Liu and Jill Kanaley

Fructose is a naturally occurring simple sugar commonly found in food; however, fructose is also manufactured into high fructose corn syrup (HFCS) which is added to many foods and beverages. Fructose is the only natural sugar able to increase uric acid concentrations, by acutely affecting purine degradation and depleting ATP levels rapidly in the liver. This project examined the effects of 2 weeks of high fructose consumption on uric acid levels in lean and obese adolescents. Additionally in a subset of individuals the effect of fructose consumption throughout the day on uric acid levels were studied. Forty male and female adolescents completed two 2 week trials: 1) they consumed 50 g fructose/day diet (HF) or 2) they consumed 50 g glucose/day (HG) in addition to their ad libitum diet. Fasting glucose and uric acid levels were then measured. In 16 (8 lean/8 obese) male adolescents, subjects were studied over 12 hr where subjects were given a liquid shake every 4 hr (16.7 g fructose meal; 50 g fructose over the entire day) and uric acid levels were measured throughout the day. Following 2 weeks of loading fasting uric acid levels were not different between the HF and HG trials (HF: 4.4±1.8; HG: 4.5±1.7 mg/dL, p=NS), but obese subjects had higher uric acid levels than the lean subjects (obese: 5.8±3.1; lean: 4.9±2.7 mg/dL). Uric acid levels increased from the first meal to the second meal (integrated area under the curve (iAUC for 90 min) 13.1±2.1 vs 20.8±3.5 mg/dL, respectively, P<0.05) but were not different from the third meal (14.6±2.4 mg/dL). In conclusion, 2 weeks of HF consumption does not change fasting uric acid levels compared to HG consumption. Consuming fructose over 12 hr results in augmented uric acid levels at the second meal, but not at the third meal in healthy adolescents.
Faculty Mentor: Dr. Jaume Padilla, Nutrition & Exercise Physiology
Funding Source: NIH Initiative for Maximizing Student Diversity (IMSD-EXPRESS)

*Endothelial cell specific overexpression of endothelin-1 enhances exercise-mediated improvements in glucose tolerance in western diet-fed mice*

James R. Ball, Zachary I. Grunewald, Thomas J. Jurrissen, Makenzie L. Woodford, Michelle L. Gastecki and Jaume Padilla

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Investigating potential genetic interactions between MKP1 and DRP2B in plant immune responses
Jessica Barberis and Scott C. Peck

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
**Correlation of biomarker production to gross tissue grade by osteoarthritic cartilage**

John Baumann and Aaron Stoker

**Introduction**

Osteoarthritis (OA) is the leading cause of disability in the United States, however the pathobiology of the disease is still poorly understood. Our lab has developed a split tissue OA cartilage ex vivo model to study OA pathobiology and to test potential treatments of OA. In order to refine the model, this study was designed to determine if biomarker production correlates with the gross appearance of OA development in the tissue and determine the stability of OA biomarker production over time in culture. It was hypothesized that there would be a strong correlation ($r>0.7$) between tissue gross score and tissue biomarker production. Further, it was theorized that OA biomarker production would decrease over time in culture in the high biomarker production tissues.

**Methods**

All procedures were performed with IRB approval (IRB# 1208392). Explants (n=48) were created from two patients after undergoing total knee arthroplasty. Explants were split in half and each half was cultured for 9 days, with media changes every 3 days. Media was collected for biomarker analysis at each time point. At the end of culture, tissues were tested for metabolic activity using the resazurin assay, and weighed to determine the dry weight of the tissue. These data were used to standardize the media biomarker data. Correlation between gross scoring and biomarker values were determined using a Spearman Correlation. Changes in biomarker production over time was assessed using a T-test.

**Results**

Assays and data analysis for this study are ongoing and will be presented on the poster.
Student-teacher relationships, unique and important
Grace Beerly, Haley Bordelon and Sara Prewett

While evidence shows students in elementary school tend to have similar student-teacher relationship profiles across grades and teachers, little is known about the stability of student-teacher relationships across grades in adolescence. We studied whether students’ views about their student-teacher relationships with their math teachers were consistent across grade levels in middle school. Participants included 299 students from a Midwest rural middle school in 5th and 6th transitioning to 6th to 7th grades. Students completed surveys in January 2016 (wave 1) and December 2016 (wave 2). The variables included in our model were students’ wave 1 and 2 responses about their math self-efficacy and interest, as well as perceptions of their teachers’ socio-emotional support, conflict and prosocial behaviors. The correlations across the students’ responses collected in wave 1 and wave 2 were significantly, but weakly, correlated across grade levels. A regression model empirically found that only students’ wave 2 responses about their self-efficacy, interest, teachers’ support and conflict predicted their student-teacher relationships at wave 2. The implications are that, for adolescents, each student-teacher relationship is unique based on students’ perceptions of their teachers’ behaviors. We can focus on supporting teachers’ student-teacher relationship-building skills for adolescents.
Haley Benson
Columbia, MO

Faculty Mentor: Dr. Thomas Piasecki, Psychological Sciences

The mediation of the relationship between alcohol sensitivity and problematic alcohol use by cognitive and emotional preoccupation with alcohol
Haley Benson and Thomas M. Piasecki

Low sensitivity (LS) to alcohol has been identified as a major predictor of problematic alcohol use, but intervening mechanisms have not been fully elucidated. Studies show LS drinkers have exaggerated neural, cognitive, and behavioral reactivity to alcohol cues, suggesting pathological craving may be part of the risk pathway. This study investigated if craving mediates the association between LS and problematic drinking. Data were drawn from a sample of 392 frequent drinkers (>1 drink/week) who completed baseline questionnaires and participated in 21 days of self-monitoring using electronic diaries. Alcohol sensitivity was measured by the Self-Rated Effects of Alcohol (SRE) form, which assesses the number of drinks needed for respondents to experience pharmacologic effects. The Alcohol Use Disorders Identification Test (AUDIT) was used to index problematic drinking outcomes. Multiple mediation analyses tested whether the association of SRE to AUDIT scores operated indirectly via Cognitive & Emotional Preoccupation (CEP), a subscale of the Temptation & Restraint Inventory (TRI) measuring frequent experiences with craving alcohol and temptation to drink. Cognitive & Behavioral Control (CBC), another TRI subscale assessing restriction of alcohol use, was tested as a possible mediator. Existing theory posits that drinking to cope and positive alcohol outcome expectancies play a role in LS risk, and measures of these constructs were also tested as potential mediators. The SRE had a significant total effect on the AUDIT (b=1.0588, p<.001). CEP was the only significant mediator of this association (indirect effect: b=.1161, 95% CI=.0385-.2283). Multilevel regression analyses of diary data confirmed CEP scores were positively associated with alcohol craving (b=.012, p<.001) despite controlling for other mediators and situational factors. Findings suggest sensitized craving may be an important mechanism explaining how LS translates to problematic drinking outcomes.

This project was completed to fulfill a Capstone requirement.
Exploring potential explanations for association of depression and alcohol hangover in ecological momentary assessment data
Andrew Bilek and Thomas M. Piasecki

Depression is concurrently and prospectively associated with reports of frequent hangover (Paljärvi et al., 2009; Piasecki, et al., 2017). This study uses daily ecological momentary assessment (EMA; Shiffman, et al., 2008) data to investigate potential explanations for the overlap of these syndromes. Data were drawn from an EMA investigation of alcohol and tobacco use (N= 416, Piasecki, et al., 2011). Participants completed a number of baseline questionnaires, including the Hangover Symptoms Scale (HSS; Robertson, et al., 2012; Slutske, et al., 2003), a measure of hangover symptom frequency, and the Patient Health Questionnaire (PHQ; Spitzer, et al., 1999), which assesses major depression. Participants were then issued a palmtop computer (Palm m500) that served as an electronic diary. They recorded drinking behaviors for 21 days, and completed a Morning Report (7,398 records) every morning, in which they indicated whether or not they consumed alcohol the night before (endorsed in 2,695 reports, 36%), currently had a hangover (555 mornings, 21% of post-drinking mornings), and rated the intensity of current hangover symptoms. Multivariate linear regression analyses revealed that, consistent with prior findings (Piasecki, et al., 2017), depression was associated with higher HSS scores (β = .182, p < .001). Multilevel regression analyses of EMA morning report data found that the number of drinks consumed the night before, predicted hangover endorsement (OR = 1.28, p < .001). However, PHQ symptom count was not related to hangover (OR = 0.99, p = .80) and did not moderate the association between consumption and hangover (OR = 1.01 p = .083). Analyses predicting individual mood states revealed that participants with higher depression experienced more negative effects on both post-drinking and post-abstention mornings. Event-level analyses do not indicate that depression is associated with heightened pharmacologic sensitivity to hangover. However, the findings suggest depressed individuals experience more dysphoria in general.

This project was completed to fulfill a Capstone requirement.
The purpose of this research is to examine the knowledge base of students regarding the topic of ecosystems. This includes but is not limited to the boundaries, cause and effect relationships, and trophic levels within the ecosystem. We ask in what ways do students understand ecosystems and the interrelationships within them, and how does their understanding change. To answer these questions, we analyzed the effects of a previously designed and documented unit introduced into three separate third grade classrooms. The research project is based upon systems thinking learning theory, and draws upon the System Thinking Hierarchical Model in particular when examining how students create and understand models. The goal of the research is to evaluate the knowledge third grade students have of ecosystems and how that knowledge base changes after the implementation of a specifically designed ecosystem unit. A unit about environments and interactions was designed in conjunction with the teachers of each classroom and implemented over the course of a semester. At the onset of the unit, students were asked to draw a model of how they think all organisms interact with each other and their ecosystem. After the implementation of the unit, the students were asked to draw another model with the same instructions. By examining and scoring the pre unit and post unit student created models and supplementing the research with student pre and post interviews, researchers are now assessing the effects of the specifically designed ecosystem unit.
Prior to conducting our research, we wanted to understand how the 18-24 YO market views college education, the broader concept of learning and their perception toward career prospects. In order to do so, a 25-minute survey was distributed through Qualtrics to a national, 18- to 24-year-old respondent panel from which 721 complete responses were collected and analyzed. Primary research findings were then coupled with secondary research support to frame our conclusion. Our research indicates that while a majority of the YAYA demographic deems a college education to be a risky investment, they still believe that it is necessary to achieve success in life. YAYA consumers’ pragmatic approach to higher education makes them value the more cost-effective online degrees and the traditional ones equally; in addition, they also prefer real world experience than learning in a classroom setting. In other words, the epicenter of learning for YAYA consumers is shifting away from the walls of the classroom. While they recognize the difficulty in finding a good job in today’s market, the YAYA consumer remains optimistic about career-building in the long term. Individual outlooks yield more optimism as this confident demographic views college as a stepping stone before they work their way to their dream job.

This project was completed to fulfill a Capstone requirement.
Prostate and breast cancer are the most diagnosed forms of cancer, making up approximately 20% of cancers for men, and 30% of cancers for women, annually. Pancreatic cancer, one of the most aggressive cancers, kills approximately 80% of those diagnosed. Moreover, available treatments present toxicity issues due to usage of hazardous substituents in developing the drugs. Therefore, it is paramount to develop cost effective treatment modalities that have minimal side effects to the patient. This study investigated the utilization of green-nanotechnology as a means to treat these cancerous cells. Gold nanoparticles (AuNPs) were synthesized using acai-berry, cranberry, and elderberry extracts, facilitated by the berries’ phytochemical compounds. FDA approved gum arabic (GA) was used as a stabilizing agent in synthesis. The nanoparticles were characterized using UV-vis spectroscopy (UV-vis), dynamic light scattering (DLS), transmission electron microscopy (TEM), and high resolution transmission electron microscopy (HRTEM). Cellular in-vitro studies were carried against cancerous cells using dark-field microscopy and 3-(4,5-dimethly thiazol-2-yl)-2,5-diphenyl tetrazolium (MTT) assay. Results revealed that acai-/cran-/elderberry successfully produced gold nanoparticles (AB/CB/EB-GA-AuNPs, respectively) with no toxic byproducts. The size and charge for AB-GA-AuNPs, CB-GA-AuNPs and EB-GA-AuNPs are 110.6 nm/-18.5 mV, 47.1 nm/-9.02 mV, and 55.1 nm/-14.2 mV, respectively. Stability and toxicity analyses showed AB/CB/EB-GA-AuNPs demonstrate stability for at least one week in biological fluids and favorable toxicity towards the cancerous cells, compared to their respective extracts. TEM images revealed the core size for the AB/CB/EB-GA-AuNPs are 8 nm, 33 nm, and 25 nm, respectively. HRTEM images indicate a face-centered cubic lattice arrangement of the gold atoms. In conclusion, these nanoparticles exhibit stability in biological fluids, as well as desired cytotoxic effects towards the cancerous cells. These phytochemical AuNPs can provide new opportunities towards cancer treatment, as they are both cost-effective and environmentally friendly, and exhibit in vitro selectivity towards the cancerous cells.
Characterization of the suppressor of sessile spikelet3 maize mutant which functions in paired spikelet development
Amanda Blythe, Mahliyah Adkins-Threats, Shelbie Wooten and Paula McSteen

Zea mays (maize) and rice are two of the most important grasses in the world due to their central role in agriculture. The spikelet, a short branch which produces florets, is the fundamental unit of grass inflorescences. However, the key difference between grasses is the number of spikelets produced. In particular, maize produces paired spikelets while rice and wheat produce single spikelets. These spikelets are produced from groups of undifferentiated stem cells, called meristems, which must be maintained for proper plant growth. In order to study paired spikelet development and meristem maintenance, the Suppressor of sessile spikelet 3 (Sos3) mutant of maize is being analyzed. Sos3 mutants produce single instead of paired spikelets, causing defects in the development of the male (tassel) and female (ear) inflorescences. The resulting phenotype is characterized by fewer tassel branches and gaps between kernels on the ears. Therefore, the sos3 gene may play a role in paired spikelet development. Histology and scanning electron microscopy (SEM) analyses show that Sos3 mutants produce single spikelet meristems in place of spikelet pair meristems. Moreover, preliminary results indicate Sos3 shows a decrease in meristem size, suggesting that sos3 may function in meristem maintenance. To determine the location of the sos3 gene, fine mapping is underway. Currently, linkage analysis with microsatellite markers shows sos3 maps to chromosome 1 between markers umc2025 and umc1395. Identifying the sos3 gene will provide valuable insight into paired spikelet development, which could lead to increased yields in important single spikelet cereal crops.
Maize standing variation affects sensitivity to auxin treatment
Jenna Bohler, Norman Best and Paula McSteen

There is great genetic variation among inbred lines of *Zea mays* (maize). This variation could be easily observed by comparing the primary root length of maize seedlings grown in a solution of dimethyl sulfoxide (DMSO) to the root length of seedlings grown in DMSO and 2,4-dichlorophenoxyacetic acid (2,4-D). The phytohormone auxin has been shown to regulate many aspects of plant growth and development, including the inhibition of root length in maize. Initially, the most abundant naturally occurring auxin indole-3-acetic acid (IAA) was used as the treatment for this research. However, IAA had minimal effects on maize root length. The seedlings were then regrown using 2,4-D, which produced visible effects. 2,4-D is a synthetic form of auxin that is commonly used as an herbicide on dicotyledonous plants. Maize, being a monocot, was normally expected to be insensitive to 2,4-D. However, the results of this research suggest that 2,4-D actually inhibited the growth of maize roots when compared to untreated seedlings. With the 2,4-D treatment, the average percent reduction was 40.10% when compared to the longer, untreated seedlings. In addition, there was a significant variation in response to 2,4-D. The inbred line Mo18W actually showed longer roots with the treatment. This was likely due to genetic variation among the inbred lines. The purpose of this research is to identify different loci that control root architecture using Genome Wide Association Studies (GWAS) to either increase or decrease root length, depending on the plant’s need. Modifying root architecture could allow the plant to better anchor in the soil, mine for water and nutrients, and/or allocate the products of carbon fixation.
Can transnational terrorist change the ideological orientation of a government? In this study, we provide a cross-national analysis of OECD countries, and examine whether there is a relationship between changes in a government’s ideology after an election and terrorism attacks that occurred before those changes. We find that there may be some evidence for such a relationship, but that it remains inconclusive, and recommend further research on the subject.

This project was completed to fulfill a Capstone requirement.
Student-teacher relationships, unique and important
Haley Bordelon, Grace Beerly and Sara Prewett

While evidence shows students in elementary school tend to have similar student-teacher relationship profiles across grades and teachers, little is known about the stability of student-teacher relationships across grades in adolescence. We studied whether students’ views about their student-teacher relationships with their math teachers were consistent across grade levels in middle school. Participants included 299 students from a Midwest rural middle school in 5th and 6th transitioning to 6th to 7th grades. Students completed surveys in January 2016 (wave 1) and December 2016 (wave 2). The variables included in our model were students’ wave 1 and 2 responses about their math self-efficacy and interest, as well as perceptions of their teachers’ socio-emotional support, conflict and prosocial behaviors. The correlations across the students’ responses collected in wave 1 and wave 2 were significantly, but weakly, correlated across grade levels. A regression model empirically found that only students’ wave 2 responses about their self-efficacy, interest, teachers’ support and conflict predicted their student-teacher relationships at wave 2. The implications are that, for adolescents, each student-teacher relationship is unique based on students’ perceptions of their teachers’ behaviors. We can focus on supporting teachers’ student-teacher relationship-building skills for adolescents.
Jaylen Bragg  
Waynesville, MO  
Senior  
Soil, Environmental & Atmospheric Sciences

Faculty Mentor: Dr. Rebecca North, School of Natural Resources  
Funding Source: CAFNR On Campus Research Internship (Dudley & Virgie Alexander Scholarship)

Quantifying greenhouse gas ebullition rates across varying land uses, sediment types, and water temperatures in wetland ecosystems  
Jaylen Bragg, Jannice Newson, Hamza Amjad, Lauren Dyck, Selena Komarevich, Colin Whitfield, Helen Baulch, Jason Venkiteswaran, Nora Casson, Richard Helme and Rebecca L. North

Around the world, wetlands and other aquatic ecosystems release greenhouse gases (GHG) into the atmosphere. GHGs such as methane, carbon dioxide, and nitrous oxide are released from these systems through vegetative processes such as respiration and denitrification. However, GHGs are also released through the process of ebullition - or bubbles being released from the aquatic sediments. Ebullition can account for a major portion of GHG release, but it is often underestimated in global GHG budgets. This observational study aims to determine the factors that influence the ebullition of GHGs by quantifying volume and concentration of GHGs that are released in wetland ecosystems representing varying land uses (e.g., urban, agricultural, pasture, and forested areas), sediment types, and water temperatures. It was found that the relationship between gas volumes and water temperatures was positive, whereas the relationship between gas volumes and sediment organic matter was negative. As global temperatures increase due to climate change, understanding the factors governing ebullition rates will give us a better understanding of how this process contributes to the global GHG budget now, and in the future.
Help-Seeking behaviors in Missouri college students and a case for increasing mental health equity
Erica Braham, Daniel Reilly and Joan Masters

Missouri Partners in Prevention (PIP) is Missouri’s higher education substance abuse consortium comprised of 21 Universities in Missouri. PIP tracks students’ high-risk behaviors and behaviors that promote health and wellness through the annual implementation of the Missouri Assessment of College Health Behaviors (MACHB) survey. By examining student mental health concerns, PIP tracks the overall wellbeing of Missouri college students. The purpose of this study was to determine the Help-Seeking Behaviors of Missouri College Students. “Help-Seeking Behaviors” refer to the extent to which students feel that they can utilize on and off-campus resources when personal concerns arise. From years 2013 to 2017, the percent of all students who felt like they could go to no one on campus when personal concerns arose (14%) decreased to 6%. White students on campus (N=9760) reported that they would go to no one on campus at a rate of 5.32% (SD = 22.4); Black students on campus (N= 953) reported that they would go to no one for help at a rate of 12.3% (SD = 32.8). White students on campus reported that they would go to no one for help at a rate of 1.79% (SD = 13.2); Black students on campus reported that they would go to no one for help at a rate of 5.4% (SD = 22.7). Race, therefore, was significant in terms of students’ help-seeking behavior on campus F (1, 8466) = 52.45, p >.001 and off campus F (1, 8505) = 39.79, p >.001. These results indicate that although student’s help-seeking behaviors have improved across PIP schools over the last five years, there is a racial disparity among our campuses in terms of the extent to which certain groups feel they can seek help from others. Future goals should focus on increasing mental health equity across Missouri college campuses.
Evaluation of the effectiveness of a level spreader for urban storm water management
Peter Brandsgaard and Enos Inniss

This program is designed to understand the effectiveness of large level spreader construction in areas prone to flooding and channel erosion. A level spreader constructed by the city of Columbia was designed to stabilize a tributary of the Hinkson Creek that runs through the Forum Nature Area. This level spreader holds water during high volume storm events and evenly distributes the water over the concrete lip to prevent the concentrated flow input to the creek, which is listed as one of the impaired (303-d) streams in the State of Missouri. Soil moisture data is collected from seven groups of soil conductivity sensors located in the area surrounding the level spreader. Each grouping has sensors buried to depths of 15, 30, & 45 centimeters. Instantaneous soil moisture data is recorded at 3:00PM every Monday along with temperature and weather at the time of the collection. Depth of water in the bowl of the level spreader is recorded using four pressure transducers and a data logger. This soil moisture data is then compared to precipitation data from a weather station located nearby. The results from this research show an even distribution of water with consistent soil moisture in the immediate proximity of the level spreader. Rather than as a concentrated flow going to the creek, the surface water effectively infiltrates the area surrounding the level spreader decreasing the flow of water through the channel and maintaining stabilization of the tributary. Data collected here suggests that use of a level spreader in similar urban and/or rural areas would effectively promote infiltration and mitigate adverse impacts on receiving streams.
Elucidating the multiple independent whole genome duplication events in the brassicales: Whole chloroplast phylogeny

Julia Brose, Makenzie Mabry, Wade Dismukes, Aleksandra Beric, Christopher A. Bottoms, Jacob Washburn, Pat Edger, Jocelyn Hall, Michael McKain, Ihsan Al-Shehbaz, Alex Harkess, M. Eric Schranz, Gavin Conant, and J. Chris Pires

Brassicales is a diverse order of flowering plants that includes the families Brassicaceae, Cleomaceae, and Capparaceae families. These three families represent most of the diversity within the Brassicales including many economically important crops such as Brassica oleracea (broccoli, kale, cabbage), Capparis spinosa (capers), and the plant model organism, Arabidopsis thaliana. Although the order Brassicales has received considerable attention, its phylogenetic history remains poorly understood. This study expands upon previous studies by increasing the sampling across the Brassicales and the number of chloroplast genes used to make phylogenetic inferences. A comparison between the chloroplast phylogeny and the nuclear phylogeny could give insight into the role of whole genome duplications throughout the Brassicales.

This project was completed to fulfill a Capstone requirement.
Financial aid and award benefits
Alison Brown, Rebecca Ceriotti, Alex Pace and Stephen Whitney

We explored the relationship between financial aid and financial awards on time to graduation. Our research question was, “How does total student financial aid and awards influence on time graduation controlling for student demographics?” We were guided by Tinto’s model of student’s retention which theorizes a complex interaction of social integration, financial support, and college quality increasing student retention and graduation. Four freshman cohorts starting with the class of fall 2011 were followed over five years at a large R-1 Midwest land grant university. Survival analysis was used with the following demographics entered as controls; biological sex, ethnicity/race, instate/outstate residency, first generation, advising group, and Pell eligibility. Using 11 levels of scholarship amounts, survival analysis indicated a significantly lower time to graduation when scholarships and awards covered between 10 and 20 percent of financial need. Time to graduation flattened after 20% of financial need is met. The 20 percent tipping point may indicate a level of financial support that reduces student’s need to work. The need to work may interfere with time spent on academics. These findings need to be understood within the context if the individual including: high poverty, Pell eligibility, and the overall cost of students. In addition, programs that financially support students, such as financial support for taking summer classes, could also offset the need of students to work during the regular school year and should decrease time to graduation. Further research into the type of financial support (loans, awards, scholarships, grants, etc.) and how that support is understood by students is needed to clarify what role financial support plays in increasing retention and on time graduation.
Autism spectrum disorder (ASD) is characterized by impairments in social communication and interaction along with restrictive and repetitive behavioral patterns. Many individuals with ASD have an increased response to stress, which has been associated with gastrointestinal (GI) problems and sensitivity to sensory stimulation (Mazurek et al., 2013; Chaidez et al., 2014). However, there is little evidence in the literature regarding the psychophysiological correlates of stress as it relates to GI and sensory issues in ASD. The goal of this study was to identify relationships between baseline psychophysiological reactivity to the testing environment and severity of sensory issues, GI problems, and ASD severity. Baseline data collected for a clinical trial currently being conducted at the University of Missouri Thompson Center for Autism and Neurodevelopmental Disorders was used as data for this study. Surveys and interviews were utilized to gather baseline data on sensory over-responsivity (SenSOR), gastrointestinal symptoms (Questionnaire on Pediatric Gastrointestinal Symptoms-Rome IV), and ASD severity (Autism Impact Measure (AIM) and Autism Diagnostic Interview- Revised (ADI-R). Baseline activity of the autonomic nervous system was assessed using pupillary light reflex (PLR) and an electrocardiogram (ECG). Relationships were analyzed between baseline stress level, as measured by PLR and ECG, ASD severity, and co-occurring symptom severity using linear regression. A significant positive relationship was revealed between AIM scores and PLR constriction time. In addition, a significant positive relationship was observed between SenSOR scores and heart rate variability. These results will help increase our understanding of the relationship between stress reactivity to the environment and sensory and GI issues in ASD. This information will be beneficial for the development of future treatments for individuals with ASD and co-occurring GI and/or sensory issues.

This project was completed to fulfill a Capstone requirement.
What factor(s) most influence student academic achievement when socioeconomic status changes over time?
Laura Brusati, Caiden Webb, Madeline Dingman, Precious Hardy, Shannise Jones and Stephen Whitney

Measures of class such as Social Economic Status (SES) are continually one of the largest predictors of student academic achievement. What is less studied is how SES works in increasing or decreasing academic achievement. Our study examined students who changed SES over a four-year period and improved one standard deviation in reading. We compared these cases with students who did not increase in SES and were below one standard deviation in reading growth between first and fifth grade. The data utilized the ECLS K-8 nationally represented longitudinal data set. There were 1,156 students in the non-moving SES, below one standard deviation growth group and 106 students in the improved-SES and improved-reading group. We examined approaches to learning, self-control, parental academic expectations, parental support for education, school level problems, and neighborhood problems. Our results indicated a significant difference in neighborhood problems between the two groups. No other comparison was significant. The results may indicate that SES acts as a suppressor on academic achievement. One explanation is that cases which improve in SES are starting with strong individual and family contexts but academic achievement is suppressed due to the stress of low income. When SES improves, the rich contextual support for academics allows reading to improve dramatically. Both individual and family level variables did not change over time when SES improved. Further, only one of the external variables changed when SES changed, neighborhood problems. That may indicate a move within school districts, but to a different neighborhood with less problems. These findings may demonstrate that the context of academic achievement is set early in a student’s school career. This supports the importance of early childhood education.
Grace Burris
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Senior Psychology

Faculty Mentor: Dr. Nicole Campione-Barr, Psychological Sciences

Role of perceived relative power differences on development of future risky behavior
Grace Burris, Sonia Giron and Nicole Campione-Barr

Power discrepancies between siblings are particularly pronounced in childhood, with the older sibling typically holding greater power within the relationship (Lindell & Campione-Barr, 2017). In addition, the sibling relationship is typically the longest lasting relationship an individual will develop over their lifetime (e.g., McHale, Updegraff, & Whiteman, 2012). This provides a platform in which siblings can be particularly influential. Investigating birth order and gender of each individual adolescent, the present study sought to understand how the perceived power imbalances between siblings can influence adolescent risky behavior one year later. The sample was made up of predominately White, middle class sibling dyad pairs (n=145), relatively equally divided across possible gender compositions: sister-sister, brother-brother, older sister-younger brother, and older brother-younger sister. Ages of the first born siblings ranged from 12-18 years old (M=14.97, SD=1.69) and ages of the second born siblings ranged from 9-17 years (M=12.20, SD=1.90). Relative power among siblings was measured with 6-items from the relative power and dominance sub-scales of the Network of Relationships Inventory (α=.68 older, α=.74 younger; Buhrmester & Furman, 1990). In addition, a 12-item measure adapted from the Problem Behavior Survey (α=.83-.84 older, α=.91-.88 younger, across T1 and T2; Mason, Cauce, Gonzales, & Hiraga, 1996) was used to assess adolescent problem behavior. In order to examine the associations between the variables, an Actor-Partner Interdependence Model (APIM; Kashy & Cook, 2006) was conducted. A significant Actor Sex X Partner Sex X Partner Perceptions of Power interaction was revealed, β = -.02, p = .01. Simple slopes analyses were employed to interpret the interaction. When brothers perceived more power over boys, it was associated with less problem behavior for those boys, t=-2.46, p=.015. In addition, when brothers perceived more power over girls, it was associated with more problem behavior for those girls, t=2.058, p=.041.

This project was completed to fulfill a Capstone requirement.
Geotechnical engineering: Construction of scale model drilled shaft for hydraulic load testing in loose sand
Elgin Burton and Andrew Boeckmann

The construction of a scale model drilled shaft for hydraulic load testing in loose sand was done in conjunction with a larger project for the California Department of Transportation (CalTrans) in regards to the increase in end bearing capacity of post-grouted drilled shafts over non-grouted drilled shafts. To understand the improvements of a post-grouted drilled shaft’s behavior in soil, a non-grouted drilled shaft is tested in similar soil to compare. Because testing in the field is expensive, scale models were constructed and tested first. For this project, a scale model drilled shaft was constructed out of concrete with a design strength of 5000 psi. The constructed drilled shaft has a diameter of 16 inches and a height of 28 inches. Encased in the shaft are six strain gauges -- four gauges measure strain via the changes in resonant frequency of a vibrating wire while the remaining two gauges measure strain via the changes in electrical resistance of a metallic foil. The displacement of the shaft is also recorded. Displacement is measured via four Linear Variable Differential Transformers (LVDTS) - two measuring displacement from the top and two measuring displacement from the bottom. Once the concrete has reached its 28-day strength, it will be loaded hydraulically in a container of loose sand whereupon the strain from the gauges as well as the displacement of the shaft will be recorded. The data from these preliminary tests will serve as a comparison to the results of the full-scale Post-Grouted Drilled Shaft tests in California set to take place in Fall 2018.
Caitlyn Cassimatis, James T. Stannard and Aaron Stoker

Intervertebral disc (IVD) disorders with associated pain and disability are prevalent and current treatment options do not result in restoration of tissue integrity or function. This study was designed to test the hypothesis that exposure of the IVD to repetitive compressive loading would result in significant increases in the production of inflammatory biomarkers and release of proteoglycans to the media. Further, that the increase in biomarker production would be dependent on the magnitude of the applied load. With IACUC approval, tails were harvested from mature male rats (n=7). Explants were created and assigned to either a no load (0 MPa n=6), low load (0.5 MPa n=7), or high load (1.0 MPa n=6) group and cultured for 6 days. Explants were stained for cell viability and pictures were taken using fluorescent microscopy. Total IVD glycosaminoglycan (GAG) content and total IVD collagen content were determined. Media were evaluated for inflammatory biomarkers. Significant differences were determined using t-Tests or Rank Sum tests based on the variance of the data, with significance set at p<0.05. The results indicate with increased load, there was a significant (p<0.05) increase in the media GAG, PGE2, IL-6, and GRO-a content. Cell viability was significantly (p<0.05) lower in the high load group compared to the no load group. The data from this study indicate that there are load-dependent responses by IVDs during ex vivo culture using this validated whole organ model. Repetitive compressive load may adversely affect intervertebral discs, especially as load increases.
Rebecca Ceriotti
Chesterfield, MO

Junior
Elementary Education

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Financial aid and award benefits
Rebecca Ceriotti, Alison Brown, Alex Pace and Stephen Whitney

We explored the relationship between financial aid and financial awards on time to graduation. Our research question was, “How does total student financial aid and awards influence on time graduation controlling for student demographics?” We were guided by Tinto’s model of student’s retention which theorizes a complex interaction of social integration, financial support, and college quality increasing student retention and graduation. Four freshman cohorts starting with the class of fall 2011 were followed over five years at a large R-1 Midwest land grant university. Survival analysis was used with the following demographics entered as controls; biological sex, ethnicity/race, instate/outstate residency, first generation, advising group, and Pell eligibility. Using 11 levels of scholarship amounts, survival analysis indicated a significantly lower time to graduation when scholarships and awards covered between 10 and 20 percent of financial need. Time to graduation flattened after 20% of financial need is met. The 20 percent tipping point may indicate a level of financial support that reduces student’s need to work. The need to work may interfere with time spent on academics. These findings need to be understood within the context if the individual including: high poverty, Pell eligibility, and the overall cost of students. In addition, programs that financially support students, such as financial support for taking summer classes, could also offset the need of students to work during the regular school year and should decrease time to graduation. Further research into the type of financial support (loans, awards, scholarships, grants, etc.) and how that support is understood by students is needed to clarify what role financial support plays in increasing retention and on time graduation.
Evaluation of Cosamine ASU using an ex vivo model of osteoarthritis
Kamryn Chastain, Karissa Simon and Aaron Stoker

Introduction: Cosamine ASU (CASU) is a commercially available nutraceutical treatment for osteoarthritis often used clinically by patients. The purpose of this study was to determine if CASU can stimulate the production of tissue proteoglycan. This study was designed to identify potential mechanisms of action for CASU using an ex vivo culture model of osteoarthritis.

Methods: With IRB approval, tissue was obtained from patients undergoing total knee arthroplasty (n=6). Cartilage obtained from femoral condyle and tibial plateau was used to create 6 mm explants. Each explant was cut in half (A and B), and one half was cultured with 0.1ug/ml or 0.01ug/ml of CASU, and the other was used as the untreated control. Twenty four plugs per patient were cultured for 21 days, media was changed every 3 days, and on day 21 tissues were assessed for GAG content, matrix molecules, and aggrecanases. Media will be tested GAG content, as well as inflammatory and degradative biomarkers.

Results: Results are pending and will be presented on the poster.

Discussion: To the author’s knowledge, these data will be the first to determine if CASU can stimulate tissue GAG production in OA tissue, potentially slowing down the progression of OA clinically.

This project was completed to fulfill a Capstone requirement.
The goal of this project is to explore the most unsuitable environment condition for Dekkera Bruxellensis, which is the spoilage yeast in wine-making, in order to obtain the peak production in grape fermentation. The main point in this research is focused on the influence that pH and oxygen level causes to the spoilage yeast and determine the factor that makes the spoilage yeast become unculturable. Different pH level will be applied in the research to acquire the optimal pH range and gain the most suitable pH under which the spoilage yeast has the lowest population and the appropriate oxygen level in liquid will be decided by changing oxygen level with the other factors remaining. In addition, the student will put forward the possible factors and investigate each possibility through using controlling variables method and acquire substances which effects the spoilage yeast to become unculturable.
Inhibition of CYP11B1 11B1-hydroxylation of Sutherlandia frutescens
Kaitlyn Chetney, Casey Hawkins, Grahamm Funk, William Folk and Rainer Glaser

One way the body responds to stress is by hydroxylation of 11-deoxycorticosterone (DOC) through the cytochrome P450 enzyme CYP11B1 to form corticosterone. Stress management aims to inhibit this synthesis, and it has been hypothesized that plant extracts from the plant Sutherlandia frutescens may lower the levels of corticosterone (Sergeant and Folk, 2011) and the phytochemical sutherlandioside B (SU1) is a possible inhibitor. It is the goal of our research to explore this hypothesis with molecular modeling techniques. We have been studying active site in the iron-oxo systems \[\text{[(Por}^{2-})(\text{Fe}^{3+})\text{O(L}_n\text{)\text{]}^{1-n}}\] (1, \(\text{L}^-\) = thiolate; 2, \(\text{L}^0\) = imidazole; 3, \(\text{L}^-\) = phenolate) in detail (see Figure). The nature of the bonds between iron and oxygen and between iron and the ligand that tethers the complex to the protein via a side chain thiolate (cysteine), imidazole (histidine), or phenolate (tyrosine) the overall spin multiplicity (doublet, quartet, sextet), and the distribution of the unpaired electrons have been explored through molecular modeling techniques. We will show that the quartet state is preferred and that the distribution of the spin depends greatly on the nature of the tether. In the imidazole system, the three unpaired spins are distributed over Fe, O, and within the pi-system of the (dideprotonated) porphin ligand. In the thiolate and phenolate systems, the three unpaired spins are distributed over Fe, O, and the almost neutral SR (OR) ligand. Results of quantitative electron and spin population analyses will be reported. Effects of the enzyme environment on steroid oxidation have been studied with QM/SEM/MM methods.
Faculty Mentor: Dr. Antje Heese, Biochemistry
Funding Source: CAFNR On Campus Research Internship (Dudley & Virgie Alexander Scholarship)

*Reduction in levels of plasma membrane proteins are independent of gene expression in the vesicular trafficking mutant*
Alex Clarke, Erica LaMontagne and Antje Heese

Research abstract withheld at the request of the faculty mentor for proprietary purposes.

*This project was completed to fulfill a Capstone requirement.*
Lexical diversity in conversation among preschool-age children who stutter and their peers
Casey Clogston and Stacy A. Wagovich

Research over many years has focused on language skills in young children who stutter (CWS), examining whether language may differ between groups and whether language impacts the fluency profile of CWS. However, earlier studies have not typically controlled for the full range of relevant variables. Careful examination of language skills requires intentional control of the variables impacting the language skills that children display. For example, as pertains to the present study, when research questions focus on “conversational vocabulary” between groups, ideally, pair-matching is needed not only for gender and age but also for SES and even receptive vocabulary. The purpose of this study was to examine conversational vocabulary in preschool-age CWS and peers, while taking into account children’s receptive vocabulary knowledge. The study differs from previous work in that groups are pair-matched for receptive vocabulary, in addition to age, gender, and SES. A larger dataset was used to draw the participants for this study (Anderson & Wagovich, MU Site). Participants were 24 CWS (8 three year olds, 8 four year olds, and 8 five year olds) and 24 pair-matched peers, each of whom had language skills in the typical range. Play-based child-parent conversational language samples of at least 350 words of children’s speech were obtained, and the children’s vocabulary diversity was measured using moving average type-token ratio (MATTR), a utility in CLAN, a suite of language analysis programs (MacWhinney, 2000). Preliminary results indicate that, as expected, the groups did not statistically differ on any of the matched variables. Language sample analyses are currently underway. Developmental and research implications of the findings will be presented. (Funding: NIDCD R01DC012517, J. Anderson)
An analysis of differences in individual variation across cognitive tasks
Hannah Cockrill, Hope Snyder and Jeff Rouder

Research abstract withheld at the request of the faculty mentor for proprietary purposes.

This project was completed to fulfill a Capstone requirement.
In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity suggests widespread and multicultural desire to discuss feelings surrounding the topic of death. Mortality is commonly the focus of various artistic expressions and previous research has shown that producing art through an art therapy class reduced death anxiety and increased willingness to discuss death-related topics. Our multi-disciplinary team is exploring the effects of providing individuals with the opportunity to address the topic of mortality via artistic expression. We are interested in extending current research to explore if creating art in response to mortality-based prompts influences death anxiety and related attitudes. In the study, participants (N = 100 to date) first complete a survey that assesses individual personality traits (e.g., meaning in life, personal need for structure, religiosity, fear of death). Participants are then given 5 days to respond to three prompts that encourage personal reflection on death by either taking photos or writing. A control condition has participants take a photo in response to prompts based on mundane activities. Upon responding to the prompts, participants complete a post-survey that includes measures of meaning in life, the cognitive availability of death-related thoughts, and death anxiety, followed by a debriefing. By exploring whether individual personality traits influence the effectiveness of taking photos or writing about mortality, we can gain a better understanding of whether creating art is a useful way of addressing mortality for everyone or only for certain individuals. In doing so, this study will provide insight into ways that people might productively address and cope with mortality.
Novel reporter system for detection of hepatitis B virus replication

Emily Coonrod, Andrew D. Huber, Philip R. Tedbury, Dandan Liu, Juan Ji, Thomas G. Laughlin, Jing Tang, Mary C. Casey, Zhengqiang Wang, Kamlendra Singh and Stefan G. Sarafianos

More than 240 million people are chronically infected with hepatitis B virus (HBV) which leads to ~800,000 annual deaths, largely from resulting cirrhosis and liver cancer. The available vaccine is ~95% effective but has varying protection against different virus genotypes and does not protect those who are already infected. For chronically infected individuals, there are two treatment options. The first are nucleoside/nucleotide reverse transcriptase inhibitors that inhibit DNA replication but do not clear the virus, making lifelong treatment necessary. The second is interferon alpha, but its use is limited by poor viral response and severe side effects. New antivirals are highly desired for HBV therapies, but their discovery is hindered by a lack of reporter viruses and cell culture systems for HBV, making it difficult to scan for HBV inhibitors and host cell factors. The reporter systems that do exist do not reflect completion of the entire viral life cycle. We have developed and optimized a two vector assay system that will express NanoLuc Luciferase (NL) only upon completion of the full HBV life cycle. The reporter can be used to assess drug resistance, measure HBV inhibition by prospective drug compounds, and effectively screen compound libraries. In cell culture, the system increases efficiency and decreases cost as compared to current methods, reducing the process to only one automatable liquid handling step. These benefits will increase productivity in future drug discovery efforts for HBV therapies.
Loss of EphA7 results in reduced myofiber size and number and fewer muscle progenitor cells
Rebecca Craigg, Laura Arnold, Danny Stark, Sammy Zino, Jacqueline Ihnat and D Cornelison

Skeletal muscle makes up about half of adult human body mass and is necessary for vital functions like breathing, moving, and eating. Skeletal muscle is made of long, multinucleated myofibers that are bundled together to form individual muscles. Research has focused on this field because understanding how muscle organization and regeneration is regulated allows for a deeper understanding of degenerative muscle diseases, which could lead to the development of more effective treatments and therapies. While a lot of progress has been made over the years in understanding muscle progenitor cells and muscle stem cells (satellite cells) that work to repair damaged muscle tissue, many questions still remain unanswered regarding their function. In investigating how satellite cells know when to differentiate into mature muscle fibers, we have identified a contact-dependent cell surface protein, EphA7, which is expressed by differentiating myogenic cells. In mice lacking EphA7 (EphA7−/−), hindlimb muscles have fewer myofibers at birth. The myofibers are reduced in size and have fewer myonuclei, as well as fewer myogenic progenitor cells. Similarly, adult EphA7−/− mice have reduced numbers of satellite cells and exhibit delayed and protracted muscle regeneration characterized by the persistence of small, immature myotubes. This suggests that EphA7 has an active role in muscle stem cell differentiation.
Christopher Dade  
Rogersville, MO  

Faculty Mentor: Dr. Jack Tanner, Biochemistry

*Structural and kinetic studies of the flavoenzyme Sinorhizobium meliloti proline utilization A*

Christopher Dade and Jack Tanner

The amino acid proline plays a central role in many organisms’ metabolic pathways and is critical in the processes of bioenergetics, apoptosis, and cancer. The enzymatic catabolism of proline therefore, is of great interest to many researchers. Proline is converted to glutamate in a four-electron oxidation reaction. Eukaryotes and bacteria alike utilize the highly-conserved proline dehydrogenase (PRODH) and Δ¹-pyrroline-5-carboxylate dehydrogenase (P5CDH) enzymes to perform this reaction. In many bacteria, PRODH and P5CDH are expressed as a continuous polypeptide chain to form the bi-functional enzyme proline utilization A (PutA). The bi-functionality of PutAs means they are useful targets for studying substrate channeling within bi-functional enzymes. Substrate channeling is critical to ensure efficient conversion of proline to glutamate and to prevent highly reactive intermediates from leaking out of the enzyme. Type A PutAs require dimerization to form functional channels. Type B PutAs have an additional C-terminal domain that folds to enclose the substrate channel within the enzyme, so they are not required to dimerize to form functional channels. In this study the PutA of *Sinorhizobium melliloti* (*Sm*PutA), is used as a representative Type B PutA. The exact characteristics of the substrate channel are not completely understood, and crystallographic studies of the SmPutA channel could yield insights into how substrate channels shuttle intermediates from one active site to the next efficiently. In this study, kinetic crystallography has been conducted on *Sm*PutA crystals soaked in proline analogues. This work was performed with the aim to capture structures where intermediates can be observed within the tunnel or bound in the PRODH active site. Resulting X-ray crystallographic structures will be presented at the forum. Site-directed mutagenesis was also performed on *Sm*PutA in an attempt to change the internal environment of the channel and block intermediates from passing completely through. Future investigations of substrate channel mutants and active site mutants of *Sm*PutA will include further structural analysis and enzyme kinetics. X-ray crystallography and cryo-EM studies will be utilized to observe how intermediates within the proline catabolism pathway move and interact within type B PutAs.

*This project was completed to fulfill a Capstone requirement.*
Science and literacy intertwined in STEM outreach
Kaia Davis and William Folk

Current research identifies huge deficits in science literacy among middle school students, with roughly two-thirds of U.S. students grades 6-8 not reading at a proficient level. This is compounded by STEM underachievement being particularly severe for diverse learners - who are defined as children with disabilities, at-risk for school failure, and/or from culturally, socioeconomically or linguistically diverse backgrounds, and who are underrepresented in the STEM workforce. Several reasons can be considered for these differences but, disabilities in language, reading and writing are critical factors.2.

The reciprocal and synergistic relationship between science learning and language learning, including literacy skills and development has been well established.1. Research indicates that improving science literacy will directly affect students’ understanding and engagement in science topics; one innovative way to accomplish this is through the development of “multimodal text sets” - a coherent sequence of texts and other information sources pertaining to a specific topic or line of inquiry that supports students in building the vocabulary and background knowledge required for science literacy and inquiry. The purpose of our study is to refine and assess teachers’ implementation of an exemplar STEM multimodal text set entitled, “Light, Color, Vision, Optics!” which was developed before the Missouri Science Learning Standards (MLS) were adopted. This text set will be redesigned to aid students with varying Lexile levels in understanding the complexity of the literacy content they are presented with that is required to fulfill the MLS. The revision will include free and accessible materials and information regarding the success and innovation of Dr. Patricia Bath, a remarkable African American ophthalmologist, inventor and role model. We hypothesize that the use of the “Light, Color, Vision, Optics!” multimodal text set, when linked to current science concepts being presented in the classroom, will strengthen diverse learners’ interest in STEM and their motivation to inquire about concepts listed within the NGSS, MLS, and CCSS-ELA.RST. This program’s evaluation plan includes evaluating the extent to which teachers integrate the text-sets in their classrooms. Furthermore, we will compare the extent to which teachers implement and sustain the text-set before and after their professional development experience. Evaluation at the student level includes assessing the “Light, Color, Vision, Optics!” text-sets ability to facilitate science interest, and ability to address NGSS, and MLS to use critical thinking and literacy skills.
Spinal cord injury causes loss of motor function below the site of injury, but also leads to a chronic, pathological increase in muscle activity known as spasticity. Increased excitability of motor neurons, as well as sensitivity to serotonin, has been implicated in spasticity. Our goal was to better understand how spinal cord injury affects the expression of ion channels and receptors associated with motor activity throughout the spinal cord - both above and below the site of injury. We focused on the changes of serotonin receptors which have an important and varied role in motor activity. We completely transected the spinal cord of adult mice at vertebral T8, or performed control laminectomies. Spinal cord tissue rostral (cervicothoracic) and caudal (lumbosacral) to the lesion was collected at 3 and 28 days post-injury. We quantified receptor mRNA levels using qRT-PCR. We found distinct changes in expression of serotonin receptors below, but not above, the site of injury. These results suggest that changes in serotonin receptor expression are associated with altered excitability of neurons following spinal cord injury. Furthermore, these results demonstrate that cells above and below the injury site respond differently to the trauma.

This project was completed to fulfill a Capstone requirement.
Faculty Mentor: Dr. Judy Wall, Biochemistry

*Sulfonate utilization in Desulfovibrio vulgaris Hildenborough*
Leslie A. Day, Kara B. De Leon and Judy D. Wall

*Desulfovibrio vulgaris* Hildenborough (DvH) is an anaerobic sulfate-reducing bacterium commonly found in heavy-metal contaminated sites. DvH uses sulfate as a terminal electron acceptor (TEA). Sulfonates, compounds containing a C-SO3- moiety, occur ubiquitously in nature, naturally or as xenobiotics. The sulfonate isethionate (C2H5NaO4S) has been shown to be utilized by various *Desulfovibrio* species as TEAs. There are several proposed mechanisms for this metabolism of isethionate, however there is little biochemical evidence to support the theories. We have shown that, despite lacking the known sulfonate utilization genes, DvH is able to use isethionate as a TEA. When DvH was subcultured into 20 mM isethionate, it underwent diauxic growth, first with residual sulfite carried over in the transfer, next by an approximately 60-h lag, and finally by continued exponential growth. Genome sequencing of isethionate metabolizing strains identified a single-nucleotide change within a tripartite ATP-independent periplasmic (TRAP) transporter which resulted in an amino acid sequence change of PPP to the highly conserved TPP found in other TRAP transporters. We hypothesize that this mutation allows transport of isethionate into the cell. This mutation was retained following subcultures into media lacking isethionate. We will use the isethionate metabolizing strain as the parent strain for constructing a mutant lacking the ability to metabolize sulfate in order to elucidate the pathway of isethionate metabolism. Additional investigations of growth on isethionate with various electron donors will be used to shed light on the energetics of isethionate metabolism.
**Spencer DeLucia**  
Kansas City, MO 

**Freshman**  
Biological Sciences

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

**Effect of culture split ratio on normal canine chondrocyte metabolism**  
Spencer E. DeLucia, Nicole T. Greco, Eli L. Pratte, Aaron M. Stoker and James L. Cook

Introduction  
Chondrocytes are also often used in tissue engineering protocols aimed at the development of new cartilage tissue. Unfortunately, chondrocytes dedifferentiate towards a fibroblastic phenotype after only a few passages in culture. While the effect of passage on chondrocyte metabolism has been studied repeatedly, the effect of split ratio at passage on chondrocytes metabolism has not been elucidated. For this study, it was theorized that increased cell culture split ratio would result in significant changes in the production of relevant biomarkers at passage 2 (P2) when compared to passage 0 chondrocytes.

Methods  
With ACUC approval, cartilage tissue was collected from dogs euthanatized for reasons unrelated to this study. Cartilage was diced and digested with collagenase overnight, and the cells were seeded onto 25cm² flasks in 10% FBS. When the chondrocytes reached 90% confluence (P0). Cells were freed from the flask using TryplE, and cells were passaged (P1) at a split ratio of 1:2, 1:4, or 1:8 in 10% FBS. Cells were allowed to reach 90% confluence again, and passage a second time (P2) at 1:2, 1:4, and 1:8 again and allowed to reach 90% confluence. A media sample was collected when cells reach confluence for biomarker testing. Media was analyzed for cytokines, degradative enzymes, inflammatory indicators, and matrix molecules. Significant differences between groups were determined by T-Test or Rank sum test based on normality of the data with significance set at p<0.05.

Results  
Assays and data analysis for this study are ongoing and will be presented on the poster.
Blaine Dennis  
Mansfield, MO  

Faculty Mentor: Dr. Soo-Yeon Cho, Institute of Public Policy  
Funding Source: Missouri Department of Health and Senior Services

*The Zika virus: Awareness and opinions of women of childbearing age in Missouri*  
Blaine Dennis and Soo-Yeon Cho

Research abstract withheld at the request of the faculty mentor for proprietary purposes.

*This project was completed to fulfill a Capstone requirement.*
What factor(s) most influence student academic achievement when socioeconomic status changes over time?

Madeline Dingman, Caiden Webb, Laura Brusati, Precious Hardy, Shannise Jones and Stephen Whitney

Measures of class such as Social Economic Status (SES) are continually one of the largest predictors of student academic achievement. What is less studied is how SES works in increasing or decreasing academic achievement. Our study examined students who changed SES over a four-year period and improved one standard deviation in reading. We compared these cases with students who did not increase in SES and were below one standard deviation in reading growth between first and fifth grade. The data utilized the ECLS K-8 nationally represented longitudinal data set. There were 1,156 students in the non-moving SES, below one standard deviation growth group and 106 students in the improved-SES and improved-reading group. We examined approaches to learning, self-control, parental academic expectations, parental support for education, school level problems, and neighborhood problems. Our results indicated a significant difference in neighborhood problems between the two groups. No other comparison was significant. The results may indicate that SES acts as a suppressor on academic achievement. One explanation is that cases which improve in SES are starting with strong individual and family contexts but academic achievement is suppressed due to the stress of low income. When SES improves, the rich contextual support for academics allows reading to improve dramatically. Both individual and family level variables did not change over time when SES improved. Further, only one of the external variables changed when SES changed, neighborhood problems. That may indicate a move within school districts, but to a different neighborhood with less problems. These findings may demonstrate that the context of academic achievement is set early in a student’s school career. This supports the importance of early childhood education.
Consider a Hamiltonian bigraph, and some assignment of probabilities to its edges obeying standard vertex degree conditions. Our purpose is twofold: i) to find the cases in which a uniform probability set may be assigned to a graph given its structure so as to minimize the likelihood of circular motion in $n$ steps, and ii) to find a graph structure which has such a uniform probability set as its assignment. Using principles of convexity and symmetry, we prove that if a graph is edge-transitive, then it exhibits a uniform probability assignment. Some interesting applications are in quantum information theory, in which one is concerned with maximizing information distribution in a network, and molecular chemistry, in which one is interested in determining the molecular structure simply from minimizing the energy of the corresponding network’s pi-bond configuration.
The tertiary structures can determine the properties and functions of RNA, which are useful information for drug design. Each step in RNA folding can affect its structure, so knowing RNA folding pathway is necessary. Different from other physical and chemical detection, in this report, we used the nanopore single molecule technique as the major method to capture each structure change processes in the RNA pseudoknot folding. By changing the folding time, different RNA pseudoknot folding intermediates could be captured and their connections can be build. Then the coarse-grained molecular dynamics simulation and other theoretical analysis such as master equation method were used to simulate the RNA folding pathway. Compared with other methods, the approach used in this report is more sensible and easier in the manipulation, which can be used for RNA-small molecule or even protein interactions analysis (see our publication in Nature Communications 8, 1458 (2017)).
Many times, data arrives sequentially and continuously, for example, weather data or activity recognition. It is not possible to wait for completion to perform analysis. There are several online streaming clustering algorithms that have been developed. As my contribution to this research project, I am part of a team in exploring an online streaming clustering algorithm that uses both fuzzy and probabilistic clustering algorithms. Clustering is a data mining technique that searches for specific structures on streaming data and detects abnormal patterns in the data. Online streaming clustering needs to recognize and adapt clusters as data evolves, so that anomalies are detected, and that new clusters are automatically formed as incoming data dictate. Our goal is to process and analyze large amounts of online streaming data with ubiquitous continuous sensing in real time. In particular, as each streaming data comes in, the algorithm either assigns it to the nearest cluster or to the anomaly group as an outlier. If the data point is assigned to one of the clusters, the parameters of that cluster are updated. Additionally, what at first seems like anomalies may actually be a new cluster forming; hence, the anomaly list is processed to detect such cluster formation. The algorithm works with large high dimensional data sets and is able to detect multiple new clusters. The superiority and robustness of the online streaming algorithm has been tested with numerous synthetic and real data sets.
Using 3D scanning technology to develop more accurate fit standards for female firefighting protective gear
Olivia Eastman, Chelsey Harrell and Kristen Morris

This research project attempts to test and improve the fit and sizing criteria of protective gear for firefighters through the use of portable 3D scanning technology. An emphasis is put on collecting information on female firefighters due to the current lack of data on them in the field. The study utilizes the Structure Scanner, an iPad compatible device and application, to capture reliable anthropometric data that can be used to create a more accurate sizing system. In conjunction with nine other universities, the MU research team has tested the Structure Sensor to enhance the scanning process and establish a technology guide of best practices for using the application. The end goal of the study is to gather 100 processed scan samples using this process and combine them with qualitative transcripts from interviews to propose a new gear sizing system for female firefighters. Collecting data through this relatively inexpensive and portable 3D scanner will create a more accessible and consistent data compilation method to better the fit and safety of protective gear for both female and male firefighters.
In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity suggests widespread and multicultural desire to discuss feelings surrounding the topic of death. Mortality is commonly the focus of various artistic expressions and previous research has shown that producing art through an art therapy class reduced death anxiety and increased willingness to discuss death-related topics. Our multi-disciplinary team is exploring the effects of providing individuals with the opportunity to address the topic of mortality via artistic expression. We are interested in extending current research to explore if creating art in response to mortality-based prompts influences death anxiety and related attitudes. In the study, participants (N = 100 to date) first complete a survey that assesses individual personality traits (e.g., meaning in life, personal need for structure, religiosity, fear of death). Participants are then given 5 days to respond to three prompts that encourage personal reflection on death by either taking photos or writing. A control condition has participants take a photo in response to prompts based on mundane activities. Upon responding to the prompts, participants complete a post-survey that includes measures of meaning in life, the cognitive availability of death-related thoughts, and death anxiety, followed by a debriefing. By exploring whether individual personality traits influence the effectiveness of taking photos or writing about mortality, we can gain a better understanding of whether creating art is a useful way of addressing mortality for everyone or only for certain individuals. In doing so, this study will provide insight into ways that people might productively address and cope with mortality.
In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity seems to suggest a desire for spaces where death can be discussed. With the development of virtual reality simulations arises the possibility of a new space where death can be explored. Virtual reality could prove useful in simulating end-of-life experiences and emotions to help individuals cope with fears or anxiety. Our interdisciplinary research team is exploring the effects of video immersion on an individual’s willingness to discuss death. Experiencing an immersive video based on mortality themes might increase thoughts about death and yet, potentially decrease death-related anxiety. Previous research has shown that graphic images have the power to elicit death anxiety, while other studies suggest that people are more comfortable addressing and discussing mortality through the use of metaphor and symbolic imagery than by addressing death outright. Therefore, our original video includes images such as birds, bats, waves, lush foliage, and expansive scenery, in addition to first-person footage of a mock burial. By including both graphic and symbolic material, we will examine whether the video will have a universal impact not directed toward a specific understanding of mortality. In our study (N= 48), roughly half of the participants completed personality and attitude surveys before watching the video, while the other half completed their surveys in two parts: before watching the video and after watching the video. In doing so, we hope to gain a better understanding of how observing and experiencing art may influence attitudes related to mortality.
Who is interested in genetic testing and why? An examination of moderators and mediators
Jessica Edgar and Jamie Arndt

As the field of medicine advances, people increasingly have options to learn about their genetic risk for various diseases. Yet, people often choose “protective ignorance” (Yaniv, Benador & Sagi). This lack of interest in testing results corresponds with information avoidance tendencies, specifically for unpreventable diseases (Taber et. al). Other psychological factors also play a role. For example, research indicates that individual differences in health optimism, tolerance for uncertainty, and perceived ambiguity all predict intentions to receive results from genetic tests (Taber et al.). However, previous research tends to focus on hypothetical disease or disease in general. Therefore we know little about decisions regarding specific, real-world diseases and whether differences in specific traits predict these decisions. The present study extends previous research by determining which traits predict interest in genetic testing for Huntington’s disease, Alzheimer’s disease, Fragile X syndrome, and Melanoma. As with previous research, we found that information avoidance was negatively related to testing decisions for all four diseases. However, tolerance for uncertainty was negatively related to only Fragile X syndrome. In addition to testing the relationships with desire to get genetic testing and traits such as need for closure, the present study also investigated the potential reasons for some of these relationships in the form of mediation analyses. As hypothesized, fear of death mediated the relationship between information avoidance and decreased interest in genetic testing for each disease. The full range of relationships and the potential implications for these are discussed. Understanding the factors surrounding genetic testing decisions can allow us to build towards potential targeted interventions and framing choices in order to more effectively disseminate the benefits and risks associated with receiving genetic test results for specific diseases.

This project was completed to fulfill a Capstone requirement.
In addition to genetic alterations, cell-cell signaling in the tumor microenvironment significantly influence tumor overgrowth, metastasis, and tumors resistance to chemotherapies. The underlying molecular mechanisms remain ill-defined. Animal models are useful for delineating signaling events. Using a Drosophila oncogenic Ras tumor model, we found that Ras tumor clones interact with one another via long membrane protrusions or cytonemes. Interestingly, only tumor perimeter cells produce cytonemes. In addition, cytonemes contain signaling molecules and are specifically targeted to distant Ras clones. More importantly, inhibition of cytonemes by genetic means suppresses tumor clones size, indicating that cytonemes-mediated interclonal interactions promote oncogenic Ras-mediated tumor overgrowth. These observations raise fundamental questions, including: i) How are cytonemes producing cells specified at the tumor margins? ii) How is cytonemes targeting specificity achieved? iii) What is the nature of cytoneme-mediated signaling events? Here we consider the hypothesis that growth-induced tissue mechanical properties prime cytonemes production in tumor perimeter cells. In this context, we propose that force-dependent EGFR signaling promotes cytonemes directed elongation via cell adhesion molecules. Consistent with this, genetic conditions interfering with cell-cell forces at the tumor periphery or mutations suppressing EGFR function or impinging on cytonemes formation all inhibit oncogenic Ras tumor overgrowth.
Laura Ellenberger
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Faculty Mentor: Dr. Kristina Aldridge, Pathology & Anatomical Sciences
Funding Source: NIH Initiative for Maximizing Student Diversity (IMSD-EXPRESS)

Cerebellum volume in individuals with Autism Spectrum Disorder
Laura E. Ellenberger, Sheldon P. Cook, Shawn E. Christ and Kristina Aldridge

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Psychologists have long been interested in why people choose a particular college major or occupation. Much research has been done to try to pinpoint factors that play a role in these choices (Lent & Brown, 2013, Betz & Hackett, 1981). However, relatively little research has addressed the role of communication style. In this research, we test whether adolescents’ communication style impacts their later college major or career choice. The original data collections included a sample of 642 adolescents in 2007-2009. The youth brought a friend to the lab to complete various tasks, including a joint decision-making task in which participants planned a party. From this task, communication style was coded using methods similar to previous studies (Leaper, 1991). Thought units were coded as Collaborate, Oblige, Inform, Control, Affiliative/Off-topic, and other. Girls were found to produce more collaborative and oblige statements than boys. The current data collection involves following up on these participants who are now young adults (ages 21-26). To date, 225 have completed an online questionnaire, and recruitment continues. Of relevance to the present study, the questionnaire assesses educational and vocational experiences. Data from The Bureau of Labor and the National Center of Education is used to classify educational and vocational choices as male-typed, female-typed, or gender neutral. Data analysis is currently underway. Multiple regressions analysis is used to test whether adolescents’ communication predicted later educational/vocational choices, and meditational analyses to test whether adolescent communication helps account for gender differences in young adults’ educational/vocational choices. Youth with particularly sex-typed styles are expected to avoid educational/career choices typical of the other gender. Of particular interest, communication style is expected to play a role in women’s avoidance of male-dominated fields, including STEM. There are negative implications for individuals and society when qualified women avoid male-dominated fields, making this especially important.
Rebecka Ernst
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Comparison of preschoolers’ self-constructed favorite meals and healthy meals
Rebecka Ernst, Sarah Hooper, Rebecca Jennings, Mubinah Khaleel, Olivia Melberg, Leenah Mustafa and Sara Gable

In recent years, excess weight has become a major public health concern in America. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. Accordingly, discovering new ways to improve young children’s eating and activity habits are of paramount importance. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Eighteen preschoolers (average age = 49 months, range = 33 to 63 months; 61% male) from the University of Missouri’s Child Development Laboratory (CDL) are participating and were pre-tested using the Placemat Protocol in September, 2017. After pre-testing, preschoolers received one-hour per week of garden-based nutrition and plant science education. Post-testing is scheduled for late April. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. The foods and beverages utilized mirror Harrison's original set with some substitutions based on recent surveys of children’s food intake (e.g., cheesecake was replaced with cheese pizza). Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables (e.g., number of fruits/vegetables, number of energy dense foods, number of nutrient dense foods, kilocalories in meal). Data analyses are underway to compare the composition of children's favorite and healthy meals and to determine if children’s pre-assessment self-rated hunger and the time elapsed since breakfast are linked with the composition of children's meals. When post-test data are added to the pre-test data, results will provide preliminary insights into the impact of Healthy Plants/Healthy Bodies on similarities and differences between preschoolers’ favorite and healthy meals.
Faculty Mentor: Dr. Gary Stacey, Plant Sciences; Biochemistry; Dr. Minviluz Stacey, Plant Sciences

Developing the Bean Yellow Dwarf Geminivirus (BeYDV) CRISPR-Cas9 for soybean
Sterling Evans, Cuong X. Nguyen, Miki Hodel, Minviluz G. Stacey and Gary Stacey

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Crayfish use physical and chemical cues to establish social dominance hierarchies. These hierarchies contribute to aspects of survival such as mate choice, shelter, and food resources. Competitions between pairs of naïve subjects result in the establishment of a dominant and a subordinate crayfish. Recent studies have found that social hierarchies contribute to stress levels of crayfish, as subordinates more often exhibit anxiety-like behavior. These behaviors include light-avoidance, tail-flips, and decreased movements. Studies have also found that communally housed crayfish have increased sensitivity to alcohol (ETOH) when compared to crayfish that were isolated for short periods. The purpose of our study is to investigate the relationships between social isolation, alcohol, and anxiety-like behaviors. We hypothesized that prolonged isolation and exposure to alcohol would increase anxiety-like behavior. Based on prior results, we predicted isolated subordinate crayfish would have the highest stress response when compared to naïve isolated or intoxicated crayfish. Using an aquatic T-maze with light and dark arms, we first tested stress responses (i.e. light-avoidance) between isolated and communal crayfish. Second, we tested for differences in stress responses between isolated and communal crayfish in the presence of ETOH (alcohol). Third, we tested the stress responses between dominant and subordinate crayfish that were housed communally. Fourth, we tested for differences in stress responses between isolated dominant and isolated subordinate crayfish. Preliminary results suggest isolated crayfish tend to spend more time than controls in dark arms of the T-maze, whereas communal crayfish spend less time. This may occur because prolonged isolation causes stress in crayfish thus causing them to exhibit anxiety-like behaviors. In future studies, we will test the effects of other stressors on paired crayfish, including whether stress can influence reproductive behaviors.

This project was completed to fulfill a Capstone requirement.
Wanga is a member of the Luyia language cluster and spoken by a community of about 300,000 people in Kakamega County in western Kenya. The language is currently underdescribed, and this project seeks to contribute toward its documentation. In this presentation, we summarize efforts by by three student researchers on the ASH: Documenting Luyia Together team to describe aspects of Wanga grammar during the 2017-2018 academic year. Ryley Ewy has co-authored a chapter on Wanga nouns and noun phrases. Drawing on the Wanga dictionary developed by the ASH team in 2016-2017, Ewy’s paper describes the various classes and subclasses that nouns fall into, which are distinguished by different prefixes for each class. Joshua Frost has co-authored multiple chapters on the Wanga verb. In one paper he describes the structure of the verb, identifying all of the prefixes and suffixes in Wanga verbs. In another paper, he describes the different ways that suffixes of the verb may be pronounced, and the ways in which they change the pronunciation of other parts of the verb. For instance, when the causative suffix -y is added to verb roots ending in l, such as oxu-kul-a ‘to buy’, the l changes to s: oxu-kus-y-a ‘to sell’. Frost’s data come from a variety of sources including the Wanga dictionary, a collection of Wanga oral narratives, and original data he has collected from a Wanga speaker. Heather Graham has carried out research on the Wanga sound system, focusing on changes in pronunciation that occur when two vowels come together within words. Heather worked with a new dataset collected from a Wanga speaker in January 2018. Her chapter makes a new contribution to the study of Wanga that provides diagnostics for distinguishing two subtypes of verb roots that appear to begin with a vowel.
Evaluation of green lights on TMAs

Elizabeth Farr, Jacob Kaltenbronn, Eunice Wang, Colby Wedwick and Carlos Sun

Moving work zones are commonly utilized for road maintenance such as striping, sweeping, and pothole patching. When these work zone vehicles are in operation, warning is given to passing drivers through the use of arrow boards, signs, and flashing lights. Additionally, warning vehicles in these moving work zones are often equipped with a Truck-Mounted Attenuator (TMA) which helps lessen impact from collisions. Collisions with TMAs may be caused by driver inattention. In an attempt to obtain drivers’ attention and reduce the number of crashes in moving work zones, the idea of using an alternate colored light (green light), as opposed to the traditional amber and white lights, was proposed. To study the effectiveness of using a green light on construction vehicles, a driving simulator study was utilized. Study participants drove through multiple work zones containing construction vehicles with different light patterns. The light patterns included the traditional amber and white light pattern, the proposed green light only light pattern, and two alternate light patterns that utilized green lights combined with the traditional amber and white lights. Study participants’ reactions to each light pattern, including their change in speed and how quickly they merged away from the TMA, were observed. Additionally, participants were asked to complete a survey regarding their experience with the different light patterns at the end of the study. In addition to the simulator study, a field study was conducted to observe speeds and merging behavior when drivers encountered TMAs with the different light patterns on Missouri roads. The results of both of these studies were analyzed and it was determined that all light patterns, including the traditional light pattern and the proposed light pattern using only green lights, were effective. There was not one light pattern that was clearly superior to another.
The role of photography and writing on attitudes related to death
Lorena Fernandez, Kendra Easton, Jarrod Russo, Luci Cook, Annalee Roustio and Jamie Arndt, Katina Bitsicas, Tyler Jimenez, Alexandria Lewis and LuAnne Roth

In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity suggests widespread and multicultural desire to discuss feelings surrounding the topic of death. Mortality is commonly the focus of various artistic expressions and previous research has shown that producing art through an art therapy class reduced death anxiety and increased willingness to discuss death-related topics. Our multi-disciplinary team is exploring the effects of providing individuals with the opportunity to address the topic of mortality via artistic expression. We are interested in extending current research to explore if creating art in response to mortality-based prompts influences death anxiety and related attitudes. In the study, participants (N = 100 to date) first complete a survey that assesses individual personality traits (e.g., meaning in life, personal need for structure, religiosity, fear of death). Participants are then given 5 days to respond to three prompts that encourage personal reflection on death by either taking photos or writing. A control condition has participants take a photo in response to prompts based on mundane activities. Upon responding to the prompts, participants complete a post-survey that includes measures of meaning in life, the cognitive availability of death-related thoughts, and death anxiety, followed by a debriefing. By exploring whether individual personality traits influence the effectiveness of taking photos or writing about mortality, we can gain a better understanding of whether creating art is a useful way of addressing mortality for everyone or only for certain individuals. In doing so, this study will provide insight into ways that people might productively address and cope with mortality.
The association between adolescent sisters’ conversational talk time and their sexual attitudes and intention
Lorena Fernandez, Anna Lindell, Sarah Killoren, and Nicole Campione-Barr

Sisters likely assume an important role in the socialization of healthy romantic relationships in adolescent girls and have been identified as mentors, confidants, and sources of support in discussing these topics (Killoren, 2014). The present study examines adolescent sister communication and willingness to speak about romantic relationships/sexuality through examining their proportion of talk-time during conversations and the associations with their sexual intentions/attitudes one year later. Using convenience sampling procedures, thirty-seven adolescent sister dyads (n = 37) participated. Younger sisters on average were age 15.05 (SD = 1.76) and older sisters were age 18.88 (SD = 4.29). Observational data was collected through a 7-minute discussion task about dating and sexuality between the sister dyads and their mothers, following procedures developed by Romo and colleagues (2002). The proportion of the 7-minutes that each sister spent talking was calculated. Sisters completed surveys assessing sexual intentions (East, 1998) and sexual attitudes (Sprecher, McKinney, Walsh, & Anderson, 1988). Separate Actor-Partner Interdependence Models (APIM; Kashy & Cook, 2006) were conducted to examine the associations between proportion of sister talk-time and sexual attitudes/intentions one year later. There was a marginally significant Birth Order X Partner Talk-Time on sexual attitudes (β = -.16; p = 10). Simple slope analyses indicated that when younger sisters talked more, older sisters held more conservative sexual attitudes (t = -2.57, p<.05), with no effect of older sisters on younger sisters. Conversely, there was a significant main effect of Partner Talk-Time on sexual intentions (β=.26; p = .045), revealing that the more sisters talked, the more sexual intentions adolescent girls held. Thus, the messages that girls receive from their sisters during dating/sexuality discussions may differentially influence sexual attitudes/intentions based on which sister (older or younger) talks more. This information can be used to determine ways sisters participate in family-based sexual health education.
Bukusu is a Bantu language spoken in Bungoma County, Kenya. With 1.4 million members (2009 Kenya Census), the Bukusu community is the largest member of the Luyia cluster of western Kenya and eastern Uganda. This presentation describes results of research carried out by several members of the ASH: Documenting Luyia Together team during the 2017-2018 academic year to document Bukusu, based on original data.

Elizabeth Kujath has co-authored a chapter describing noun phrases, building on work by Erik Platner and Emily Raney in summer 2017. Bukusu nouns fall into many different classes that mark singular vs. plural differences as well as other semantic differences. Observe the six different classes that the root -ndu takes: omuu-ndu 'person,' aβaa-ndu 'people,' sisii-ndu 'thing,' βiβii-ndu 'things,' axaa-ndu 'tiny person/thing,' βuβuu-ndu 'place.' Nominal modifiers agree with the noun, usually taking on a prefix similar to the noun's: ómúú-ndú ómu -βoofu 'big person.'

Building on the research of Sarah Pribe and Alexa Thein in summer 2017, Clarabelle Fields has co-authored a study of the structure of verbs. This includes describing the prefixes and suffixes in the verb such as subject agreement markers, markers of tense and aspect, and suffixes that refer to a location.

Katrina Smith has written a description of basic syntax, focusing on word order. For example, in kámátúunda kakúsiβwa xúsóóko ‘Fruits are sold at the market’ the subject precedes the verb and the location is formed using a locative noun class marker xu- 'at.' She is also studying the different forms of suffixes found in Bukusu verbs. For example, the causative suffix has a short form -y with most verbs, e.g. xuu-aand-y-a 'to make stick ' (cf. xuu-aand-a 'to stick'), but has a long form -isy with short verbs, e.g. xuu-kw-iisy-a 'to make fall' (cf. xuu-kw-a 'to fall').
Correlation of osteoarthritic cartilage’s initial metabolism to the tissue’s metabolic response to load
Elizabeth A. Fletcher, Riley L. Short, Jack J. Sudekum, Ferris M. Pfeiffer, James A. Keeney, James P. Stannard, James L. Cook and Aaron M. Stoker

Osteoarthritis (OA) is the leading cause of disability in the United States. Typically, the disease progresses from a focal lesion, and there is heterogeneity in the metabolism of the cartilage tissue across the surface of the tissue. It is not clear how these changes in tissue metabolism effect the tissue’s response to the compressive load that occurs during joint movement. This study was designed to determine if there is a strong correlation between the tissue’s initial in vitro metabolism and the metabolism of the tissue in response to compressive load during culture. It was hypothesized that explants that produce high levels of inflammatory and degradative biomarkers will have a significantly higher increase in biomarker production in response to compressive load compared to low producing tissues. All procedures were performed with IRB approval (IRB# 1208392). Explants were taken from patients undergoing knee arthroplasty. The explants were cultured for 2 days prior to application of injury compressive load at 0.5 MPa. Pre-culture media was collected for biomarker analysis. The load was applied for 16 hours a day through a cycle of 10 minutes of loading and 10 minutes of rest, and the tissue was allowed to rest for 8 hours. Tissues were loaded for 6 days, and media was changed on day 3, and collected on day 3 and 6 for biomarker analysis. Media was tested for inflammatory and degradative biomarkers. Assays and data analysis for this study are ongoing and will be presented on the poster.
Do peers know that their friends have dark personalities?
Ryan Foltz, Jake Womick, and Laura King

In keeping with popular culture and humanistic psychology, substantial research shows a strong positive correlation between authenticity and psychological well-being. The purpose of these studies was to examine whether the relationship between authenticity and well-being might be moderated by a person's personality. Specifically, we were interested in seeing if “being oneself” is associated with well-being even among those with “dark” personalities. The Dark Tetrad (Machiavellianism, narcissism, psychopathy, and sadism) is a constellation of traits reflecting aversive personalities. Is it best, for personal well-being, for individuals high on these traits to “be themselves”? In two studies, the Dark Tetrad moderated the association between authenticity and well-being: Among those low on dark traits, authenticity predicted well-being however for those high on dark traits, inauthenticity predicted higher well-being. A third study examined this issue incorporating peer reports to test whether peer reports of target personality accurately reflect their dark traits and whether this association matters to target well-being. 364 students (“targets”) completed measures of well-being, authenticity, and the Dark Tetrad and were asked to provide email addresses for up to five people who know them well (“peers”). Peers completed brief measures of target personality, well-being, and authenticity. Analyses showed, first, that peer ratings of dark traits showed agreement among themselves and with target reports of dark traits. Second, within targets only, authenticity was associated with well-being only among those low on the dark traits. Finally, we accuracy in peer reports of target dark traits was associated with well-being, suggesting that being known for “who we really are” is associated with adjustment, even among those whose personalities might be considered dark.

This project was completed to fulfill a Capstone requirement.
The differing influences of mothers versus siblings on adolescent body perceptions
Baylee Francka, Chris Odudu and Nicole Campione-Barr

The roles of family relationships in adolescents’ body evaluations have frequently been evaluated. Parents’ levels of nurturance and support have shown to be positively correlated with adolescents’ body perceptions (Crespo et al., 2010). Sibling relationships, however, have been relatively understudied in this context (Keery, et al., 2005; Ricciardelli, et al., 2000). Additionally, siblings experience family life differently depending on birth order as stated by resource dilution theory (Blake, 1981), and older siblings typically spend more time with their parents (Price, 2008). These findings suggest that familial relational processes that impact body conceptions may differ by adolescent birth order and relationship partner. Thus, this study aimed to examine the differing impacts of mothers and siblings on adolescent body esteem.

The sample consists of 101 sibling dyads, evenly distributed among gender compositions, and their mothers. Siblings were less than five years apart in age, closest-in-age, and with at least one in grades 10-12. Most were middle-class, European Americans, and from intact families. Scores for relationship quality with siblings and mothers, rated separately by both older and younger siblings, were measured by the Network of Relationships Inventory (Furman & Buhrmester; 1985). Siblings’ body esteem was measured using the Body Esteem Scale (Mendelson and White, 1982). Greater mother positivity is associated with higher older sibling body esteem ($t(92) = 3.70, p<0.001$) and greater negativity with lower body esteem ($t(92) = -2.09, p=.04$). Younger siblings have no significant effects. Greater older sibling positivity is associated with higher body esteem for younger siblings ($t(91) = 3.36, p=.001$). There are no significant associations between younger sibling body esteem and mother positivity, mother negativity or older sibling negativity. Understanding family dynamics could help in treating the increasing prevalence of body-related disorders.

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Wanga is a member of the Luyia language cluster and spoken by a community of about 300,000 people in Kakamega County in western Kenya. The language is currently underdescribed, and this project seeks to contribute toward its documentation. In this presentation, we summarize efforts by by three student researchers on the ASH: Documenting Luyia Together team to describe aspects of Wanga grammar during the 2017-2018 academic year. Ryley Ewy has co-authored a chapter on Wanga nouns and noun phrases. Drawing on the Wanga dictionary developed by the ASH team in 2016-2017, Ewy’s paper describes the various classes and subclasses that nouns fall into, which are distinguished by different prefixes for each class. Joshua Frost has co-authored multiple chapters on the Wanga verb. In one paper he describes the structure of the verb, identifying all of the prefixes and suffixes in Wanga verbs. In another paper, he describes the different ways that suffixes of the verb may be pronounced, and the ways in which they change the pronunciation of other parts of the verb. For instance, when the causative suffix -y is added to verb roots ending in l, such as oxu-kul-a ‘to buy’, the l changes to s: oxu-kus-y-a ‘to sell’. Frost’s data come from a variety of sources including the Wanga dictionary, a collection of Wanga oral narratives, and original data he has collected from a Wanga speaker. Heather Graham has carried out research on the Wanga sound system, focusing on changes in pronunciation that occur when two vowels come together within words. Heather worked with a new dataset collected from a Wanga speaker in January 2018. Her chapter makes a new contribution to the study of Wanga that provides diagnostics for distinguishing two subtypes of verb roots that appear to begin with a vowel.
Psychologists have long been interested in why people choose a particular college major or occupation. Much research has been done to try to pinpoint factors that play a role in these choices (Lent & Brown, 2013, Betz & Hackett, 1981). However, relatively little research has addressed the role of communication style. In this research, we test whether adolescents’ communication style impacts their later college major or career choice. The original data collections included a sample of 642 adolescents in 2007-2009. The youth brought a friend to the lab to complete various tasks, including a joint decision-making task in which participants planned a party. From this task, communication style was coded using methods similar to previous studies (Leaper, 1991). Thought units were coded as Collaborate, Oblige, Inform, Control, Affiliative/Off-topic, and other. Girls were found to produce more collaborative and oblige statements than boys. The current data collection involves following up on these participants who are now young adults (ages 21-26). To date, 225 have completed an online questionnaire, and recruitment continues. Of relevance to the present study, the questionnaire assesses educational and vocational experiences. Data from The Bureau of Labor and the National Center of Education is used to classify educational and vocational choices as male-typed, female- typed, or gender neutral. Data analysis is currently underway. Multiple regressions analysis is used to test whether adolescents’ communication predicted later educational/vocational choices, and meditational analyses to test whether adolescent communication helps account for gender differences in young adults’ educational/vocational choices. Youth with particularly sex-typed styles are expected to avoid educational/career choices typical of the other gender. Of particular interest, communication style is expected to play a role in women’s avoidance of male-dominated fields, including STEM. There are negative implications for individuals and society when qualified women avoid male-dominated fields, making this especially important.
Novel high gravity ethanol fermentation with co-utilization of hexoses and pentoses
Jacob Gajewski, Zhu Chen and Caixia (Ellen) Wan

Fossil fuels such as petroleum have become significantly more scarce in the past decade. This has sparked a growing dependency on renewable energy sources. Bioethanol is one of the most commonly researched renewable fuel sources. However, efficient ethanol production from lignocellulosic biomass via fermentation is limited by inefficient co-utilization of glucose and xylose, low tolerance to inhibitors, and low productivity. This study examined the factors that can induce ethanol production by an oleaginous strain. Effects of strain immobilization on ethanol fermentation were also examined. Overall, this study provides a new process for efficient ethanol production from lignocellulosic biomass-derived C6 and C5 sugars.
Breeding the dog of the plant world: Development of doubled haploid Brassica oleracea
Evan Y. Gallagher, Brandin Grindstaff, Ruma Devi, Makenzie E. Mabry and J. Chris Pires

Just like dogs are known for their tremendous diversity in size and shape, Brassica oleracea is one plant species that has been domesticated into many familiar crops. These include vegetables such as Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kale, and Kohlrabi. The challenge with improving these vegetables is that there are not publicly available inbred lines that can be used to develop elite germplasm, as has been done in corn (maize) and other crops. One way to make inbred lines of diploid organisms is to instantaneously double the genome of male or female gametes. We are developing and optimizing the process of making doubled haploids (DH) lines in our lab to reduce the time spent selfing plants into homozygosity from many generations to one. At present, there are only a few DH lines publicly available for each of these important crops, with most of them being kales. Improving upon previous techniques and producing doubled haploids for each of these six major morphotypes allows for studies to assess the genotype to phenotype relationship on completely homozygous lines within a single species.
Gable Galusha
Lamoni, IA

Senior
Electrical & Computer Engineering

Faculty Mentor: Dr. James Keller, Electrical Engineering & Computer Science
Funding Source: College of Engineering Undergraduate Research Option

A fast target detection algorithm for underwater Synthetic Aperture Sonar Imagery
Gable Galusha, Aquila Galusha and James Keller

The ability to discern the characteristics of the seafloor has many applications. Due to minimal visibility, Synthetic Aperture Sonar Imagery (SAS) uses sonar signal processing to produce a texture map of the seabed below. As part of a team, a method is designed for use in detecting targets within these texture maps, from varying seafloor contexts. The approach begins with one or more anomaly detecting prescreeners that use minimal target information and can be applied under various seafloor conditions. In addition, these anomaly detectors are utilized in multiple fusion experiments and manipulation to bolster and account for unique target characteristics. Suppressed hits or peaks in the resultant confidence surface are further processed for scoring. Through Receiver Operating Characteristic (ROC) curve production and examining the areas under each curve, detection effectiveness becomes simple to distinguish. Taking advantage of this, the anomaly detecting prescreeners can be trained, modifying parameters internal to their designs, using the resolved ROC curves to designate how effective detection is under specific configurations and conditions. More than this, attention is paid to determine performance with respect to seafloor type from different various locations. The approach is tested on a SAS data collection conducted by the U.S. Navy.
The role of hydrogenases and membrane complexes in uranium reduction by *Desulfovibrio vulgaris*

Catherine P. Gjerstad, Thomas R. Juba, Erica L-W. Majumder, Kara B. De Leon, and Judy D. Wall

The bacterium *Desulfovibrio vulgaris* Hildenborough (DvH) is a Gram-negative, anaerobic, curved rod that reduces uranium from U(VI) to U(IV). Uranium reduction is important because uranium is both radioactive and toxic. U(VI) is soluble and travels with groundwater flow, while U(IV), the reduced form, is insoluble and practically immobile. Therefore, reduction of uranium is beneficial for removing uranium from contaminated groundwater. Cytochrome c3 has been shown to be important for U(VI) reduction by DvH; however, the source of electrons donated to cytochrome c3 for this reduction is unknown. Hydrogenases and membrane complexes, Tmc, Rnf, and Hmc, have been hypothesized to play this role. DvH has six hydrogenases and one hypothetical hydrogenase. Periplasmic hydrogenases oxidize hydrogen, (H₂ -> 2H⁺ + 2e⁻), creating a proton gradient for ATP synthesis and electrons for uranium reduction. Alternatively, electrons may be shuttled from the cytoplasm through Tmc, Rnf, or Hmc to the periplasm for uranium reduction. Cultures of JW710 (wild type DvH), JW5076 (lacking the six known hydrogenases), JW5096 (lacking all seven hydrogenases), JW9087 (lacking cytochrome c3), JW5112 (lacking Rnf), and JW9053 (lacking Tmc) were harvested. Each culture was standardized to 0.3 mg/mL cell protein and exposed to 1 mM uranyl acetate. Samples were collected over 24 hours to monitor uranium reduction as a function of time. A modified uranium assay showed that the deletion of the six known hydrogenases did not completely hinder uranium reduction and, therefore, they are not the sole electron donors for uranium reduction.
Education among the YAYA market
Maxwell Goldner, Katelyn Blechinger, Dun Li, Jamie Flink and Jon Stemmle

Prior to conducting our research, we wanted to understand how the 18-24 YO market views college education, the broader concept of learning and their perception toward career prospects. In order to do so, a 25-minute survey was distributed through Qualtrics to a national, 18- to 24-year-old respondent panel from which 721 complete responses were collected and analyzed. Primary research findings were then coupled with secondary research support to frame our conclusion. Our research indicates that while a majority of the YAYA demographic deems a college education to be a risky investment, they still believe that it is necessary to achieve success in life. YAYA consumers’ pragmatic approach to higher education makes them value the more cost-effective online degrees and the traditional ones equally; in addition, they also prefer real world experience than learning in a classroom setting. In other words, the epicenter of learning for YAYA consumers is shifting away from the walls of the classroom. While they recognize the difficulty in finding a good job in today’s market, the YAYA consumer remains optimistic about career-building in the long term. Individual outlooks yield more optimism as this confident demographic views college as a stepping stone before they work their way to their dream job.

This project was completed to fulfill a Capstone requirement.
Faculty Mentor: Dr. Raghuraman Kannan, Bioengineering; Radiology

*Receptor targeted gold nanorods as immunohistochemistry agents*
Allison Gordon, Sairam Yadavilli and Raghuraman Kannan

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Chloe Gossett
Liberty, MO

Junior
Soil, Environmental & Atmospheric Sciences

Faculty Mentor: Dr. Enos Inniss, Civil & Environmental Engineering

Efficiency of soil additives on phosphorus removal from stormwater runoff in bioretention cells
Chloe Gossett, Demmi Christensen, William Riley, Shelby Sample, Lindsey Sommerfeldt, Elizabeth Taylor and Enos Inniss

In 2001, Allen Davis and his colleagues at the University of Maryland published their research paper, “Laboratory Study of Biological Retention for Urban Stormwater Management,” concluding that bioretention is a viable option for reducing concentrations of heavy metals, nitrogen, ammonium, and phosphorus in stormwater runoff. Davis’ paper states that “bioretention design requires a sandy loam soil or a texture near sandy loam,” yet most of Missouri is known to have soils high in clay, and therefore the bioretention cells may treat stormwater runoff differently due to the change in surrounding conditions. In an attempt to improve bioretention design for Missouri, this project explores the effects of various soil additives (gypsum, mulch, biochar, compost, and drinking water treatment residuals) on the removal of phosphorus, a nutrient abundant in runoff causing eutrophication & poor water quality in surface waters. To evaluate these additives, separate pilot-scale containers having a soil mix containing one of the respective additives were placed outside of the Grissum Building in Columbia to receive actual storm events, and a set of bench-scale containers were placed in the lab to receive controlled, synthetic storm events. Levels of phosphate for select storm events were tested using spectrophotometry to determine the amount retained in the soil. To date, it appears that these bioretention cells serve more as a source of phosphate rather than a sink. However, our data corroborate with further studies by Allen Davis stating that changes in the bioretention design can help to curb the release of phosphate from these systems.
Childhood obesity has become a nationwide problem. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. In addition to excess weight, preschoolers’ vegetable intake is far below the recommended amounts. These trends are worrisome because excess weight and poor nutrition underlie many chronic health problems. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Using data gathered from both parents and children, two research questions will be addressed: 1) what is the relationship between parent reports of child food intake and children’s self-reported favorite meals? And, 2) what is the relationship between family mealtime routines and children’s self-reported favorite meals? Seventeen preschoolers (11 boys and 6 girls; average age 49 months) from the University of Missouri Child Development Laboratory are participating. Before the garden program began, children completed the Placemat Protocol (Harrison et al., 2015) and parents completed a survey about children’s eating habits and mealtime routines. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. This study examines only children’s favorite meals. Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables. For the survey, parents reported the weekly frequency with which their preschooler consumed a variety of vegetables, fruits, grains, dairy, meats and beans, and beverages and their mealtime routines at home. Data analyses are underway to determine the relationship between: family meals and the dietary quality of children’s favorite meals and the frequency and type of family meals and the dietary quality of children’s favorite meals. Results will provide a baseline from which to evaluate the preliminary impact of the garden program.
Wanga is a member of the Luyia language cluster and spoken by a community of about 300,000 people in Kakamega County in western Kenya. The language is currently underdescribed, and this project seeks to contribute toward its documentation. In this presentation, we summarize efforts by by three student researchers on the ASH: Documenting Luyia Together team to describe aspects of Wanga grammar during the 2017-2018 academic year. Ryley Ewy has co-authored a chapter on Wanga nouns and noun phrases. Drawing on the Wanga dictionary developed by the ASH team in 2016-2017, Ewy’s paper describes the various classes and subclasses that nouns fall into, which are distinguished by different prefixes for each class. Joshua Frost has co-authored multiple chapters on the Wanga verb. In one paper he describes the structure of the verb, identifying all of the prefixes and suffixes in Wanga verbs. In another paper, he describes the different ways that suffixes of the verb may be pronounced, and the ways in which they change the pronunciation of other parts of the verb. For instance, when the causative suffix -y is added to verb roots ending in l, such as oxu-kul-a ‘to buy’, the l changes to s: oxu-kus-y-a ‘to sell’. Frost’s data come from a variety of sources including the Wanga dictionary, a collection of Wanga oral narratives, and original data he has collected from a Wanga speaker. Heather Graham has carried out research on the Wanga sound system, focusing on changes in pronunciation that occur when two vowels come together within words. Heather worked with a new dataset collected from a Wanga speaker in January 2018. Her chapter makes a new contribution to the study of Wanga that provides diagnostics for distinguishing two subtypes of verb roots that appear to begin with a vowel.
Many different tasks are used in communication science to measure a speaker’s level of proficiency in a language, and most of these tasks involve an audio recording of the speaker's responses which must later be manually transcribed to be of use. The purpose of this research is to develop software to transcribe these tasks automatically, which could save significant amounts of time for language science researchers. The initial goal is to create software to accurately transcribe the MINT (Multilingual Naming Test) in English, Spanish, and Chinese. In this test, the participant names pictures out loud, one at a time, in the chosen language or otherwise indicates that they do not know the name of the object. The software will recognize what name the participant gave to each object or if they indicated that they did not know. The single, independently spoken word nature of these recordings is unsuited for most general speech recognition tools which rely heavily on context. It does, however, have the advantage of a limited vocabulary and clear, slow speech patterns. One final challenge is to separate the words spoken for the task from background noise and conversations between the participant and the researcher. The software will be built upon the CMUSphinx speech recognition but customized with new grammars and dictionaries as well as specialized voice activity detection and alignment techniques to accurately distinguish relevant from irrelevant noise and speech. This research is currently ongoing, and results and conclusions will be presented at the Forum.
Effect of osteochondral allograft storage time on chondrocyte metabolism in vitro
Nicole T. Greco, Spencer E. DeLucia, Eli L. Pratte, James L. Cook and Aaron M. Stoker

Introduction: Osteoarthritis (OA) is the leading cause of disability in the United States. Osteochondral allograft (OCA) transplantation is one potential treatment for patients with OA. Because of mandatory disease testing, OCAs must be stored for at least 14 days, and can be stored for up to 56 days using the MOPSsm method. However, it is not clear how storage effects the metabolism of the chondrocytes. Therefore, this study was designed to determine if storage time effects the metabolism of the chondrocytes in the OCA. It was theorized that there would not be a significant difference in the metabolism of chondrocytes obtained from day 0 OCAs and OCAs stored for at least 28 days in vitro. Methods: All procedures were performed with IRB approval (IRB# 1208392). Human osteochondral allograft tissue at time 0, and day 28 of storage were obtained from MTF for an unrelated study. Further, osteochondral allograft tissue normally discarded after surgery was collected for this study. Cartilage was diced and digested with collagenase overnight, and the cells were seeded onto 25cm2 flasks in 10% FBS. When the chondrocytes reached 90% confluence a media sample was collected for biomarker analysis, and the cells were freed from the flask using TrypLE and counted using the trypan blue exclusion assay. Significant differences between groups were determined by T-Test or Rank sum test based on normality of the data with significance set at p<0.05. Results: Assays and data analysis for this study are ongoing and will be presented on the poster.
In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity seems to suggest a desire for spaces where death can be discussed. With the development of virtual reality simulations arises the possibility of a new space where death can be explored. Virtual reality could prove useful in simulating end-of-life experiences and emotions to help individuals cope with fears or anxiety. Our interdisciplinary research team is exploring the effects of video immersion on an individual’s willingness to discuss death. Experiencing an immersive video based on mortality themes might increase thoughts about death and yet, potentially decrease death-related anxiety. Previous research has shown that graphic images have the power to elicit death anxiety, while other studies suggest that people are more comfortable addressing and discussing mortality through the use of metaphor and symbolic imagery than by addressing death outright. Therefore, our original video includes images such as birds, bats, waves, lush foliage, and expansive scenery, in addition to first-person footage of a mock burial. By including both graphic and symbolic material, we will examine whether the video will have a universal impact not directed toward a specific understanding of mortality. In our study (N= 48), roughly half of the participants completed personality and attitude surveys before watching the video, while the other half completed their surveys in two parts: before watching the video and after watching the video. In doing so, we hope to gain a better understanding of how observing and experiencing art may influence attitudes related to mortality.
The impact of social and communication skill instruction on bullying involvement
Claire Griese, Rebekah Hurley, Josie Lovejoy, Halie Pyla, Olivia Shafer, Janae Walsh, Abby Wurdack and Chad Rose

Bullying has become a pervasive problem among school aged-youth. According to recent data from the United States Department of Education, approximately 1 in 5 students report being victimized within American schools. Two of the most common predictors among youth that experience prolonged victimization are social and communication skills deficits. Therefore, it’s critical to examine the relationship between social skills instruction and youth who have been identified with low social skills. The current study highlights data and outcomes from a larger project that is a collaboration from the Mizzou Ed Bully Prevention Lab, Boone County Mental Health Coalition, and 9 partner elementary schools. Schools used a teacher-reported behavior checklist to identify students who may be at-risk for bullying involvement due to low social or communication skills. Additionally, teachers and students completed a pre/post survey related to skill development and bullying involvement. Overall, 439 students in grades K-5 were involved in the study, where they received eight weeks of targeted, small group instruction in response skills related to bullying scenarios presented through an interactive curriculum called Cool School. Based on pre/post analyses, teachers reported significant increases in prosocial behaviors, emotion regulation, and academic competence; where students reported significant increases in prosocial behaviors, academic self-efficacy, and decreases in victimization. This study demonstrates that targeted, skill-based instruction can increase prosocial behaviors and academic outcomes, while decreasing victimization. Therefore, educational stakeholders should begin to emphasize the importance of social and emotional learning as a critical component of students’ daily curriculum.
Brandin Grindstaff  
Lexington, MO  
Senior  
Biological Sciences  

Faculty Mentor: Makenzie Mabry, Biological Sciences; Dr. J. Chris Pires  
Biological Sciences  
Funding Source: NSF Plant Genome Award  

*Big Data Revolution in Plant Science: Affordable remote sensing using Raspberry Pi’s*  
Brandin Grindstaff, Makenzie E. Mabry, and J. Chris Pires  

Using the Raspberry Pi as a platform, we have been developing affordable ways to remotely monitor plants in growth chambers and greenhouses. The primary data being collected has been photographs, short videos, temperature, and humidity. The small, credit card sized computer, paired with a mobile phone sized camera, a DHT temperature/humidity sensor and access to the internet allows for precise monitoring of experiments from anywhere for around 100 dollars. The programming of cameras, sensors, and other components that would have required an advanced understanding of computer science a decade ago, can now be done with ease using free, open source Python function libraries such as “ADAfruit_Python_DHT” from GitHub, or “python-picamera”, a python library from raspberrypi.org. The camera will be set up to collect live video and photos in a multitude of configurations and be able to log that data onboard or remotely as backup. Most of these functions can be utilized through Putty, a secure Shell program, which is essentially a remote command prompt. These devices are revolutionizing the affordable acquisition of “Big Data” by collecting data at any time of the day, autonomously, that can be viewed from anywhere with internet access.
Maha Hamed
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Juni or
Biochemistry

Faculty Mentor: Dr. Antje Heese, Biochemistry
Funding Source: NIH Initiative for Maximizing Student Diversity (IMSD-EXPRESS)

Towards understanding the role of salicylic acid in growth and constitutive defense responses in Arabidopsis clathrin-coated vesicle mutants
Maha Hamed, Erica LaMontagne, Alex Clarke and Antje Heese

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
In positive relationships with the parents, research has shown that adolescents are more likely to be perceived positively by their peers (Harter & Whitesell, 1998). In contrast, research has shown that a negative relationship with parent can lead to behavioral problems (Harter & Whitesell, 1998). However, as with most close relationships, positivity and negativity are both experienced within parent-adolescent relationships. Thus, the goal of the present study was to examine positive, negative, or both qualities on domains of self-perception: global, academic, physical, behavioral, and social.

101 predominantly White and middle class first-born adolescents, adolescents, ranging in age from 11-21 years, M=16.46, SD=1.35, participated in the study. Participants completed the Network of Relationships Inventory to measure positive and negative relationship qualities. Additionally, adolescents completed the Harter Self-perception scale to evaluate the five domains self-perception. We conducted five hierarchal linear regressions. In the first step, gender of the adolescent was entered. In the second step, we entered the main effects of positivity and negativity with the mothers. In the third step we entered the interaction between positivity and negativity with the mother. Each analysis included one of the five domains of self-perception. There was a significant effect of negativity with mothers on the behavioral domain as well as the global domain of self-perception. The more adolescents perceived negativity from mothers, the lower their behavioral and global domains of self-perception. Positivity was not significantly protective for self-perceptions of any kind when negativity was also measured.

Given that relationships with parents are never just positive or negative, but both concurrently, the present study shows it important to examine both simultaneously to gain a more complete picture of the influences on adolescent self-perceptions. Parents and therapists may utilize this information to better understand family relationship dynamics and their influences.

This project was completed to fulfill a Capstone requirement.
A study of reproductive organ development in Ambystoma salamander species
Behirah Hartranft, Arianne Messerman and Manuel Leal

The growth and viability of populations is dependent on the rate at which organisms reach sexual maturity and, thus, can reproduce. Salamander species of the genus Ambystoma are not born with reproductive organs, but instead develop them as juveniles reach sexual maturity. Studies have documented ambystomatid sexual morphology but fewer data are available describing the transitional period between the juvenile and adult life stages. The aims of this study were to characterize reproductive organ development among juvenile Ambystoma salamanders and develop a better understanding of ambystomatid maturation rates. We euthanized, preserved, and dissected salamanders of a single cohort of four Ambystoma species following an outdoor survival study. We recorded both the presence and size of reproductive organs. Through dissection, we found that 70% of the surviving study animals had reached sexual maturity. Our data also show that the ratio of male to female in the surviving study animals was 9:1. We additionally found that male reproductive organs become apparent in the order of testes, Wolffian ducts, and then collecting ducts. Salamander body size and length of the testes were positively correlated and salamander body size and ova mass were also positively correlated. The results of this study contribute to our understanding of maturation rates, sex ratios, and reproductive development relative to body size for the four study species and may help to inform future projections of population growth and persistence among ambystomatid salamanders.
Inhibition of CYP11B1 11B1-hydroxylation of Sutherlandia frutescens
Casey Hawkins, Kaitlyn Chetney, Graham Funk, William Folk and Rainer Glaser

One way the body responds to stress is by hydroxylation of 11-deoxycorticosterone (DOC) through the cytochrome P450 enzyme CYP11B1 to form corticosterone. Stress management aims to inhibit this synthesis, and it has been hypothesized that plant extracts from the plant Sutherlandia frutescens may lower the levels of corticosterone (Sergeant and Folk, 2011) and the phytochemical sutherlandioside B (SU1) is a possible inhibitor. It is the goal of our research to explore this hypothesis with molecular modeling techniques. We have been studying active site in the iron-oxo systems [(Por^{2-})(Fe^{3+})O(L^{-})]^{1-n} (1, L^{-} = thiolate; 2, L^{0} = imidazole; 3, L^{-} = phenolate) in detail (see Figure). The nature of the bonds between iron and oxygen and between iron and the ligand that tethers the complex to the protein via a side chain thiolate (cysteine), imidazole (histidine), or phenolate (tyrosine) the overall spin multiplicity (doublet, quartet, sextet), and the distribution of the unpaired electrons have been explored through molecular modeling techniques. We will show that the quartet state is preferred and that the distribution of the spin depends greatly on the nature of the tether. In the imidazole system, the three unpaired spins are distributed over Fe, O, and within the pi-system of the (dideprotonated) porphin ligand. In the thiolate and phenolate systems, the three unpaired spins are distributed over Fe, O, and the almost neutral SR (OR) ligand. Results of quantitative electron and spin population population analyses will be reported. Effects of the enzyme environment on steroid oxidation have been studied with QM/SEM/MM methods.
Faculty Mentor: Dr. Antoinette Landor, Human Development & Family Science
Funding Source: McNair Scholars Program

*Exploring the associations between sexual intensity, skin tone, and relationship quality among African American young adults*
Jayla Head and Antoinette Landor

Despite popular belief, Blacks do marry. To properly provide counseling to Black couples, cultural differences have to be accounted for, instead of providing therapy from a Eurocentric lens. It is also important to examine what aspects of relationships are the most detrimental to the longevity of Black relationships. This study examines whether the level of sexual intensity in a relationship is associated with relationship quality components (e.g., satisfaction, commitment, intimacy, trust, love) and, whether skin tone moderated the association between sexual intensity and relationship quality components. More research is needed on the functionality of Black relationships and why it is so impactful to the progression of the Black community. Examining sexual intensity and its effects on romantic relationships can bring forth new research that contributes to the analysis of what relationship satisfaction is. Also examining skin tone and its effect on relationship satisfaction can also help tailor the therapy that couples receive when they are not at their peak of satisfaction.

*This project was completed to fulfill a Capstone requirement.*
Stealing votes: Voter ID laws as a modern device to suppress African American voting
Victoria Henley and William Horner

The recent proliferation of voter ID laws warrants a deep look into the motives behind them, in large part due to the history of voting rights abuses in the United States. Specifically, it is important to question whether voter ID laws are racially motivated and would, therefore, violate the Voting Rights Act of 1965, a momentous piece of legislation that virtually ended century-long discriminatory voting laws aimed at preventing people of color from voting. However, after the Shelby County v. Holder decision by the Supreme Court in 2013, the Voting Rights Act has been completely transformed. There has been some research on the impact and motives of voter ID laws, but very little research done on whether these laws legally violate the Voting Rights Act; much less what is left of the Act after Shelby County. This thesis fills the gap in literature as well as to analyze whether lawmakers are attempting to disenfranchise people based on their ethnicity. This thesis does so by exploring the history of voting rights abuses that led to the creation of the Voting Rights Act, the gradual weakening of the Act over time, voter ID laws, and important court cases. I find that voter ID laws would have violated the Voting Rights Act prior to the Shelby County decision, however, they do not violate what remains of the Act today.

This project was completed to fulfill a Capstone requirement.
Amanda Henry  
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Psychology  

Faculty Mentor: Dr. Rebecca Johnson, College of Veterinary Medicine

Adoption of a shelter cat: Effects on children with Autism Spectrum Disorder and cat stress  
Amanda Henry and Rebecca Johnson

Research abstract withheld at the request of the faculty mentor for proprietary purposes.

This project was completed to fulfill a Capstone requirement.
More than half of youths with autism spectrum disorder (ASD) frequently engage in physically aggressive behavior. Although the causes are unknown, such aggression has been linked with several social-ecological (e.g., family, peer, school) correlates that are proximal to the individual youth. However, the influence of the youth’s broader environment on these social-ecological correlates has not been examined. This examination seems warranted, since research has suggested that several individual and social-ecological variables differentially affect rural youths with ASD (e.g., Antezana et al., 2017). Taken together, it seems necessary to examine whether the social-ecological variables linked with aggressive behavior in youths with ASD are moderated by a family’s rural or urban status. Thus, the present study examined a broad range of social-ecological variables for youth living in diverse settings to determine whether differences existed. Participants included 120 families with an 11- to 17-year-old youth with ASD. The youths and their primary caregiver each completed a battery of measures to assess a range of social-ecological variables. Measures of individual functioning (severity of youth autistic symptoms, sleep quality), family functioning (caregiver stress and coping, overall family relations, parenting practices), and youth academic functioning were completed by caregivers. Measures of peer relationships (friendship quality, victimization by peers) were completed by the youth. A hierarchical multiple regression analyses indicated that caregiver avoidant coping, caregiver stress, repetitive and restrictive behaviors, and youth sleep quality accounted for unique and significant proportions of variance in youth’s physically aggressive behavior. Analyses were then conducted to determine whether family urban/rural status significantly moderated the relation between these four variables and youth aggressive behavior. The present study found that key family- and individual- level variables were linked with aggressive behaviors in youths with ASD, and that a subset of these variables were moderated by family urban/rural status.

This project was completed to fulfill a Capstone requirement.
Alicia Hoagenson
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Faculty Mentor: Dr. Raghuraman Kannan, Bioengineering; Radiology

NIR camera system for biomedical imaging
Alicia Hoagenson, Anandhi Upendran, Henry White and Raghuraman Kannan

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Improving gene editing in soybean hairy root system using different promoters to express Cas9
Miki Hodel, Cuong X. Nguyen, Sterling C. Evans, Minviluz G. Stacey and Gary Stacey

The rhizobium-legume symbiosis is an interesting research topic at several levels from physiology to molecular biology. Genetic screens using large mutated populations have been useful in uncovering key genes involved in the early and late stages of nodule development. However, this approach is laborious and costly. The recent introduction of CRISPR/Cas technology is revolutionizing biology by allowing targeted editing of the genome. The M. Stacey laboratory has recently developed and deployed the CRISPR/Cas9 genome editing system via Agrobacterium rhizogenes-mediated hairy root transformation in order to study gene function in soybean roots, including root nodules. This system is highly efficient, with up to 70% of the transgenic roots having a homozygous mutation in the targeted gene. The aims of our study are to improve the efficiency of this CRISPR/Cas system through modifying the promoter sequence that drives the Cas9 protein. We acquired three constitutive promoters, Cauliflower mosaic virus (35S), Cassava vein mosaic virus (CvMV), and soybean native promoter Ubiquitin (GmUBQ). These promoters are highly expressed in soybean roots and nodules. Constructs were made in which each of these promoters was used to drive transcription of the nuclease Cas9 along with guide RNA directed toward nodule uricase (UOX) and xanthine dehydrogenase (XDH) as target genes. Consistent with previous results, 70% of the transgenic roots generated from the 35S promoter were unable to fix N2 as exemplified by their lack of leghemoglobin production. We are currently analyzing hairy roots made using the other promoters but, based on preliminary results, expect a higher success rate. Our study further validates the utility of using the CRISPR/Cas9 in soybean hairy roots and, hopefully, will improve the system further to facilitate a wide range of studies related to soybean roots and the associated nitrogen fixing symbiosis.
Amino acids primarily serve as building blocks for proteins, in addition to playing critical roles as precursors to multiple essential processes in the cell. It is well documented that the free amino acids of the glutamate family serve pivotal roles in nitrogen assimilation and storage, respond to abiotic stresses, and function as osmolytes during water deficiency. However, the function and regulation of free glutamate amino acids in seeds remain mostly unclear. To shed light upon this issue, a genome-wide association study (GWAS) of free glutamate amino acid derived traits measured from dry *Arabidopsis thaliana* seeds was performed using a 300 accession association panel. This analysis aimed to identify loci that were significantly associated with the glutamate traits of interest. Several candidate genes were uncovered as a result of the study. My project aimed to characterize the involvement of one of the genes identified by this analysis, AT3G01640, in the free glutamate amino acids regulation in seeds. This gene’s functional annotation in the public database is sugar kinase and it is highly expressed in mature pollen with relatively low expression throughout the rest of the organism. In order to further understand the involvement of this gene in free amino acid metabolism regulation, I identified the only SALK T-DNA knockout mutant available at the time, which was located in the promoter region very close to the 5’ UTR. I isolated a homozygous mutant and examined whether the T-DNA insertion in the promoter caused changes in expression levels of the gene, or the neighboring gene AT3G01630. Results suggest that although the T-DNA insertion is very close to AT3G01640, there is not sufficient suppression, even partially, of the genes expression. Recently, another T-DNA mutant that resides within the gene became available and is now being characterized.

This project was completed to fulfill a Capstone requirement.
Greyson Holliday  
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Faculty Mentor: Dr. Ken Sheldon, Psychological Sciences

Career motivation: A novel approach to determining career preference utilizing Self-Determination Theory  
Greyson Holliday and Ken Sheldon

For over 50 years, occupational psychologists have been using the Holland Code to predict and guide students’ career choices. The Holland code was designed to determine students’ interests and abilities in order to match them with an appropriate career (Holland, 1997). In the present study, researchers considered a new measure of career preference based on Self-Determination Theory (SDT). According to SDT, intrinsic motivation, which is built on interest, enjoyment and inherent satisfaction, is the optimal form of motivation that can lead to job satisfaction and sustained engagement in work (Deci & Ryan, 1987). This is contrary to popular methods of career decision that are based on external draws to careers such as prestige and income. Given this inconsistency, researchers gathered Self-Determination Theory-based Career Preference Measure (SDT-CPM) and Holland-based Career Preference Measures (H-CPM) to test whether a motivational-based or interest-based career decision measure would better predict actual career choice. Researchers tested three hypothesis: the SDT-CPM and the H-CPM will correlate with each other, both measures will correlate with actual career selection at the time of the assessment and the H-CPM will better predict career selection over time because the Holland based nature of the classes the data was gathered. Correlational analysis found that SDT-CPM and H-CPM were positively associated with each other in 4 of 6 Holland domains. These positive correlations provide some validity evidence for the two career preference assessment methods. At time 1, SDT-CPMs explained more variance than H-CPMs, on average, although both measures predicted actual career selection. During time 2, however, H-CPMs explained more variance than SDT-CPMs, on average. This discrepancy between time 1 and 2 results demonstrates the need for further analysis of factors that predict career choice.
In recent years, excess weight has become a major public health concern in America. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. Accordingly, discovering new ways to improve young children’s eating and activity habits are of paramount importance. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Eighteen preschoolers (average age = 49 months, range = 33 to 63 months; 61% male) from the University of Missouri’s Child Development Laboratory (CDL) are participating and were pre-tested using the Placemat Protocol in September, 2017. After pre-testing, preschoolers received one-hour per week of garden-based nutrition and plant science education. Post-testing is scheduled for late April. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. The foods and beverages utilized mirror Harrison's original set with some substitutions based on recent surveys of children’s food intake (e.g., cheesecake was replaced with cheese pizza). Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables (e.g., number of fruits/vegetables, number of energy dense foods, number of nutrient dense foods, kilocalories in meal). Data analyses are underway to compare the composition of children’s favorite and healthy meals and to determine if children’s pre-assessment self-rated hunger and the time elapsed since breakfast are linked with the composition of children’s meals. When post-test data are added to the pre-test data, results will provide preliminary insights into the impact of Healthy Plants/Healthy Bodies on similarities and differences between preschoolers’ favorite and healthy meals.
Rebekah Hurley
Chicago, IL
Junior
Early Childhood Education

Faculty Mentor: Dr. Chad Rose, Special Education

The impact of social and communication skill instruction on bullying involvement
Rebekah Hurley, Claire Griese, Josie Lovejoy, Halie Pyla, Olivia Shafer, Janae
Walsh, Abby Wurdack and Chad Rose

Research abstract withheld at the request of the faculty mentor for proprietary
purposes.
The accuracy of an eyewitness identification can have a massive impact on the outcome of a criminal trial. Having to describe a perpetrator after observing a staged crime has been found to reduce correct identifications of targets from lineups (Schooler & Engstler-Schooler, 1990). This phenomenon, called the “verbal overshadowing effect”, has been well replicated (Alogna et al., 2014). But there has been little research on the verbal overshadowing effect in the context of aging, and the research that has been done is contradictory (Memon & Bartlett, 2002; Kinlen et al. 2007). Moreover, because these studies have only included target-present lineups, they have not been able to separate effects on discriminability from effects on tendency to choose. It is only by including target-absent lineups that these factors can be separated (Mickes & Wixted, 2015). In the present study we tasked participants (N=96, 48 younger and 48 older) with watching four different videos depicting a crime. Each video was followed by a 5 minute crossword puzzle task (filler task), after which the participant either described the perpetrator in detail (verbal overshadowing condition) or listed states and capitals (control condition) for 5 minutes. They were then presented with a lineup consisting of six suspects. Crucially, half of the lineups were target-present lineups and half were target-absent lineups.

After indicating whether the culprit was in the lineup, participants were asked to rate their confidence in their decision. To separate out effects of age and overshadowing on sensitivity (ability to distinguish targets from non-targets) and response bias (tendency to choose) we used ROC analysis. Results are discussed in relation to theories of cognitive aging and the broader literature on eyewitness memory.

This project was completed to fulfill a Capstone requirement.
Understanding the interactions between light and biological subjects is critical for biomedical imaging applications. When coherent light is scattered off of a heterogeneous sample, speckle is formed in free space due to the interference of randomly scattered light. The speckle pattern changes with the size of the incoming light beam (objective speckle) and the collection angle of the scattered light (subjective speckle), as well as the coherence of the incoming light. In most coherence domain imaging modalities, the light beam should be focused into a small spot so that a high lateral resolution is possible. Traditionally, Gaussian beams are used for sample detection because they can be easily focused into micrometer-sized spots. However, Gaussian beams have a fundamental depth-of-field limitation due to strong diffraction along the beam waist. As a result, there is a trade-off between the lateral resolution and the total depth length when Gaussian beams are used for coherent domain imaging. Recently, structured light beams such as Bessel beams and Airy beams have been used to improve the depth-of-field in optical coherence tomography (OCT) and light sheet microscopy. However, speckle properties of these structured beams have not been studied. In this work, we compare the speckle generated from the Gaussian, Airy, and Bessel beams. Our results provide a fundamental knowledge on speckle formation using the structured light.
Faculty Mentor: Dr. D Cornelison, Biological Sciences
Funding Source: Life Sciences Undergraduate Research Opportunity Program (LS UROP)

*The role of EphA3 in muscle fiber-type patterning*
Jacqueline Ihnat, Laura Arnold, Jessica Kolisch and D Cornelison

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Written in stone: A critical look at the nation’s dealings with racial discussion in 2017
Beckie Jaeckels and Berkley Hudson

This project analyzes the role and discussion of Confederate monuments in the 21st century, particularly in the context of racial tensions in the United States. It considers the role that journalists, politicians and other public figures have in determining the telling of American history. The project’s goal is to contextualize debate over the appropriateness of these monuments. This includes consideration of the South’s “Lost Cause” narrative and white supremacist ideology. Social media posts, journalistic documentation, historical studies, and an image derived from the collection of Mississippi photographer O.N. Pruitt were examined to determine the historical significance and contemporary placement of Confederate monuments and memorials. Through this analysis, it becomes clear that there is a distinct difference between monuments that recognize American history and those that glorify it. This research highlights the importance of continued discussion around the sanitized history of the United States.
Allison Jarombek
Platte City, MO

Junior
Communication Science & Disorders

Faculty Mentor: Dr. Dana Fritz, Communication Science & Disorders

Young women’s fundamental frequencies: A longitudinal study
Allison Jarombek, Erin Tippit and Dana Fritz

For the past five years, women aged 20-21 were asked to determine their fundamental frequency using the freeware speech analysis program PRAAT. They were also asked to find their vocal range using this software as well as a virtual piano or standard piano keyboard. This data was analyzed for apparent changes in fundamental frequency over time. As has been reported by Decoster and Debruyne (2000) and Russell, Penny, and Pemberton (1995) regarding changes in female fundamental frequency, this data supported the idea that fundamental frequency has decreased in recent history. Median frequency decreased from 294 Hz to 220 Hz with piano keyboard correlates of D4 (above C4/middle C) to A3. Further analysis of changes in vocal range over time will also be included in this study, as well as analysis of additional physical changes in women that may influence fundamental frequency.
Rebecca Jennings
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Junior Nutritional Sciences

Faculty Mentor: Dr. Sara Gable, Nutrition & Exercise Physiology  
Funding Source: NEP Undergraduate Research Internship Program

Comparison of preschoolers’ self-constructed favorite meals and healthy meals
Rebecca Jennings, Rebecka Ernst, Sarah Hooper, Mubinah Khaleel, Olivia Melberg, Leenah Mustafa and Sara Gable

In recent years, excess weight has become a major public health concern in America. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. Accordingly, discovering new ways to improve young children’s eating and activity habits are of paramount importance. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Eighteen preschoolers (average age = 49 months, range = 33 to 63 months; 61% male) from the University of Missouri’s Child Development Laboratory (CDL) are participating and were pre-tested using the Placemat Protocol in September, 2017. After pre-testing, preschoolers received one-hour per week of garden-based nutrition and plant science education. Post-testing is scheduled for late April. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. The foods and beverages utilized mirror Harrison's original set with some substitutions based on recent surveys of children’s food intake (e.g., cheesecake was replaced with cheese pizza). Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables (e.g., number of fruits/vegetables, number of energy dense foods, number of nutrient dense foods, kilocalories in meal). Data analyses are underway to compare the composition of children’s favorite and healthy meals and to determine if children’s pre-assessment self-rated hunger and the time elapsed since breakfast are linked with the composition of children’s meals. When post-test data are added to the pre-test data, results will provide preliminary insights into the impact of Healthy Plants/Healthy Bodies on similarities and differences between preschoolers’ favorite and healthy meals.
Interactive big data visualization for traffic operations and management
Peng Jin, Xiaofan Shu and Yaw Adu-Gyamfi

This research leverages recent developments in high performance computing to develop a platform for seamless integration and visualization of traffic datasets. At the heart of this platform is an application center (“AppCenter”) which provides a non-programmatic GUI access to an underlying database and guides users to derive powerful analytical insights from the collated data. The “AppCenter” also hosts a user-friendly, interactive, web-based visualization toolbox to enable efficient visual data exploration and analytics. The toolbox design follows a big data visualization architecture which synergistically utilizes the power of distributed computing on the server side and GPU strengths of data rendering on the client end. In the “AppCenter”, traffic managers will be able to configure routes and perform customized analysis such as traffic queue detection or monitoring, computing congestion hours, travel time reliability or speed performance, etc. The framework developed is compared with traditional data visualization platforms such as Tableau to evaluate its strengths and limitations.
Conveying warmth through control: Links to academic achievement in Black fifth graders
Kania Johnson and Jean Ispa

Research shows that authoritative parenting (medium control, high warmth) is better than authoritarian parenting (high control, low warmth) in White families (e.g., Steinberg et al., 1991). However, this not consistently true in Black families. (e.g., Dornbusch et al., 1987; Steinberg et al, 1994). High control along with high warmth has been linked to good outcomes, including academic achievement, in Black families (e.g., Dornbusch et al., 1987; Steinberg, 1994). There is literature also showing that most Black mothers value their children’s education and encourage them to do well in school (Robinson & Werblow 2012). This leads to questions about how Black mothers convey control with warmth when they talk to their children about education, how this parenting strategy may affect the child behaviorally and psychologically, and whether maternal warmth with control has links to children’s academic achievement. To answer these questions, we are capitalizing on the availability academic performance data on a sample of low-income Black 5th graders and on videotapes of them discussing issues related to education with their mothers. Using NVivo 11 (a qualitative software management system), we have coded all statements made by mothers and children for both emotional tone and discussion strategy. The codes were generated inductively using constant comparison techniques (Strauss & Corbin, 2014). The codes for mothers’ emotional tone during the discussions identify behaviors indicative of affection. Statements were also coded for level and type of control. Next, we will determine if children whose mothers combine control through warmth have higher academic achievement than children of mothers who are low in either control or warmth.
The presidential election of 1896 saw Republican William McKinley pitted against William Jennings Bryan, a Democratic candidate backed by the infamous New York Democratic political machine, Tammany Hall. This realignment election resulted in a slim McKinley victory and revealed an America divided along multiple social and regional fault lines. Volume 8, no. 181 of Tammany Hall’s weekly periodical, *The Tammany Times*, was published just days after the results of the 1896 election were in. Titled “The Nebraska Edition,” this issue contains exclusively pro-Nebraska propaganda, including praise of the recently vanquished Bryan (a native Nebraskan) and blatant appeals for Northeast-to-Midwest migration in the form of detailed testimonials from Nebraska residents lauding the state’s agricultural, industrial, financial, educational, and cultural prosperity. Both the timing and the content of the Nebraska Edition prove interesting in light of the demographic divisions that drove the outcome of the 1896 election, and beg the questions: (a) why a New York-based political machine would concern itself with the settlement of Nebraska; and, perhaps more importantly and specifically, (b) what Tammany’s motivations for the publication were in relation to the narrowly lost presidential election and its own political influence? The answer may lie with William Jennings Bryan himself. My research explores both the broader historical context of the Nebraska Edition and the specific language and themes included in its articles and testimonials. Ultimately, I argue that Tammany Hall used the Nebraska Edition to simultaneously set the stage for another Bryan campaign in 1900, reconcile divisions within the Democratic Party, and encourage members of its urban, democratic base to settle Nebraska, with the goal of extending its political clout and influencing elections on a national scale.
Does color matter? Prey selection by the bold jumping spider (*Phidippus audax*)
Joshua Jones and Manuel Leal

The diversity of colors displayed by animals has been a subject of much interest in behavioral and evolutionary ecology. A hypothesis that has received considerable attention proposes that color diversity has evolved in response to predation pressure, in particular that selection favors colors that reduce potential attacks from predators. Two strategies commonly found are camouflaged and conspicuous warning colorations. Camouflage has evolved as a mechanism where animals can blend in with their environment, diminishing detection by predators. Whereas, warning coloration, also known as aposematic coloration, has evolved to increase the conspicuousness of animals. These vivid colors and patterns are used to warn predators of the potential danger of the prey, which discourages a potential attack. Traditionally red coloration has been associated with aposematism in insects. This experiment tested the prediction that predators avoid red-colored prey species due to their coloration. To do so, newly hatched and wild-caught bold jumping spiders were presented with prey of three different colors: red, green, and blue. Fruit flies, painted to reflect the desired color, were used as prey. The predation experiments were conducted inside petri dishes, which contained three flies of each of the colors, and all prey attacked by the spider were recorded. Contrary to the prediction, the results show that bold jumping spiders attack all three colors of flies, with equal likeliness. This finding suggests a lack of perceptual bias contributing to prey selection in bold jumping spiders, this is, red color prey was not avoided by the spiders.
Madison Kaempfe  
Carthage, MO

Faculty Mentor: Dr. Mark Kirk, Biological Sciences

*Social isolation increases stress responses in the crayfish* *Procambarus clarkii*

Madison Kaempfe, Sabrea Ewing, Michael Moedritzer and Mark Kirk

Crayfish use physical and chemical cues to establish social dominance hierarchies. These hierarchies contribute to aspects of survival such as mate choice, shelter, and food resources. Competitions between pairs of naïve subjects result in the establishment of a dominant and a subordinate crayfish. Recent studies have found that social hierarchies contribute to stress levels of crayfish, as subordinates more often exhibit anxiety-like behavior. These behaviors include light-avoidance, tail-flips, and decreased movements. Studies have also found that communally housed crayfish have increased sensitivity to alcohol (ETOH) when compared to crayfish that were isolated for short periods. The purpose of our study is to investigate the relationships between social isolation, alcohol, and anxiety-like behaviors. We hypothesized prolonged isolation and exposure to alcohol would increase anxiety-like behavior. Based on prior results, we predicted isolated subordinate crayfish would have the highest stress response when compared to naïve isolated or intoxicated crayfish. Using an aquatic T-maze with light and dark arms, we first tested stress responses (i.e. light-avoidance) between isolated and communal crayfish. Second, we tested for differences in stress responses between isolated and communal crayfish in the presence of ETOH (alcohol). Third, we tested the stress responses between dominant and subordinate crayfish that were housed communally. Fourth, we tested for differences in stress responses between isolated dominant and isolated subordinate crayfish. Preliminary results suggest isolated crayfish tend to spend more time than controls in dark arms of the T-maze, whereas communal crayfish spend less time. This may occur because prolonged isolation causes stress in crayfish thus causing them to exhibit anxiety-like behaviors. In future studies, we will test the effects of other stressors on paired crayfish, including whether stress can influence reproductive behaviors.
Mouse models of osteogenesis imperfecta present with increased proteoglycan: Hydroxyproline ratio
Alp Kahveci, Youngjae Jeong, Salah Daghas and Charlotte Phillips

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Moving work zones are commonly utilized for road maintenance such as striping, sweeping, and pothole patching. When these work zone vehicles are in operation, warning is given to passing drivers through the use of arrow boards, signs, and flashing lights. Additionally, warning vehicles in these moving work zones are often equipped with a Truck-Mounted Attenuator (TMA) which helps lessen impact from collisions. Collisions with TMAs may be caused by driver inattention. In an attempt to obtain drivers’ attention and reduce the number of crashes in moving work zones, the idea of using an alternate colored light (green light), as opposed to the traditional amber and white lights, was proposed. To study the effectiveness of using a green light on construction vehicles, a driving simulator study was utilized. Study participants drove through multiple work zones containing construction vehicles with different light patterns. The light patterns included the traditional amber and white light pattern, the proposed green light only light pattern, and two alternate light patterns that utilized green lights combined with the traditional amber and white lights. Study participants’ reactions to each light pattern, including their change in speed and how quickly they merged away from the TMA, were observed. Additionally, participants were asked to complete a survey regarding their experience with the different light patterns at the end of the study. In addition to the simulator study, a field study was conducted to observe speeds and merging behavior when drivers encountered TMAs with the different light patterns on Missouri roads. The results of both of these studies were analyzed and it was determined that all light patterns, including the traditional light pattern and the proposed light pattern using only green lights, were effective. There was not one light pattern that was clearly superior to another.
This research looks at the use of Screencast to facilitate teacher inquiry into student learning, as well as its limitations. The Screencast is a recording that is made using a tablet device that includes audio data as well as anything that is written by the student solving the given math problem. The research draws on the use of student recordings as the focus of teacher discussion, with a facilitator to direct the discussion. The facilitator ultimately aided in keeping the conversation centered on student’s mathematical thinking, though the teachers made substantial contributions in terms of interpreting student thinking.
The church of hard bop: How gospel, blues, and Black church music created a genre
Devin Kaveler and Maya Gibson

Conventional jazz history says that hard-bop as a jazz genre took influence from bebop and was created as a response to the predominantly white cool jazz that had sprouted up on the west coast. This is the way that Ingrid Monson presents the timeline in her textbook; the transition goes from Charlie Parker and bebop to west coast cool jazz to east coast hard bop and then on to modal jazz and the avant garde. The legacy of hard bop, according to Monson and most jazz historians, is that it was in a sense a “second school” of truly black jazz. It helped to reclaim jazz as a black artform. By and large, I agree with Monson’s description of hard bop, but I do feel that she does not place enough emphasis on the influence of the black church, and religion in a broader sense, on the genre. I argue that hard bop would not have existed without the great migration, it would not have been created without the blues and gospel traditions that were introduced to northern cities in the first half of the twentieth century. Hard bop jazz could not have existed without the influence of the black church. I’d like to pose the question: does conventional jazz history’s relegation of hard bop as simply a response to cool devalue it? Does it do a disservice to hard bop musicians and black music as a whole? I think that the argument can be made that it does. I feel that viewing hard bop as a genre created by black musicians for black audiences and influenced by black music traditions is a much more empowering and accurate narrative.
Abigail Kehrer
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Senior
Biological Sciences

Faculty Mentor: Dr. Troy Zars, Biological Sciences
Funding Source: NSF & NIH Grants to T. Zars

An investigation into decreased fertility in a Drosophila melanogaster model of classic galactosemia
Abigail Kehrer, Judy Fridovich Keil and Troy Zars

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Comparison of preschoolers’ self-constructed favorite meals and healthy meals
Mubinah Khaleel, Rebecka Ernst, Sarah Hooper, Rebecca Jennings, Olivia Melberg, Leenah Mustafa and Sara Gable

In recent years, excess weight has become a major public health concern in America. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. Accordingly, discovering new ways to improve young children’s eating and activity habits are of paramount importance. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Eighteen preschoolers (average age = 49 months, range = 33 to 63 months; 61% male) from the University of Missouri’s Child Development Laboratory (CDL) are participating and were pre-tested using the Placemat Protocol in September, 2017. After pre-testing, preschoolers received one-hour per week of garden-based nutrition and plant science education. Post-testing is scheduled for late April. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. The foods and beverages utilized mirror Harrison’s original set with some substitutions based on recent surveys of children’s food intake (e.g., cheesecake was replaced with cheese pizza). Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables (e.g., number of fruits/vegetables, number of energy dense foods, number of nutrient dense foods, kilocalories in meal). Data analyses are underway to compare the composition of children’s favorite and healthy meals and to determine if children’s pre-assessment self-rated hunger and the time elapsed since breakfast are linked with the composition of children’s meals. When post-test data are added to the pre-test data, results will provide preliminary insights into the impact of Healthy Plants/Healthy Bodies on similarities and differences between preschoolers’ favorite and healthy meals.
The effects of a retention interval on blocking
Teresa Killmade and Todd Schachtmann

An initial experiment examined if a retention interval might increase the competitive ability (blocking of another CS) of a latent inhibitor and found that conditioned performance to a latent inhibitor can be greater after a long retention interval than a short retention interval. The present experiment explored if such an effect could simply be due to “incubation” of the CS-US association, meaning that the CS preexposure was not relevant to the phenomenon. In order to examine this incubation explanation, sixteen rats were randomly assigned to Groups RI or Group noRI. On Day 1, Group RI received one flavor (A) followed by an injection of LiCl, and then began a 21-day retention interval at this time (Days 2-22). On Day 21, the rats in Group noRI received flavor A followed by LiCl. All rats were given a compound conditioning trial on Day 23 in which the rats initially received flavor B, followed by flavor A and were then given LiCl. A test on flavor B occurred on Days 25-29. In the earlier experiment, A 2 (Pretraining vs. Control) X 2 (Retention Interval vs. No Retention Interval) ANOVA obtained no effect of Pretraining, but an effect of Retention occurred, F(1,25) = 5.54, p < .05, and a marginally significant interaction of these factors, p < 0.085. As predicted, the retention interval enhanced the degree that the pretrained flavor competed with the target flavor. In the current experiment, mean scores from the test data reveal no effect of group or interaction, Fs < 1. Without the CS preexposure phase, there is little evidence that incubation from the retention interval exerted an influence on associative competition produced by the pretrained CS. Instead, conflicting associations may be needed in order for the retention interval to enhance the retrieval of associations that may influence competition.

This project was completed to fulfill a Capstone requirement.
Cold calling a company is inherently a difficult task. It is widely known among salesmen that being friendly can lead to higher rates of ‘successful’ sales. Cold callers wishing to successfully land another meeting, pitch a service, or sell a product want to know some of the other contributing factors that they could improve upon that would ultimately lead to a ‘successful’ call. This research seeks to identify other contributing factors to ‘successful’ sales by analyzing both audio and transcript data for ‘successful’ and ‘unsuccessful’ sales calls. To find the most predictive features, we will compare results of various machine learning algorithms on various feature sets. The feature vectors will be constructed using metrics from both audio and transcript data such as speech rate, sentiment, psychological word categories, pitch, energy, frequency spectrum, etc. By increasing the accuracy of call outcome prediction, companies and their salesmen can tailor their approach to the customer. This could provide a deeper, more positive customer experience, which ultimately leads to more sales for the company.
The great horned owl (*Bubo virginianus*) is an apex predator whose dietary ecology is poorly understood in mid-Missouri and across the mid-continental US. Great horned owls are known to feed on a diverse array of prey items, including bird, fish and small mammal species. Therefore, an in-depth understanding of predator-prey dynamics is essential for the development of conservation and management strategies that account for diversity in both predator and prey abundance at broad scales. Our objective was to determine the distribution and diets of great horned owls to quantify the extent to which owls have shaped prey communities at Prairie Fork Conservation Area in mid-Missouri. We divided Prairie Fork into 8 plots for greatest spatial coverage of the conservation area. We conducted surveys to determine owl abundance and locate nests, and collected regurgitated remains of prey items (i.e., owl pellets). Initial great horned owl and nest sightings have been infrequent, possibly due to overnight owl activity and relatively low abundance at Prairie Fork. We will complete data collection by April 2018 and anticipate our results could be combined with ongoing mammal work at Prairie Fork for multi-species and predator-prey conservation planning.
Plants are used every day in an array of functions vital for modern life. Each year the economy loses millions of dollars due to crop loss from pathogenic attacks. Understanding plant immunity is imperative for the effective production of food, medicine and biofuel. Vesicular trafficking proteins are essential components in regulating plant immunity in both model and crop species. The Heese lab focuses on determining how vesicular trafficking proteins regulate plant innate immunity by examining coordination of the plant immune receptor Flagellin Sensing 2 (FLS2). FLS2 senses the bacterial flagellin and causes a cascade of plant immune responses. We have found that the vesicular trafficking protein Dynamin-Related Protein 2B (DRP2B) functions in robust ligand-induced endocytosis of FLS2 and plant immune signaling.

To further research the dynamin-related protein network, interacting protein candidates were identified. This included Vesicular Trafficking 3 (VES3), a protein that co-immunoprecipitated with DRP2B. The ves3 mutant plants have shown similar immune-signaling defects as the drp2b mutant. Interestingly, even in the absence of a pathogen, drp2b ves3 seedlings displayed stunted growth and constitutive activation of defense responses, such as elevated levels of callose, a plant β-1, 3 glucose linked polysaccharide.

My research focuses on investigating the effects of the loss of POWDERY MILDEW RESISTANT 4 (PMR4) on constitutive callose deposition in drp2b ves3. PMR4 is one of the callose synthases in plants that produces callose in response to pathogenic attack. I will delineate if lack of PMR4 can rescue the callose phenotype of the drp2b ves3 double mutant. To test this I am isolating a pmr4 drp2b ves3 triple mutant and will perform a callose assay to determine if the elevated basal callose levels in the drp2b ves3 double mutant are PMR4-dependent.
**Metabolic response of co-cultured IVD tissues to inflammation ex vivo**  
Jake Kramer, Naomi Lee and Aaron Stoker

Introduction: Intervertebral disc degeneration (IVDD) is a common condition clinically, however the etiology and pathogenesis of IVDD is poorly understood. Increased tissue inflammation has been associated with IVDD development and progression, however the response of IVD tissues to inflammation, and the cross talk that occurs between the tissues of the IVD, is poorly understood. This study was designed to determine how co-cultures of annulus fibrosus and nucleus pulposus respond to inflammation during ex vivo culture. It was theorized that co-cultures of IVD tissue would have a significantly higher inflammatory and degradative response to inflammation compared to historic monoculture samples.

Methods: With ACUC approval, whole intervertebral disks (IVDs) were harvested from canine subjects euthanized for reasons unrelated to this study (n=6). Four millimeter explants were created from both the annulus fibrosus and nucleus pulposus of each IVD. Explants were co-cultured in 2ml of media with or without 10ng/ml IL-1B stimulation for 21 days. Media was changed and collected every three days for biomarker analysis. On day 21 of culture, tissues were assessed for viability and ECM biochemical composition. Media will be tested for inflammatory and degradative biomarkers associated with IVDD.

Results: Sample and data analysis are ongoing, and final results will be presented on the poster.
Skyler Kramer
Independence, MO

Junior
Biochemistry

Faculty Mentor: Dr. Paula McSteen, Biological Sciences; Dr. Ruthie Angelovici, Biological Sciences

Natural variation of boron content in Zea maize and its implications on seedling development
Skyler Kramer, Michaela Matthes, Vivek Shrestha, Ruthie Angelovici and Paula McSteen

It is known that the micronutrient boron (B) plays a significant role in species across all domains of life. In plants, B (borate under physiological conditions) is essential for proper growth by forming dimers of the intrinsic cell wall polysaccharide rhamnogalacturonan II (RG-II). Other studies, however, suggest that B influences several membrane-specific, hormonal, and reproductive processes in plants. Regardless, a lack of this essential micronutrient in soil negatively affects crop yield. The present study aims to help answer basic questions concerning B in maize. Specifically, the first aim was to assess the natural variation of B content in several inbred Zea mays lines of the Goodman diversity panel. This data was obtained via the application of the dry ashing method on ear leaf tissue from mature plants. Because all plants were grown with the same B concentration in the soil, this analysis shows which of the tested maize lines most effectively take up B. The second aim of the study was to analyze several inbred lines, regarding their performance under conditions that mimic B deficiency – treatment with phenylboronic acid (PBA). This compound is known to compete with borate for binding sites, preventing cross-links of RG-II in the cell wall. A series of seedling assays are currently being performed, and preliminary results show that elevated levels of PBA lead to statistically significant reductions in both root and shoot length.
Metabolic mapping of osteoarthritic joints
Jessee Kruse, Jimi Cook, James Stannard, Chantelle Bozynski, Jakoby Swanson, Caitlyn Cassamitis, Ishita Patel and Aaron Stoker

Introduction: Osteoarthritis (OA) progresses from a focal lesion of articular cartilage to whole-joint inflammation and degradation. The “focal spread” progresses in inhomogeneous patterns resulting in significant regional variation in production of biomarkers across the joint surface. This study was designed to map the production of specific biomarkers across the surface of an osteoarthritic joint. It was hypothesized that the regional production of these biomarkers would not strongly correlate to the histological grading of OA severity.

Methods: All procedures were performed with IRB approval (IRB# 1208392) and informed patient consent. Six millimeter osteochondral plugs were harvested from the femoral condyle, trochlear groove, and tibial plateau surfaces that are normally discarded from patients (n=3) undergoing Biojoint Surgery. Tissues were cultured for 3 days at 37 degC. After 3 days, media were tested for biomarker concentrations and tissues were evaluated biochemically and histologically. Biomarker, histological, and biochemical-specific “heat” maps were created by ranking data from lowest to highest, and assigning a value from 1-8, 1 being the highest producing and 8 the lowest. These rankings were used for spearman correlation analysis. For mapping, the numbers were assigned a color on a gradient and that gradient was applied to the position on the joint surface the plug was collected from.

Results: Results will be presented on poster.

This project was completed to fulfill a Capstone requirement.
Bukusu is a Bantu language spoken in Bungoma County, Kenya. With 1.4 million members (2009 Kenya Census), the Bukusu community is the largest member of the Luyia cluster of western Kenya and eastern Uganda. This presentation describes results of research carried out by several members of the ASH: Documenting Luyia Together team during the 2017-2018 academic year to document Bukusu, based on original data.

Elizabeth Kujath has co-authored a chapter describing noun phrases, building on work by Erik Platner and Emily Raney in summer 2017. Bukusu nouns fall into many different classes that mark singular vs. plural differences as well as other semantic differences. Observe the six different classes that the root -ndu takes: omuu-ndu ‘person,’ aβaa-ndu ‘people,’ sisii-ndu ‘thing,’ βiβii-ndu ‘things,’ axaa-ndu ‘tiny person/thing,’ βuβuu-ndu ‘place.’ Nominal modifiers agree with the noun, usually taking on a prefix similar to the noun’s: ómúú-ndú ómu -βoofu ‘big person.’

Building on the research of Sarah Pribe and Alexa Thein in summer 2017, Clarabelle Fields has co-authored a study of the structure of verbs. This includes describing the prefixes and suffixes in the verb such as subject agreement markers, markers of tense and aspect, and suffixes that refer to a location.

Katrina Smith has written a description of basic syntax, focusing on word order. For example, in kámátúunda kakúsiβwa xúsóóko ‘Fruits are sold at the market’ the subject precedes the verb and the location is formed using a locative noun class marker xu- ‘at’. She is also studying the different forms of suffixes found in Bukusu verbs. For example, the causative suffix has a short form -y with most verbs, e.g. xuu-aand-y-a 'to make stick' (cf. xuu-aand-a 'to stick'), but has a long form -isy with short verbs, e.g. xuu-kw-issy-a 'to make fall' (cf. xuu-kw-a 'to fall').
Devesh Kumar
Columbia, MO

Sophomore
Biochemistry

Faculty Mentor: Dr. Sara Gable, Nutrition & Exercise Physiology

Parent reports of children’s eating habits and preschoolers’ self-constructed favorite meals
Devesh Kumar, Jaime Gottlieb, Rachael Marlar, Shahrukh Naseer and Sara Gable

Childhood obesity has become a nationwide problem. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. In addition to excess weight, preschoolers’ vegetable intake is far below the recommended amounts. These trends are worrisome because excess weight and poor nutrition underlie many chronic health problems. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Using data gathered from both parents and children, two research questions will be addressed: 1) what is the relationship between parent reports of child food intake and children’s self-reported favorite meals? And, 2) what is the relationship between family mealtime routines and children’s self-reported favorite meals? Seventeen preschoolers (11 boys and 6 girls; average age 49 months) from the University of Missouri Child Development Laboratory are participating. Before the garden program began, children completed the Placemat Protocol (Harrison et al., 2015) and parents completed a survey about children’s eating habits and mealtime routines. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. This study examines only children’s favorite meals. Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables. For the survey, parents reported the weekly frequency with which their preschooler consumed a variety of vegetables, fruits, grains, dairy, meats and beans, and beverages and their mealtime routines at home. Data analyses are underway to determine the relationship between: family meals and the dietary quality of children’s favorite meals and the frequency and type of family meals and the dietary quality of children’s favorite meals. Results will provide a baseline from which to evaluate the preliminary impact of the garden program.
Politics and news media are deeply intertwined, and political news coverage is often the subject of discussion and criticism. Throughout recent years of a volatile political climate, biases and accuracy of news media are continuously questioned. This study examines how the current political climate influences the 18- to 24-year-old Youth and Young Adult (YAYA) market’s attitudes and behaviors surrounding the news. This study explored the following research questions: What are the YAYA market’s attitudes towards politics and political news? What are their news consumption preferences? What are the motivations behind their news consumption? A survey was developed and distributed to a national respondent panel that resulted in a sample comprised of 722 complete responses, providing data to reveal the perceptions surrounding politics and news.
Osteoarthritis (OA) is the most common musculoskeletal disability worldwide, yet the pathogenesis of the disease is not fully understood. Previous studies have identified differences in the metabolism of infrapatellar fat pad (IPFP) obtained from normal versus OA knees. This study was designed to characterize responses of osteoarthritic chondrocytes to stimulation with conditioned media obtained from cultures of OA and normal knees. With IRB approval, IPFPs were collected from knees of six osteoarthritic patients undergoing total knee arthroplasty and three normal knees provided as organ donor tissues. Normal and OA explants were cultured in 2mls and 15mls of DMEM respectively at 37 degC and 5% CO2. Primary chondrocyte cultures (n=18) were created from tissues normally discarded after total knee arthroplasty, and passage 1 cells were used for culture. Cells were stimulated with media containing 10% OA (n=6), normal (n=6) IPFP conditioned media, and negative controls (n=6). Media were collected on days 3 and 6 of culture and tested for biomarker concentration. Using a t-Test or rank sum test with significance set at p<0.05, chondrocytes stimulated with conditioned media from OA IPFP produced significantly higher levels of IL-6, IL-8, MCP-1, MMP-1, MMP-2, MMP-3, and total MMP activity compared to chondrocytes stimulated with media from Normal IPFP. The data from this study indicate that development of OA in the knee may stimulate production of bioactive factors by the IPFP that can contribute to the shift towards and/or preservation of an OA metabolic phenotype in chondrocytes.
Hypotaurine (HT) is added to culture medium as a reactive oxygen species (ROS) scavenger to protect embryos during preimplantation development. The purpose of this study was to determine the effectiveness of HT on porcine preimplantation embryos incubated at a lower oxygen tension (5% O2) compared to atmospheric oxygen (approximately 20% O2). We hypothesized that HT is not necessary at 5% O2 but is beneficial for culture at higher O2 tension to protect against oxidative stress. Porcine cumulus-oocyte complexes were aspirated, matured, and fertilized with standard procedures from our laboratory. Presumptive zygotes were cultured in four different conditions: MU2 with 5mM HT at 5% O2 (Low O2+HT; control), MU2 without HT at 5% O2 (Low O2-HT), MU2 with 5mM HT at 20% O2 (High O2+HT), or MU2 without HT at 20% O2 (High O2-HT). The percentage of zygotes that developed to the blastocyst stage at day 6 was measured, and total cell number was determined by staining with Hoechst 33342. Apoptosis was assessed by TUNEL staining of day 6 blastocysts. All groups showed significantly increased blastocyst development compared to High O2-HT. Low O2-HT had significantly more cells compared to High O2+HT (50.2±2.5 vs 45.0±1.5), and Low O2+HT had significantly more cells than High O2-HT and High O2+HT (52.3±1.9 vs 47.2±1.3 and 45.0±1.46, respectively). Apoptotic rates for High O2+HT tended (P=0.09) to be decreased compared to High O2-HT (3.9±0.8% vs 6.0±0.7%). Moreover, apoptotic rates for Low O2-HT and Low O2+HT tended (P=0.06 and P=0.09, respectively) to be decreased compared to High O2-HT (3.7±1.0% and 4.1±0.8%, respectively, vs 6.0±0.7%). Our current results show that HT may not be necessary as a ROS scavenger for in vitro-produced porcine embryos at low oxygen tension but is beneficial at for embryos cultured at atmospheric oxygen tension.
Osteogenesis imperfecta (OI), known as brittle bone disease, is a genetic condition primarily caused by type I collagen gene mutations resulting in reduced musculoskeletal mass and strength. While OI can be diagnosed in utero, current treatments are limited and postnatal. Recent treatment strategies have aimed at increasing muscle mass which can increase musculoskeletal strength. Myostatin, a TGF-β superfamily member, negatively regulates muscle growth. Previously, we found mice with mild OI (+/oim), which were also myostatin deficient (+/mstn), had improved musculoskeletal mass and strength as compared to +/oim alone. In a separate study, we demonstrated that offspring from +/oim X +/oim crosses, when transferred as embryos into pseudo-pregnant recipient +/mstn dams had greater musculoskeletal strength than those born to recipient +/oim dams. The present study takes two approaches to determine whether maternal myostatin deficiency throughout the entire pregnancy can also improve offspring musculoskeletal deficiency in both moderate (+/oim) and severe (oim/oim) OI. To accomplish this, “double het” (+/mstn +/oim) dams were mated with +/oim sires and their offspring compared to those of +/oim X +/oim crosses. We also examined pharmacologically inhibiting myostatin by treatment of +/oim dams during pregnancy with a monoclonal myostatin antibody. Offspring from these experimental approaches were weighed weekly (weaning to 4 months), sacrificed at 4 months of age, hindlimb muscles harvested, and weighed. Body and muscle weights were analyzed to evaluate the impact of genetic versus pharmacological myostatin deficiency in OI mice.
Emma LePage
Dardenne Prairie, MO

Evaluation of intervertebral disc response to injury/inflammation using an ex vivo rat tail model
Emma LePage, James T. Stannard and Aaron Stoker

Intervertebral disc (IVD) disorders are associated with debilitating low back pain and accompanying disabilities. IVD degeneration is a multi-factorial disease that can lead to pain and loss of function. Currently, the pathobiology of IVD degeneration is poorly understood, although aging, injury, nutrition, metabolism and mechanical stress are suspected to contribute. This study was specifically designed to assess the pathologic and metabolic changes that occur after injury inflammation to a rat tail whole organ IVD during long term culture. It was hypothesized that application of inflammation and/or injury to the IVD would result in a significant increase in the production of inflammatory indicators and degradative enzyme activity, and a significant decrease in tissue cell viability and proteoglycan content, compared to uninjured controls. Under IACUC approval, tails were collected from 7 skeletally mature Sprague Dawley rats euthanatized for reasons unrelated to this study. IVD Explants (n=88) were created and assigned to either the Injured or Uninjured group with or without IL-1β or TNF-α at 10.0 or 0.1ng/ml (n=8-9/group, 10 total groups). Explants were cultured for 21 days, and media were changed every 3 days and collected for biomarker analysis. On day 21 tissues were processed for cell viability and extracellular matrix analysis. Sample and data analysis are ongoing and will be presented on the poster. This study uses a whole organ model of disc disease to uncover pathways activated injury and inflammation by the IVD and provide potential diagnostic biomarkers and therapeutic targets for IVD degeneration.
Prior to conducting our research, we wanted to understand how the 18-24 YO market views college education, the broader concept of learning and their perception toward career prospects. In order to do so, a 25-minute survey was distributed through Qualtrics to a national, 18- to 24-year-old respondent panel from which 721 complete responses were collected and analyzed. Primary research findings were then coupled with secondary research support to frame our conclusion. Our research indicates that while a majority of the YAYA demographic deems a college education to be a risky investment, they still believe that it is necessary to achieve success in life. YAYA consumers’ pragmatic approach to higher education makes them value the more cost-effective online degrees and the traditional ones equally; in addition, they also prefer real world experience than learning in a classroom setting. In other words, the epicenter of learning for YAYA consumers is shifting away from the walls of the classroom. While they recognize the difficulty in finding a good job in today’s market, the YAYA consumer remains optimistic about career-building in the long term. Individual outlooks yield more optimism as this confident demographic views college as a stepping stone before they work their way to their dream job.
Organization of the brain locomotor command system in the lamprey
Lefei Li and Andrew McClellan

Locomotor behavior is initiated by a locomotor command system in the brain that activates spinal central pattern generators (CPGs) that generate the electrical pattern of muscle activity cord. The output elements of the command system are reticulospinal (RS) neuron that directly activate spinal CPGs. The brains of many vertebrates have been found to contain a locomotor command system, but the organization of this system is still under investigation. In the present study, the lamprey, a lower vertebrate that is a model system of studying locomotor systems, was used to investigate the organization of the locomotor command system. In the lamprey, locomotor activity can be initiated by stimulation in brain regions: lateral rhombencephalon (LR); rostrolateral rhombencephalon (RLR), dorsolateral mesencephalon (DLM), ventromedial diencephalon (VMD), and RS neurons in reticular nuclei. The purpose of the present study was to use retrograde neuroanatomical tracers to determine the connections between these different brain locomotor areas. In the present experiment, small quantities of biocytin were pressure ejected into a given brain locomotor area, and the biocytin was taken up and retrogradely transported to the cell bodies of input neurons. Following a 24-hour transport time, the brains were histologically processed to view the biocytin-labeled neurons. Injection of biocytin in reticular nuclei resulted in labeling of neurons in the LR, and sometimes in the VMD and DLM locomotor areas. Injection of biocytin in the VMD or DLM sometimes resulted in labeling of neurons in the RLR. The results from the current study and additional future results will provide a better understanding of locomotor command systems, not only in the lamprey but also in higher vertebrates, including perhaps humans.

This project was completed to fulfill a Capstone requirement.
Cold calling a company is inherently a difficult task. It is widely known among salesmen that being friendly can lead to higher rates of ‘successful’ sales. Cold callers wishing to successfully land another meeting, pitch a service, or sell a product want to know some of the other contributing factors that they could improve upon that would ultimately lead to a ‘successful’ call. This research seeks to identify other contributing factors to ‘successful’ sales by analyzing both audio and transcript data for ‘successful’ and ‘unsuccessful’ sales calls. To find the most predictive features, we will compare results of various machine learning algorithms on various feature sets. The feature vectors will be constructed using metrics from both audio and transcript data such as speech rate, sentiment, psychological word categories, pitch, energy, frequency spectrums, etc. By increasing the accuracy of call outcome prediction, companies and their salesmen can tailor their approach to the customer. This could provide a deeper, more positive customer experience, which ultimately leads to more sales for the company.
Jenna Lin
Ballwin, MO

Faculty Mentor: Dr. Lorin Milescu, Biological Sciences; Dr. Mirela Milescu, Biological Sciences

*Intracellular calcium alters sodium channel kinetics to influence neuronal firing*

Jenna L. Lin, Marco A. Navarro, Benton R. Berigan, Mirela Milescu and Lorin S. Milescu

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
The effects of alcohol on working memory updating
Cole Lympus, Curtis Von Gunten, Jorge Martins and Bruce Bartholow

The purpose of this study was to test the effects of alcohol on executive cognitive functioning (ECF; see Miyake & Friedman, 2012), specifically working memory updating. A secondary aim of the study was to test whether alcohol’s acute effects differ when blood alcohol concentration (BAC) is rising versus falling. Participants were 231 young adults (age 21-30) who met health- and drinking-related eligibility criteria. Participants completed a set of three computer-based tasks meant to assess working memory updating (i.e., the ability to hold and manipulate information in working memory) at a sober baseline session and again two weeks later. For the second session, participants were randomly assigned to one of three beverage consumption conditions (alcohol, placebo, or control). Within each condition, participants also were assigned to one of two task completion groups: one in which tasks were completed twice following beverage consumption (ascending blood alcohol concentration [BAC] and descending BAC) and one in which the tasks were completed only during descending BAC. Performance on the three updating tasks (Keep Track, Letter Memory, and spatial N-back) was correlated at each assessment, supporting the notion that the tasks measured a similar underlying construct. Regression analyses examining performance during ascending BAC, accounting for baseline performance, indicated a significant alcohol effect for Keep Track and Letter Memory but not spatial N-back. Performance on all three tasks was affected by alcohol during descending BAC. For each task, alcohol generally eliminated performance improvements from baseline that were evident for participants in the placebo and control groups. The current results indicate that a moderate dose of alcohol impairs working memory updating, consistent with the idea that alcohol impairs overall ECF. These findings have implications for understanding loss of control while drinking.

This project was completed to fulfill a Capstone requirement.
Basal forebrain cholinergic neurons are vital for cortical desynchronization and behavioral arousal observed after nicotine consumption
Chelsea Mackey, Torin Hunter, Brandon McKethan, Abhilasha Sharma, Rishi Sharma, Pradeep Sahota and Mahesh Thakkar

Nicotine disrupts sleep; however, the underlying neuronal mechanism is unknown. The basal forebrain (BF) is a wake-promoting center and contains multiple neuronal phenotypes including cholinergic, GABAergic and glutamatergic subtypes. Thus, this study was designed to examine the neuronal subtype responsible for nicotine effects on sleep-wakefulness. We focused on BF cholinergic neurons because BF cholinergic neurons are wake-promoting, express nicotinic receptors and supply acetylcholine to the prefrontal cortex, hippocampus and amygdala. We hypothesized that lesions of BF cholinergic neurons will attenuate nicotine induced cortical arousal/desynchronization.

To test our hypothesis, adult male Sprague-Dawley rats were implanted with sleep recording electrodes and were divided into two groups: **Lesion:** Selective lesion of the BF cholinergic neurons was performed by bilateral administration of immunotoxin, 192-IgG-Saporin (SAP; 0.28 µg/0.5µL/side) in the BF; **Sham (controls):** Rats were bilaterally infused with saline (0.5µL/side). After injections, animals were left undisturbed for 3 weeks. Day 1: saline was administered subcutaneously at light/sleep onset. Day 2: Nicotine (0.3 mg/Kg) was administered at the same time. Sleep-wakefulness was examined for next 6 hours. On completion, animals were euthanized and the brains were processed for choline acetyltransferase (ChAT) immunohistochemistry to verify BF cholinergic lesions. Compared to controls, lesioned rats, with a 64% reduction in cholinergic neurons, displayed attenuated nicotine induced cortical desynchronization and behavioral arousal. Our results suggest that the BF cholinergic neurons mediate nicotine induced cortical arousal/desynchronization that may be the cause of sleep disruptions in nicotine users.
In today’s power environment, there are many choices of renewable sources. Because of this, it is important to find the best source for a given application. This research examines the feasibility of using lithium ion batteries in solar driven power grid substations. They are used in three applications: frequency regulation, peak shaving, and stabilizing the output from intermittent distributed sources, such as solar arrays when clouds reduce illumination. Peak shaving is used to supplement power supplied from the main power plant during periods of maximum demand. Lithium ion batteries are currently popular in power systems on and off the grid. The qualities they offer help these power systems to be maintained properly and more efficiently than those using other sources of power. Although they are useful, they do have degradation problems that the utilities have to address. In this project, lithium ion batteries are being charged and discharged to determine how soon they will degrade. During each cycle, the voltage, the charge capacity, and the discharge capacity are measured. These measurements help to calculate the rate of degradation. In recent measurements, a battery began to degrade after 70 cycles of an 82% discharge. Currently, more data is being gathered, which will be included in the poster.
The present study sought to examine how the context of a reaching and pointing task affects the coordination and performance of the task. By manipulating the context of the task, we were able to explore how certain contextual factors play a role in motor coordination, as well as how these factors may interact. The contextual factors manipulated were vision, and end-effector. Each session displayed one of two levels of vision (no vision of surrounding environment, or full vision of the surrounding environment). Similarly, in each session, the end-effector used to complete the task was one of two (either the tip of the index finger, or the tip of a short tool which extended the finger). As a result, the availability of underlying feed-forward and feed-back systems was altered. Further, we sought to examine how movement is modulated following a change in target location. To test these research questions, 12, right-handed, college undergraduates were recruited from the University of Missouri Psychology 1000 research pool to participate. Participants completed a series of reaching and pointing movements, directed at one of two specified targets, under various contextual conditions. In each condition, 48 trials were completed. The three-dimensional position of the hand was recorded at high frequency by using infrared emitting diodes, and infrared sensitive cameras. Values of several response variables were derived from this data, from which conclusions were drawn. We expect to see that the strength of the effect on kinematic variables will be largest under the no-vision condition in conjunction with the use of the tool as the end-effector. We expect that a change in target location coming after movement initiation will strengthen these effects. These results will add to the understanding of the underlying processes which assist the coordination of reaching movements.

This project was completed to fulfill a Capstone requirement.
Parent reports of children’s eating habits and preschoolers’ self-constructed favorite meals
Rachael Marlar, Jaime Gottlieb, Devesh Kumar, Shahrukh Naseer and Sara Gable

Childhood obesity has become a nationwide problem. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. In addition to excess weight, preschoolers’ vegetable intake is far below the recommended amounts. These trends are worrisome because excess weight and poor nutrition underlie many chronic health problems. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Using data gathered from both parents and children, two research questions will be addressed: 1) what is the relationship between parent reports of child food intake and children’s self-reported favorite meals? And, 2) what is the relationship between family mealtime routines and children’s self-reported favorite meals? Seventeen preschoolers (11 boys and 6 girls; average age 49 months) from the University of Missouri Child Development Laboratory are participating. Before the garden program began, children completed the Placemat Protocol (Harrison et al., 2015) and parents completed a survey about children’s eating habits and mealtime routines. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. This study examines only children’s favorite meals. Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables. For the survey, parents reported the weekly frequency with which their preschooler consumed a variety of vegetables, fruits, grains, dairy, meats and beans, and beverages and their mealtime routines at home. Data analyses are underway to determine the relationship between family meals and the dietary quality of children’s favorite meals and the frequency and type of family meals and the dietary quality of children’s favorite meals. Results will provide a baseline from which to evaluate the preliminary impact of the garden program.
Brittney Marshall
Republic, MO

Faculty Mentor: Dr. Cheryl Rosenfeld, Biomedical Sciences

The effects of direct and developmental exposure to genistein on the gut microbiome and metabolome
Brittney Marshall, Michelle Farrington, Madison Ortega, Sarabjit Kaur, Ezra Solidum, Juliette Baker, Madison Bellamy, Sarah Scherrer, Saurav Sarma, Zhentian Lei, Lloyd Sumner, Yang Liu, Trupti Joshi, Victoria Vieira-Potter and Cheryl Rosenfeld

Phytoestrogens (PhytoE2s) are plant-derived compounds that are structurally similar to hormonal estradiol in animals. They are naturally found in a variety of foods, including soy. Though the mechanisms are still unknown, PhytoE2s have been shown to benefit metabolic health, insulin resistance, and neurobehavior. However, there are also concerns that PhytoE2s can act as endocrine disruptors and exert adverse health effects. Moreover, PhytoE2s might affect not only the host animal, but also their gut microbiome. The hypothesis tested in the current studies was that bacterial metabolites may be the key factors between diet, gut microbiome, and health status of the host. As genistein (GEN) is the major PhytoE2 found in soy protein isolate, we examined the effects of a chronic GEN diet (250 mg/kg feed weight) in male and female adult Peromyscus californicus mice and their F1 male and female offspring. In the F1 offspring, we are currently assessing several neurobehavioral domains, including cognition, depressive-like, anxiety-like, and social traits in combination with the gut microbiome, as assessed by 16s rRNA sequencing, and fecal metabolome. These results were compared to those of their control (CON) counterparts. Clear separations in data were observed between GEN and CON groups. Key gut bacterial species have been identified and have shown positive or negative correlations with several physiological and behavioral outcomes, including increases or decreases in a variety of metabolites. Improved understanding of physiological mechanisms and identification of critical metabolites and microbial species could have important therapeutic impacts and further the development of personalized medicine.
Characterizing gating properties of T-type voltage-gated calcium channels
Paige Martinez, Lorin S. Milescu and Mirela Milescu

Voltage-gated ion channels are transmembrane proteins that enable cellular excitability by allowing a flux of ions across the lipid bilayer. More specifically, it is known that voltage-gated calcium channels play an essential role in the repetitive firing of action potentials from cells such as thalamic neurons. T-type calcium channels have biophysical properties which are different from other calcium channels in that they activate at voltages near the resting membrane potential of the cell and inactivate quickly. Structurally, calcium channels are made up of four homologous domains (DI-DIV) that are covalently linked. Each of the four domains contains six transmembrane helices (S1-S6); the voltage-sensing segment has been identified as S4, though each domain is believed to contribute differently to the channels voltage dependence because of variability in the amino acid sequence. The degree to which each domain contributes to the state of the channel has yet to be distinguished, and characterizing the contribution of each voltage-sensor is one aim of this project. To do this we use the pharmacological agent kurtoxin, a gating-modifier toxin isolated from the South African scorpion Parabuthus transvaalicus, which is useful because of its high affinity for T-type calcium channels. To explore domain contribution, we are currently using Two-Electrode Voltage-Clamp.
Gustatory receptors (Gr) are a family of transmembrane proteins that have been extensively studied in the context of insect taste and odor sensory systems. A recent study identified Gr28bD, a member of the *Drosophila* Gr family, as a key player in thermosensation. Very little is known about the structure and function of Gr28bD, other than having a putative seven-transmembrane domain architecture. In a previous study, we showed that Gr28bD exhibits a non-inactivating, temperature dependent, cation non-specific current, when expressed in *Xenopus laevis* oocytes. Here, we identified and tested Grs from other *Drosophila* species and discovered that their temperature response varies across species. By comparing the Gr28bD sequence with these orthologs, we identified functional domains. We then generated various chimeric constructs and obtained proteins with distinct properties, including temperature dependence. We expect these results to aid in the design of new thermogenetic tools for extrinsic neuronal control.
The purpose of this research study was to investigate a possible correlation between white guilt and political ideology. Previous research on white guilt has looked at connections between white guilt and anti-racist attitudes and white guilt and health outcomes. The research questions for this study were, “Does white guilt predict political ideology?” and “Does perceived pressure to feel white guilt predict political ideology?”. We tested these questions by administering an online survey to undergraduate students at the University of Missouri- Columbia, a university with especially strained racial relations. The survey collected data on the participant’s level of white guilt, political ideology, and other variables such as year in school and GPA. The data was analyzed using frequency distributions and crosstabs to test for correlations.
The effect of service motivation over time
Paige McArthur, Todd Schachtman and Ken Sheldon

There are many factors that affect that quality (i.e. the internality) of a person’s motivation to complete a task. The purpose of this study was to examine the effects of motivational internalization across time. The study employed a group of women in a community service sorority, and analyzed the relationship of internal motivation to changes in both the quality and quantity of service over a three week period. On average, both the quality/quantity of service decreased during this time. Service hours decreased from a mean of 4.67 hours to a mean of only 1.95 at time 2. Service quality also decreased from a mean of 64.72 to a mean of 46.37 at time 2. However, the quality of the woman’s motivation had important effects on service quality. Median split analyses showed that those with internal motivation did not report a drop-off in the quality of their service, despite reporting a drop-off in their hours of service. In contrast, those with external motivation reported large declines in both the quantity and quality of their service. Discussion focuses on the fact motivation can serve as a critical buffer that can help people continue to do well, even as time and other stressors cause them to reduce their quantity of effort towards their commitments.

This project was completed to fulfill a Capstone requirement.
Psychologists have long been interested in why people choose a particular college major or occupation. Much research has been done to try to pinpoint factors that play a role in these choices (Lent & Brown, 2013, Betz & Hackett, 1981). However, relatively little research has addressed the role of communication style. In this research, we test whether adolescents’ communication style impacts their later college major or career choice. The original data collections included a sample of 642 adolescents in 2007-2009. The youth brought a friend to the lab to complete various tasks, including a joint decision-making task in which participants planned a party. From this task, communication style was coded using methods similar to previous studies (Leaper, 1991). Thought units were coded as Collaborate, Oblige, Inform, Control, Affiliative/Off-topic, and other. Girls were found to produce more collaborative and oblige statements than boys. The current data collection involves following up on these participants who are now young adults (ages 21-26). To date, 225 have completed an online questionnaire, and recruitment continues. Of relevance to the present study, the questionnaire assesses educational and vocational experiences. Data from The Bureau of Labor and the National Center of Education is used to classify educational and vocational choices as male-typed, female-typed, or gender neutral. Data analysis is currently underway. Multiple regressions analysis is used to test whether adolescents’ communication predicted later educational/vocational choices, and meditational analyses to test whether adolescent communication helps account for gender differences in young adults’ educational/vocational choices. Youth with particularly sex-typed styles are expected to avoid educational/career choices typical of the other gender. Of particular interest, communication style is expected to play a role in women’s avoidance of male-dominated fields, including STEM. There are negative implications for individuals and society when qualified women avoid male-dominated fields, making this especially important.
Characterizing genes co-expressed with SRFR1 in Arabidopsis thaliana in response to bacterial infection
Alexander McClelland, Sang Hee Kim and Walter Gassmann

Much like humans and other animals, plants employ biochemical weapons to fight off a wide variety of foreign invaders. SRFR1, a negative regulator of plant immunity, is a key player in contributing to a balanced immune response to bacterial infection in Arabidopsis thaliana. Using a co-expression network as a starting point is one way to hypothesize potential mechanisms by which a gene of interest, in this case, SRFR1, functions by association. Co-expression data show us that ILP1, SAC3A, and TOP1BETA are potential players in SRFR1 function. The function of ILP1 and SAC3A are largely unknown in Arabidopsis thaliana, and TOP1B codes for a type I DNA topoisomerase. By conducting bacterial growth curve assays in mutant lines of these genes, we are trying to uncover new insights into how SRFR1 mechanistically regulates Effector Triggered Immunity (ETI). We are taking an additional step to inducibly silence a TOP1BETA paralog, TOP1ALPHA - a gene crucial to early plant development - via artificial microRNAs (amiRNAs) in order to ensure that no potential functions of TOP1BETA are recovered by this redundancy.

This project was completed to fulfill a Capstone requirement.
Autonomous motivation in collegiate music students: A longitudinal study
Sam McCullough and Ken Sheldon

The purpose of this study was to examine factors that may impact or be impacted by self-determined motivations, and to understand how musicians better internalize the behavior of practicing their musical instruments, such that they engage in the grind of practice willingly, rather than with a sense of pressure. Collegiate musicians (n = 48) were recruited from the MU School of Music. To be eligible for the study, musicians had to have been enrolled in music classes at the university. Surveys were utilized to study the extent to which collegiate music students internalized their motivations to practice their musical instruments, including other measures of psychological needs, perceived skill, and autonomy support. A path analysis was performed to examine the causal relationships between self-determined motivations and perceived music proficiency at three points in time. A regression analysis was used to examine the relationship between self-determined motivation and autonomy support as well as other study variables such as well-being and needs satisfaction. Regressions revealed that self-determined motivation was positively associated with needs satisfaction, and needs satisfaction was positively associated with subjective well-being. In addition, initial self-determined student motivation evoked increasing support from professors over time. The path analysis showed that initial self-determined motivation also predicted boosted self-reported skill at time 2, while boosted self-determined motivation at time 2 predicted further increases in skill at time 3. This study is important because it shows the importance of self-determined motivation for the success of collegiate musicians. Our findings could have important implications for how music instructors, and teachers in general, should interact with students to increase their self-motivation in their practice regimen.

This project was completed to fulfill a Capstone requirement.
Autumn McLain  
Callao, MO

Faculty Mentor: Dr. Michael R. Marlo, English; Dr. Rebecca Grollemund, English  
Funding Source: ASH Scholars

*Documenting Luyia Together: Explorations of Tiriki Grammar*
Autumn McLain, Patrick Skrivan, Rebecca Grollemund and Michael R. Marlo

Tiriki is an understudied member of the Luyia language cluster that is spoken in Vihiga County in western Kenya by a community of approximately 200,000 people. This poster presents the combined work of two student researchers on the ASH: Documenting Luyia Together team to describe the Tiriki language during the 2017-2018 academic year. Autumn McLain’s research has focused on the tonal patterns of nouns in the Tiriki lexicon, based primarily on data collected by Prof. Michael Marlo in 2016 and subsequently processed and compiled by other members of the ASH team in 2016-2017. McLain has developed a classification of the tone patterns found on Tiriki nouns. For instance, the four nouns *mu-limi* ‘farmer’, *mú-lína* ‘friend’, *mú-híní* ‘stick for threshing grain’, and *mu-lamwá* ‘sister-in-law’ all have high tones (indicated by acute accent marks) on different positions of the word. In total, McLain has identified around 8 tonal classes of nouns in Tiriki. Ongoing and future work includes comparing the isolation form of nouns with the pronunciation of nouns in phrases because some tonal classes are distinguished from each other only when the noun is combined with another word, such as a possessive marker. Patrick Skrivan’s primary research activity has been the development of a chapter on the structure of Tiriki nouns and noun phrases. He has identified the morphological and semantic properties of the many noun classes of Tiriki, which are signified with a prefix on the noun. For instance, the examples in the paragraphs above all have a *mu*-prefix which is found in class 1 to indicate humans and in class 3 to indicate a variety of semantic types including trees and body parts. Skrivan provides detailed description of noun modifiers and the way in which they agree with the head noun of the phrase.
In recent years, excess weight has become a major public health concern in America. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. Accordingly, discovering new ways to improve young children’s eating and activity habits are of paramount importance. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Eighteen preschoolers (average age = 49 months, range = 33 to 63 months; 61% male) from the University of Missouri’s Child Development Laboratory (CDL) are participating and were pre-tested using the Placemat Protocol in September, 2017. After pre-testing, preschoolers received one-hour per week of garden-based nutrition and plant science education. Post-testing is scheduled for late April. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. The foods and beverages utilized mirror Harrison’s original set with some substitutions based on recent surveys of children’s food intake (e.g., cheesecake was replaced with cheese pizza). Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables (e.g., number of fruits/vegetables, number of energy dense foods, number of nutrient dense foods, kilocalories in meal). Data analyses are underway to compare the composition of children’s favorite and healthy meals and to determine if children’s pre-assessment self-rated hunger and the time elapsed since breakfast are linked with the composition of children’s meals. When post-test data are added to the pre-test data, results will provide preliminary insights into the impact of Healthy Plants/Healthy Bodies on similarities and differences between preschoolers’ favorite and healthy meals.
Min Meng  
Shanxi, Fenxi , China

Senior  
Mechanical & Aerospace Engineering

Faculty Mentor: Dr. Jian Lin, Mechanical & Aerospace Engineering

*Thermal conductivity of two-dimensional graphitic carbon nitrides by Molecule Dynamics Simulation*

Min Meng, Melinda Groves, Yuan Dong, Chi Zhang and Jian Lin

Two-dimensional (2D) graphitic carbon nitrides (2D GCNs) are a rising class of 2D polymeric materials. The thermal conductivities of three kind of 2D GCNs, heptazine-based g-C3N4 (HEP), triazine-based g-C3N4 (TRI) and 2D polyaniline g-C3N (PANI), were studied by non-equilibrium molecule dynamics (NEMD) simulations. Both Tersoff and ReaxFF potentials were used to give more comprehensive information. It was found that the PANI is good thermal conductor with the thermal conductivity predicted to be 461.9 to 810 W/(m.K). The HEP and TRI have much lower thermal conductivities, ranging from 14.5 to 119 W/(m.K). Nevertheless, these values are still much higher than traditional polymers.
Epilepsy is a common neurological disorder typically caused by hyperexcitation of neurons in the brain. Missense mutations in KCNT1, a sodium-gated potassium (K+) channel, that transports K+ out of the cell and contributes to the hyperpolarization of neurons, have been found to cause several types of epilepsy. However, the mechanisms by which mutant KCNT1 causes seizures is not understood. KCNT1 associated with epilepsy are shown to increase K+ current. Using the fruit flies to model this disease, the Zhang lab expressed mutant KCNT1 channels in inhibitory neurons and observed mechanically induced seizures in flies. This observation is consistent with the idea that increased K+ current reduces the inhibitory output, and thereby tipping the balance toward hyperexcitation. When expressed in excitatory neurons, however, the Zhang lab also observed seizures. This result is more puzzling and cannot be explained by silencing effects of increased K+ efflux. Rather, the Zhang lab found that expression of the KCNT1 mutant in excitatory neurons caused the cell to compensate for the increased K+ efflux by reducing other K+ channel levels. My project extends this line of research by studying whether anticonvulsants such as Levetiracetam and Valproic Acid currently used to treat epileptic patients can suppress seizures in the fly model. I expressed wildtype or mutant KCNT1 channels in fly neurons, raised the flies on food containing the anticonvulsants, and then quantified the effects of the drugs on mechanically induced seizures. I found that Levetiracetam suppresses seizure activity in flies expressing mutant KCNT1 channels in excitatory neurons while Valproic Acid fails to suppress seizures, and rather slightly increases length of seizure activity. These results suggest first, that Drosophila successfully models this human disorder and second, that the mechanism by which mutant KCNT1 channels lead to seizures is associated with that by which Levetiracetam suppresses their activity.

This project was completed to fulfill a Capstone requirement.
Faculty Mentor: Dr. Roger Fales, Mechanical & Aerospace Engineering
Funding Source: College of Engineering Undergraduate Research Option

Oxygen saturation control for premature infants during feeding using automatic control
Lydia Meyer and Roger Fales

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Politics and news media are deeply intertwined, and political news coverage is often the subject of discussion and criticism. Throughout recent years of a volatile political climate, biases and accuracy of news media are continuously questioned. This study examines how the current political climate influences the 18- to 24-year-old Youth and Young Adult (YAYA) market’s attitudes and behaviors surrounding the news. This study explored the following research questions: What are the YAYA market’s attitudes towards politics and political news? What are their news consumption preferences? What are the motivations behind their news consumption? A survey was developed and distributed to a national respondent panel that resulted in a sample comprised of 722 complete responses, providing data to reveal the perceptions surrounding politics and news.

*This project was completed to fulfill a Capstone requirement.*
Crayfish use physical and chemical cues to establish social dominance hierarchies. These hierarchies contribute to aspects of survival such as mate choice, shelter, and food resources. Competitions between pairs of naïve subjects result in the establishment of a dominant and a subordinate crayfish. Recent studies have found that social hierarchies contribute to stress levels of crayfish, as subordinates more often exhibit anxiety-like behavior. These behaviors include light-avoidance, tail-flips, and decreased movements. Studies have also found that communally housed crayfish have increased sensitivity to alcohol (ETOH) when compared to crayfish that were isolated for short periods. The purpose of our study is to investigate the relationships between social isolation, alcohol, and anxiety-like behaviors. We hypothesized prolonged isolation and exposure to alcohol would increase anxiety-like behavior. Based on prior results, we predicted isolated subordinate crayfish would have the highest stress response when compared to naïve isolated or intoxicated crayfish. Using an aquatic T-maze with light and dark arms, we first tested stress responses (i.e. light-avoidance) between isolated and communal crayfish. Second, we tested for differences in stress responses between isolated and communal crayfish in the presence of ETOH (alcohol). Third, we tested the stress responses between dominant and subordinate crayfish that were housed communally. Fourth, we tested for differences in stress responses between isolated dominant and isolated subordinate crayfish. Preliminary results suggest isolated crayfish tend to spend more time than controls in dark arms of the T-maze, whereas communal crayfish spend less time. This may occur because prolonged isolation causes stress in crayfish thus causing them to exhibit anxiety-like behaviors. In future studies, we will test the effects of other stressors on paired crayfish, including whether stress can influence reproductive behaviors.
Mikaela Mongeon
Smithton, IL

Faculty Mentor: Dr. Bimal Balakrishnan, Architectural Studies
Funding Source: A&S Undergraduate Research Mentorship Program

The impact of stereoscopy, interactivity, and product type on perceptions of advertising
Mikaela Mongeon, Ehsan Naderi and Bimal Balakrishnan

Recently, virtual reality has become more affordable and accessible. We have also seen human-computer interaction become more natural, enabling direct manipulation of objects and interface elements. Through a controlled experiment, we investigated the impact of stereoscopy - a key feature of VR, interactivity, and product type on perceptions of 3D advertising. This research enhances our understanding of psychological mechanisms underlying the impact of VR on attitudes towards advertising and our sense of product presence to guide the future of 3D advertisements. The study is designed as a 2 (stereo vs non-stereo 3-D display) x 2 (high vs low interactivity) x 2 (product type - hedonic vs utilitarian) full factorial, controlled experiment. Participants (N=80) were students from a midwestern institution. The experimental stimulus in the form of a product ad was presented using a zSpace 3D display in the appropriate stereoscopic condition. Then a questionnaire with items drawn from previously validated scales was administered to measure attitudes towards the ad, cognitive involvement, and their perceptions of product presence. Data collection began in February and was completed in March of 2018. The hypotheses were tested using a factorial ANCOVA including multiple control variables consisting of attention and cognitive involvement, among others. The study examined how consumers reacted to different products presented through different visual platforms. The results found that with object presence, there were quite a few main effects for the different independent variables. There were also significant three-way interactions within the study for two dependent variables. These results have both research and industry implications. Most industries today are dependent on technology, therefore having a greater understanding of how humans interact is crucial to any field.

This project was completed to fulfill a Capstone requirement.
The role of state anxiety in multi-component working memory performance
Justin Moore and Shawn Christ

State anxiety can be conceptualized as a subjective experience of arousal or tension with varying levels of intensity (Spielberger, et al., 1983). Past research suggests that individuals with increased state anxiety perform worse on measures of working memory (WM) (e.g., Vytal, 2016; Patel, 2016). The present study aims to determine the mechanism(s) of WM most affected by anxiety: WM capacity, the ability to irrelevant information, and/or attentional control. Undergraduate students aged 18-25 will be recruited to participate. Participants will complete a change-detection WM task under baseline (low anxiety) or high induced anxiety conditions. This is a computerized exercise designed to gauge performance in WM capacity, filtering ability, and attentional control. Participants will see an array of 4, 6, or 8 colored shapes (circles and/or triangles), notified prior to the block of trials that one shape may be probed more frequently than the other (high-frequency and low-frequency shapes). Following a brief delay, memory is probed for color of one target item as “same” or “different”. Three different trials of blocks were included: trials containing ONLY high-frequency (HF) shapes, trials that contain low-frequency (LF) shapes but never probe them, and trials when the probed items maintain a HF-to-LF ratio of 70-to-30. Considering previous research (e.g., Vytal, 2016; Patel, 2016), we anticipate that participants will perform poorer on filtering and attentional control categories in the high anxiety as compared to low anxiety condition. These findings would parallel previous findings on the role of state anxiety on memory performance and support the hypothesized inhibitory effect of anxiety on the mechanisms of filtering and attentional control mechanisms. The present research will have implications for the understanding of the detriments of anxiety on memory cognition. Furthermore, this is important for the future treatment of anxiety disorders.

This project was completed to fulfill a Capstone requirement.
In recent years, excess weight has become a major public health concern in America. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. Accordingly, discovering new ways to improve young children’s eating and activity habits are of paramount importance. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Eighteen preschoolers (average age = 49 months, range = 33 to 63 months; 61% male) from the University of Missouri’s Child Development Laboratory (CDL) are participating and were pre-tested using the Placemat Protocol in September, 2017. After pre-testing, preschoolers received one-hour per week of garden-based nutrition and plant science education. Post-testing is scheduled for late April. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. The foods and beverages utilized mirror Harrison’s original set with some substitutions based on recent surveys of children’s food intake (e.g., cheesecake was replaced with cheese pizza). Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables (e.g., number of fruits/vegetables, number of energy dense foods, number of nutrient dense foods, kilocalories in meal). Data analyses are underway to compare the composition of children’s favorite and healthy meals and to determine if children’s pre-assessment self-rated hunger and the time elapsed since breakfast are linked with the composition of children’s meals. When post-test data are added to the pre-test data, results will provide preliminary insights into the impact of Healthy Plants/Healthy Bodies on similarities and differences between preschoolers’ favorite and healthy meals.
In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity seems to suggest a desire for spaces where death can be discussed. With the development of virtual reality simulations arises the possibility of a new space where death can be explored. Virtual reality could prove useful in simulating end-of-life experiences and emotions to help individuals cope with fears or anxiety. Our interdisciplinary research team is exploring the effects of video immersion on an individual’s willingness to discuss death. Experiencing an immersive video based on mortality themes might increase thoughts about death and yet, potentially decrease death-related anxiety. Previous research has shown that graphic images have the power to elicit death anxiety, while other studies suggest that people are more comfortable addressing and discussing mortality through the use of metaphor and symbolic imagery than by addressing death outright. Therefore, our original video includes images such as birds, bats, waves, lush foliage, and expansive scenery, in addition to first-person footage of a mock burial. By including both graphic and symbolic material, we will examine whether the video will have a universal impact not directed toward a specific understanding of mortality. In our study (N= 48), roughly half of the participants completed personality and attitude surveys before watching the video, while the other half completed their surveys in two parts: before watching the video and after watching the video. In doing so, we hope to gain a better understanding of how observing and experiencing art may influence attitudes related to mortality.
Parent reports of children’s eating habits and preschoolers’ self-constructed favorite meals
Shahrukh Naseer, Jaime Gottlieb, Devesh Kumar, Rachael Marlar and Sara Gable

Childhood obesity has become a nationwide problem. In 2015-2016, among 2- to 5-year-olds, 26% were overweight and 13.7% were obese. In addition to excess weight, preschoolers’ vegetable intake is far below the recommended amounts. These trends are worrisome because excess weight and poor nutrition underlie many chronic health problems. The current study presents pre-test data from a pilot preschool vegetable garden program, Healthy Plants/Healthy Bodies. Using data gathered from both parents and children, two research questions will be addressed: 1) what is the relationship between parent reports of child food intake and children’s self-reported favorite meals? And, 2) what is the relationship between family mealtime routines and children’s self-reported favorite meals? Seventeen preschoolers (11 boys and 6 girls; average age 49 months) from the University of Missouri Child Development Laboratory are participating. Before the garden program began, children completed the Placemat Protocol (Harrison et al., 2015) and parents completed a survey about children’s eating habits and mealtime routines. The Placemat Protocol is a meal creation assessment tool; children use 3D food models to create their “favorite” meal and a “healthy” meal. This study examines only children’s favorite meals. Photos were taken of children’s favorite meal and their conception of a healthy meal and have been coded for a range of dietary quality variables. For the survey, parents reported the weekly frequency with which their preschooler consumed a variety of vegetables, fruits, grains, dairy, meats and beans, and beverages and their mealtime routines at home. Data analyses are underway to determine the relationship between: family meals and the dietary quality of children’s favorite meals and the frequency and type of family meals and the dietary quality of children’s favorite meals. Results will provide a baseline from which to evaluate the preliminary impact of the garden program.
Madaline Niemuth
Kansas City, MO

Faculty Mentor: Dr. Mike Metz, Learning, Teaching & Curriculum

An exploration of teachers’ language use as an indicator of language ideology
Madaline Niemuth and Mike Metz

Teachers in culturally and linguistically complex classrooms face the challenge of honoring students’ language while helping them take up standard English. Previous studies have looked at pedagogical practices and teaching materials to explore the language ideologies communicated in the classroom. In this study, we build on this research by exploring how teachers’ language use helps shape the kinds of language accepted in the classroom. The way that teachers style shift helps create language norms in the classroom that may signal the acceptance of linguistics features that have been historically stigmatized. In this study, we use a Dialect Density Measure to assess the language use of five English teachers during three types of language interactions: formal teaching, side talk with students, and an interview. We found that, in general, the five teachers used standardized English syntax across all contexts. There were some differences in the phonological feature of nasal fronting (g-dropping). In English classrooms, the phonological differences may signal the acceptance of a range of language varieties while maintaining the expected standards of Standardized grammar. Our findings indicate that a dialect density measure may not capture the most relevant aspects of teachers’ language use. Future research should look more carefully at how phonological differences index particular social meaning through teacher talk.
Connor Nordwald
East Prairie, MO

Faculty Mentor: Katie Guthrie, Biological Sciences; Dr. Paula McSteen, Biological Sciences
Funding Source: Freshman Research in Plant Sciences (FRIPS)

Understanding the function of the Suppressor of sessile spiklet 2 (Sos2) gene in maize reproductive development
Connor Nordwald, Katie Guthrie and Paula McSteen

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Lauren Norfleet  
Columbia, MO

Junior  
Early Childhood Education

Faculty Mentor: Dr. Katie Eklund, Educational, School & Counseling Psychology; Dr. Stephen Kilgus, Educational, School & Counseling Psychology

Examining the impact of Check-In/Check-Out and social skills training on student social skills  
Lauren Norfleet, Sophia Sears, Stephen Kilgus and Katie Eklund

Previous research has supported the use of Tier 2 interventions to help address the needs of students with behavioral concerns, including social skills training (SST) and Check-In/Check-Out (CICO). The purpose of the current study was to examine Check-In/Check-Out and Social Skills Training and to discover which one, or a combination of, is most effective at improving student levels of social skills. The study was conducted at three elementary schools in the Midwest during the 2015-2016 school year. Participants ranged in age from 6 to 11 years old, in grades 1st through 5th. One third of the students received CICO, the second group received SST, and the final group received a combined CICO+SST intervention over 10-12 weeks. Overall results suggested that student levels of social skills across all three groups improved during the intervention. Additional evaluations will explore which group of students demonstrated the greatest benefit. Implications for practice, study limitations, and directions for future research will be discussed.
Spinal muscular atrophy (SMA) is an autosomal recessive disorder that is the leading genetic cause of infantile death. It occurs in approximately 1:6,000 live births. The gene responsible for SMA is called survival motor neuron-1 (SMN1). However, another human specific gene is present on the same region of the chromosome 5q that is called SMN2. This gene is almost identical to SMN1 except that a mutation in SMN2 causes this gene to produce transcripts that are alternatively spliced. The product of SMN2 is ~90% of the time a truncated and unstable protein that lacks exon 7. SMN2, however, is a critical disease modifier because of the low level of full-length SMN that it produces. Current clinical and research studies have shown that SMN2 is not the only disease modifier. Several SMA disease modifier genes were identified based upon differential expression in “resistant” and “susceptible” muscles in SMA mice. Our previous work has identified EVL-1 as a genetic modifier. EVL-1 plays a role in the regulation of the cytoskeleton of the cell by regulating microtubule dynamics. Utilizing the scAAV9 viral vector system, over expression of EVL-1 resulted in significant improvement of life span, NMJ pathology, and tubulin stability in the mouse model of the disease.

*This project was completed to fulfill a Capstone requirement.*
Sexually dimorphic differences in the brain transcriptome profile in Amami spiny rats (Tokudaia osimensis)
Madison T. Ortega, Sarah A. Johnson, Nathan Bivens, Takamichi Jogahara, Asato Kuroiwa, Scott A. Givan and Cheryl S, Rosenfeld

Within therian mammals, females are generally homozygous (XX), while males are heterozygous (XY). However, Amami spiny rat (Tokudaia osimensis), has neither the Sry gene nor the Y chromosome that direct the undifferentiated gonad to become a testes and result in an increase in testosterone during fetal life that permanently masculinizes the brain. The Sry gene is located on the Y chromosome and is primarily responsible for male sexual differentiation. Both males and females of this species only have a single X chromosome, resulting in an XO genotype. It remains unclear how sexual differentiation occurs in this species. By examining the brain transcriptomic profile in both sexes this species, it will provide better understanding of genes or transcripts that might compensate for absence of the Y chromosome and Sry. The hypothesis being tested is that such genes likely reside on autosomal chromosomes or the X chromosome. Thus, we examined the global brain transcriptomic profile from male and female Amami spiny rats, and identified several genes and select transcripts that showed sexually-dimorphic expression differences. By using quantitative Real Time Polymerase Chain Reaction, we validated that Svs5 and Serpina1b were elevated in the brain of males and females, respectively (\(p < 0.05\)). It remains to be determined whether some of the gene and transcript expression differences identified in adult male and female spiny rats might compensate for the absence of Sry and serve as the initial drivers of brain sexual differentiation. These findings could be useful in recovery efforts for this endangered species.

This project was completed to fulfill a Capstone requirement.
We explored the relationship between financial aid and financial awards on time to graduation. Our research question was, “How does total student financial aid and awards influence on time graduation controlling for student demographics?” We were guided by Tinto’s model of student’s retention which theorizes a complex interaction of social integration, financial support, and college quality increasing student retention and graduation. Four freshman cohorts starting with the class of fall 2011 were followed over five years at a large R-1 Midwest land grant university. Survival analysis was used with the following demographics entered as controls; biological sex, ethnicity/race, instate/outstate residency, first generation, advising group, and Pell eligibility. Using 11 levels of scholarship amounts, survival analysis indicated a significantly lower time to graduation when scholarships and awards covered between 10 and 20 percent of financial need. Time to graduation flattened after 20% of financial need is met. The 20 percent tipping point may indicate a level of financial support that reduces student’s need to work. The need to work may interfere with time spent on academics. These findings need to be understood within the context if the individual including: high poverty, Pell eligibility, and the overall cost of students. In addition, programs that financially support students, such as financial support for taking summer classes, could also offset the need of students to work during the regular school year and should decrease time to graduation. Further research into the type of financial support (loans, awards, scholarships, grants, etc.) and how that support is understood by students is needed to clarify what role financial support plays in increasing retention and on time graduation.
Interclonal communication via cytonemes
Nisha Patel, Emma Elbert and Yves Chabu

In addition to genetic alterations, cell-cell signaling in the tumor microenvironment significantly influence tumor overgrowth, metastasis, and tumors resistance to chemotherapies. The underlying molecular mechanisms remain ill-defined. Animal models are useful for delineating signaling events. Using a Drosophila oncogenic Ras tumor model, we found that Ras tumor clones interact with one another via long membrane protrusions or cytonemes. Interestingly, only tumor perimeter cells produce cytonemes. In addition, cytonemes contain signaling molecules and are specifically targeted to distant Ras clones. More importantly, inhibition of cytonemes by genetic means suppresses tumor clones size, indicating that cytonemes-mediated interclonal interactions promote oncogenic Ras-mediated tumor overgrowth. These observations raise fundamental questions, including: i) How are cytonemes producing cells specified at the tumor margins? ii) How is cytonemes targeting specificity achieved? iii) What is the nature of cytoneme-mediated signaling events? Here we consider the hypothesis that growth-induced tissue mechanical properties prime cytonemes production in tumor perimeter cells. In this context, we propose that force-dependent EGFR signaling promotes cytonemes directed elongation via cell adhesion molecules. Consistent with this, genetic conditions interfering with cell-cell forces at the tumor periphery or mutations suppressing EGFR function or impinging on cytonemes formation all inhibit oncogenic Ras tumor overgrowth.

This project was completed to fulfill a Capstone requirement.
Ishita Patel  
Raymore, MO  

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

**Evaluation of serum and urine biomarker concentrations in patients with and without osteoarthritis**  
Ishita R. Patel and Aaron M. Stoker

Osteoarthritis is the leading cause of disability worldwide. Unfortunately, there is no cure for osteoarthritis, and there are no diagnostic or disease staging assays available for clinical use. This study was designed to evaluate the diagnostic and disease staging potential of specific biomarkers in urine and serum collected from patients with and without osteoarthritis. It was hypothesized that a diagnostic and disease staging biomarker panel can be developed based on biomarker concentrations in the serum and the urine. With IRB approval, knee radiographs, serum, and urine were collected from 53 patients that reported to have (n=40) or free (n=13) of osteoarthritis. Knee radiographs were scored using the Kellgren/Lawrence (KL) scoring system by one radiologist blinded to disease status. Serum and urine were tested using commercially available assays according to the manufacturer’s protocol. Urine biomarker concentrations were standardized to the creatinine concentration of the urine. Patients will be grouped based on OA diagnosis and KL grade. Significant differences between groups for each individual biomarker were evaluated by t-test with significance set at p < 0.05. Biomarker panels were evaluated using ROC curve analysis to determine if biomarkers sets were able to differentiate between groups. The results showed that no individual biomarker had consistent or accurate diagnostic or disease staging potential. When complied into a panel of biomarkers, biomarkers had the potential to differentiate between patient populations with and without osteoarthritis.
Mustard oils (glucosinolates) are a diverse group of natural plant compounds that are present in many important crop species. We are familiar with these compounds from the taste and smell of mustard, wasabi, arugula, Brussels sprouts, kale, and a variety of vegetables and spices. However, glucosinolates affect not just human palatability, but also human health, plant defense, and how plants interact with their environment. However, breeding efforts for one trait may have a negative trade-off with other important traits; e.g., selecting for better tasting Brussel sprouts may reduce the plants ability to fend off insect pests. Thus, elucidating the specific function(s) that each glucosinolate plays in the context of a local environment is important to understand both crop development and improvement. In this study, we used four accessions of kale (*Brassica oleracea*), which were selectively bred for high and low levels of two glucosinolates: sinigrin and glucobrassicin. Plants were grown for one month in laboratory conditions and then transplanted into field mesocosms. Over a one month period, the plants were measured for insect recruitment, growth speed, and other conditions. The plants then were harvested to assess percent leaf herbivory and for metabolomic analyses. We hypothesize that plants with high levels of glucosinolates will be correlated with decreased overall insect recruitment rate, but with a higher ratio of specialist to generalist herbivores. The inverse is expected in the low sinigrin and glucobrassicin lines. Results will highlight the impact of glucosinolate profile diversity in *Brassica oleracea* grown in a mid-Missouri environment.
Polymorphisms (PMs) are known to affect therapy outcome. The objective was to determine significant differences in the polymorphisms of HIV-1B and non-B subtypes. Moreover, the binding-affinities of first- and second-generation INSTIs in non-B HIV subtypes. The binding affinities of drugs to their targets can predict its efficacy. Hence, another objective was to determine in vitro and in silico subtype-specific differences in the binding affinities of first (raltegravir and elvitegravir) and second generation (dolutegravir) integrase strand transfer inhibitors (INSTIs). Multiple sequence alignment was performed against HIV-1 HXB2. Variant-calling of each residue was performed using an in-house R script and a CIRCOS plot generated to visualise variant-calling. Subtype-specific consensus sequences were generated by an alignment. Naturally occurring polymorphisms were defined as mutations that are present in >50% of sequences. Using consensus sequences, the structures of HIV-1 IN for the representative subtypes were generated. Moreover, we cloned, expressed and purified IN proteins from HIV-1B, HIV-1C, 01_AE and 02_AG patient isolates and biochemically assessed the binding affinity of first- and second-generation INSTIs. Some subtype specific naturally occurring polymorphisms were also observed. The CIRCOS data revealed that HIV-1B had lower number of polymorphism residues. The binding affinity of second-generation inhibitors to non-B INs was 1.8-fold greater than HIV-1B. On average, the binding affinity of DTG was better (2.1-fold) than first-generation INSTIs in the strand-transfer reaction of non-B subtypes. However, the binding affinity of first-generation INSTIs was better (5.6 – fold) than DTG binding in the 3’-end processing reaction. The molecular modeling results showed that DTG’s average binding energy for non-B subtypes was -22.6 kcal/mol compared to -8.7 and 6.6 kcal/mol for RAL and EVG, respectively. For HIV-1B, the binding energies of DTG, RAL and EVG was comparable. The second-generation INSTI DTG is a better inhibitor for non-B subtypes despite the presence of more polymorphisms in non-B.
Development of a high throughput screen to identify non-essential cell division proteins in Agrobacterium tumefaciens
Rebecca Piccolo and Pamela Brown

Agrobacterium tumefaciens cells divide slightly asymmetrically, giving rise to two daughter cells of similar cell length. Prior to cell division, FtsZ localizes near mid-cell and forms a contractile ring that enables cell division. In some bacteria, FtsZ placement is regulated by the Min system; however, we’ve recently shown that the Min system is not essential for proper FtsZ positioning and completion of cell division in A. tumefaciens. Given that the Min system is the only known FtsZ positioner found in the genome, it is likely that other unknown proteins contribute to FtsZ positioning in A. tumefaciens. To identify unknown FtsZ positioners, we have created a transposon mutant library in the ΔminCDE background. Initially, we utilized a microscopic imaging approach to look for cell division defects based on cell morphologies. Cell division mutants were identified as having branching, bulging, and/or asymmetric sites of constriction. From the hundreds of colonies screened, only seven showed cell division defects. This microscopy-screen is labor-intensive and inefficient for detection of cell division mutants. Thus, we are presently developing a high-throughput screen using a swim motility assay based on the assumption that most mutants with atypical morphologies will be unable to swim efficiently. This method will allow us to simultaneously screen hundreds of transposons mutants. Since a reduced swim ring size compared to wild type is not exclusively caused by defects in cell division defects, we expect to recover multiple classes of mutants including motility mutants, mutants with cell cycle defects, and cell division mutants. The efficiency of this assay for identifying genes involved in cell division of A. tumefaciens is currently being determined.

This project was completed to fulfill a Capstone requirement.
Erik Platner  
Columbia, MO  

Faculty Mentor: Dr. Rebecca Grollemund, English; Dr. Michael R. Marlo, English  
Funding Source: ASH Scholars  

*Documenting Luyia Together: Phylogenetic classification of Luyia language varieties*  
Erik Platner, Sarah Pribe, Alexa Thein, Thanh Nguyen, Michael R. Marlo and Rebecca Grollemund  

This presentation aims to present the results of a comparative study of the Luyia cluster of Bantu languages spoken in western Kenya and eastern Uganda. We propose a new classification of Luyia using phylogenetic methods. Our study is currently based on a 200 word list of basic vocabulary that is known to be reliable for historical linguistic studies, representing 37 language varieties from the Luyia cluster, the closest neighbors to Luyia, as well as a few more distantly related languages that function as controls. To build trees showing the relatedness between language varieties, we identified cognate sets for each entry by applying the Comparative Method and then applied the Neighbor-Net algorithm with representations displaying relatedness between languages. Our goal is to give a state-of-the-art comprehensive picture of the internal relationships among Luyia varieties in Kenya and Uganda, and the relationships between Luyia and its closest neighbors, including Ganda, Gwere, and Soga to the west, and Gusii and Kuria to the south. Our results are broadly consistent with past classifications by Mould (1976, 1981) and Williams (1973), but refine our understanding of the relatedness of the target languages by employing more extensive data from more languages within the Luyia cluster and others in the region.
Improving micronutrient uptake in maize using root associating rhizobacteria

Garren Powell, Ashley L. Anstaett, Amber Gerheart, James M. Guthrie, Barry Higgins, Alexandra Bauer, Michael J. Schueller, Stacy Wilder, David Robertson and Richard A. Ferrieri

Along with rice and wheat, maize is considered one of the world’s leading cereal grains. Together these grain crops serve as food sources for both humans and animal, it is estimated that they provide at least 30% of the food calories for more than 4.5 billion people living in developing countries. Increasing demands for food, driven by an increasing global population, has led to farming practices that rely on intensive, high-density cultivation of high-yielding cultivars and excessive fertilizer use. Unfortunately, these practices have been shown to cause severe depletion of essential micronutrients in the soil. Most notable are the depletions of iron and zinc which can result in poor grain quality and micronutrient malnutrition. The work described, herein, involves laboratory-based studies on 3 week-old aeroponically grown maize plants that were inoculated with two mutant strains of *Azospirillum brasilense* rhizobacteria; HM053, a high auxin producing strain, and *ipdC*, a strain with an impaired capacity to biosynthesize auxin. Results from ICP-MS analysis of digested tissues revealed that HM053 inoculated plants had 1.5, 3.8 and 4.4 – times more Mn-55, Fe-56 and Zn-64, respectively, than non-inoculated controls. Spatial analysis using LA-ICP-MS of root and leaf sections also revealed that *HM053* bacteria strongly influenced the spatial patterning of these elements across cellular-scale features of the plant tissues suggesting an effect on metal transport. Follow-up studies using radioactive Fe-59 revealed effects of both bacteria on whole-plant iron uptake and allocation. HM053 inoculated plants exhibited increased uptake of ferric form of Fe-59, as well as increased root-to-shoot allocation of tracer relative to non-inoculated controls. Plants inoculated with the *ipdC* bacteria also exhibited higher Fe-59 uptake, but lower allocation of tracer to shoots relative to non-inoculated controls. This suggests that the auxin producing capacity of these bacteria may play a role in regulating iron trafficking within their host.
Osteoarthritis (OA) is the leading cause of disability worldwide. One factor that makes OA difficult to treat is the considerable patient-to-patient variability in the development of OA clinically. Current OA categorizations lack the necessary insight into the pathobiology of the disease. This study was designed to determine if chondrocytes collected from patients undergoing surgical treatment for OA have unique metabolic profiles based on protein biomarker production at passage 0 in vitro. With IRB approval (IRB#1208932 & 2002628) and patient consent, cartilage tissue normally discarded during surgery was obtained from OA patients undergoing total knee arthroplasty (n=7) or osteochondral allograft transplantation (n=6). Cartilage was diced and digested overnight. After digestion, the cells were washed and plated on 25cm² flasks. The cells were allowed to grow until they reached >90% confluency. Then, the media were changed and the cells were cultured for 3 days. After 3 days, the media were collected and stored for biomarker analysis. Media were then assessed for biomarker values using commercially available assays according to the manufacturer’s protocol. To transform our data into comparable values, the median value for each biomarker was subtracted from the measured biomarker value for each patient, and this difference was divided by the median value of the biomarker. The resulting transformed value is the percentage distance from the median that can be used to compare the metabolic responses of patients across all biomarkers tested. Results will be presented on the poster.
Documenting Luyia Together: Phylogenetic classification of Luyia language varieties
Sarah Pribe, Erik Platner, Alexa Thein, Thanh Nguyen, Michael R. Marlo and Rebecca Grollemund

This presentation aims to present the results of a comparative study of the Luyia cluster of Bantu languages spoken in western Kenya and eastern Uganda. We propose a new classification of Luyia using phylogenetic methods. Our study is currently based on a 200 word list of basic vocabulary that is known to be reliable for historical linguistic studies, representing 37 language varieties from the Luyia cluster, the closest neighbors to Luyia, as well as a few more distantly related languages that function as controls. To build trees showing the relatedness between language varieties, we identified cognate sets for each entry by applying the Comparative Method and then applied the Neighbor-Net algorithm with representations displaying relatedness between languages. Our goal is to give a state-of-the-art comprehensive picture of the internal relationships among Luyia varieties in Kenya and Uganda, and the relationships between Luyia and its closest neighbors, including Ganda, Gwere, and Soga to the west, and Gusii and Kuria to the south. Our results are broadly consistent with past classifications by Mould (1976, 1981) and Williams (1973), but refine our understanding of the relatedness of the target languages by employing more extensive data from more languages within the Luyia cluster and others in the region.
Interactive contribution of mother and father attachment to mothers’ sensitive caregiving
Emma Pursley, Rachael Robinson and Ashley Groh

Mothers’ sensitive responding to infant signals has enduring predictive significance for children’s socioemotional development (Raby et al., 2015). Thus, understanding factors that contribute to maternal sensitivity is important for promoting children’s positive adjustment. Meta-analytic evidence indicates that maternal attachment is a robust predictor of sensitive caregiving (Zeegers et al., 2017) but the association’s magnitude is small, suggesting that other factors might affect this association. Because fathers are playing an increasing role in caregiving responsibilities (Day & Lamb, 2004) and mothers look to their significant other for support (Gouveia, Costa, & Schulz, 2015), fathers’ attachment might contribute to maternal sensitivity by moderating the link between mothers’ attachment and sensitivity. This study will examine the direct and interactive significance of fathers’ attachment for maternal sensitivity to distress.

Mothers and their 6-month-old infants (N=140) visited the lab and participated in a free-play context. Within one week, fathers completed the Attachment Script Assessment (Waters & Rodrigues-Doolabh, 2004), the measure of adult attachment in this study.

Data for this study was analyzed using a regression analysis. Maternal sensitivity to distress was regressed on mothers’ attachment security, fathers’ attachment security, and the interaction between mothers’ and fathers’ attachment security. This model was significant, F(5, 42) = X, p < .05, and accounted for 30% of the variance. A significant interaction (b = -.25, p < .05, one-tailed) was probed using simple slopes analysis (Aiken & West, 1991) which indicated that at lower levels of paternal attachment security, maternal attachment security was positively associated with maternal sensitivity (b = 0.05, p < .05, one-tailed). Thus, contrary to prediction, when fathers were less secure, secure mothers appeared to compensate by providing higher levels of sensitive care to their infants.

This project was completed to fulfill a Capstone requirement.
Learning and engaging in science requires students possess critical literacy skills, as the foundations of science are rooted in communicating information. This relationship between science education and literacy is supported by the Next Generation Science Standards (NGSS) and the Common Core State Standards-English Language Arts, and is especially important for middle school students, who are typically transitioning from learning-to-read to reading-to-learn. However, almost two-thirds of middle schools students within the United States are not reading at grade level and therefore are not developing the skills to participate in scientific inquiry. Many of these students are within underprivileged, low socioeconomic, or rural areas. This project aims to develop STEM multimodal complex text sets related to the main concepts within the NGSS. These text sets provide carefully scaffolded multimodal resources designed to educate students on the principles outlined in the NGSS. Each text set will be accompanied by a series of inquiry based activities, with the aim of fostering students’ interests and abilities to analyze and interpret data. The culmination of each text set is an Anchor Text, following the traditional format of a scientific research paper, related to the main concepts of each area. In our text set, designed to strengthen students understanding of the importance of climate change, an Anchor Text is being developed that explains the potential impacts global warming could have on the greater St. Louis area. This anchor text attempts to demonstrate the importance of modeling in predicting climate patterns and begins to develop students understanding of how modeling is used within science. Adopted and modified from a paper Steinweg and Gutowski, 2015, this anchor text outlines how climate is studied, how data is used within modeling to predict future changes, and analyzes the potential impacts global warming has on the lives of citizens living within Missouri.
Ex vivo responses of cartilage and synovial tissues to various concentrations of IL-1B
Stephanie Quoss and Aaron Stoker

Introduction: IL-1b is considered a significant contributor to osteoarthritis (OA) development and progression. Therefore, IL-1b has consistently been used for in vitro models of OA. However, the concentration of IL-1b used in these models is significantly higher than is typically observed clinically. In a previous study, stimulation with 0.1ng/ml of IL-1b resulted in significantly higher cartilage tissue GAG content compared to untreated controls after 42 days of culture and minimal inflammatory response by the tissues. For this study, the effect of IL-1b stimulation at 0.1 and 10 ng/ml on cartilage tissue GAG synthesis and degradation were determined. It was hypothesized that the increase in tissue GAG observed in the 0.1ng/ml of IL-1b groups would be due to a significant reduction in tissue GAG degradation compared to untreated controls and tissues stimulated with 10ng/ml IL-1b. Methods: All procedures were performed with ACUC approval. Cartilage and synovium tissues were collected from dogs (n=6) euthanatized for reasons unrelated to this study. Co-cultures of cartilage and synovium were created, along with monocultures of cartilage. Co-cultures were assigned to either the Negative Control (0ng/ml), Low (0.1ng/ml), or High (10ng/ml) culture group based on IL-1b concentration. Tissues were cultured for 42 days. After 42 days, cartilage tissue was tested for proteoglycan content and collagen content. Media will be tested for inflammatory indicators, degradative enzymes, cytokines, and proteoglycan content. Significant differences between groups will be determined by T-test with p<0.05. Results: Pending.

This project was completed to fulfill a Capstone requirement.
The goal of this project is to develop nanocellulose-based bioink suited for 3-D printing toward biomedical applications, such as wound dressing and tissue engineering. The student will design and optimize the nanocellulose-based formula, utilizing different composition ratios and processing parameters. The ink properties and performance will be evaluated in terms of rheological property of the ink, mechanical strength of the printed gel, and antimicrobial activities and biomedical functionalities of the fabricated materials. The student will gain the knowledge of nanocellulose, 3-D printing, and biomedically functional materials from the project. The design and optimization of the bioink formula is the most important part of this project. It requires an understanding of the roles of different components as well as the mechanism of the gelation process during printing. The student will investigate the benefits of cellulose nanofibers, both commercial and lab-made. In addition, the student will test various biopolymers and cross-linking agents, as well as the ratio of the biopolymers to the cellulose. The student will focus optimization on viscosity and strength of the bioink after printing and the biological properties of the gel provided by the biopolymers. The bioink will first be tested for viscosity and strength by manually dispensing it through a syringe in order to determine viability for 3-D printing. The biological properties will be evaluated based on their biomedical functionalities and compatibilities with human cells and tissue.
Luyia refers to a cluster of Bantu languages spoken in Kenya and Uganda, as well as the ethnic group of the speakers of those languages. Like many indigenous languages in the region, Luyia has been historically underdocumented. In a country where English is the national language, urbanization is occurring at a rapid pace, and social attitudes about ancestral languages are changing, Luyia faces many threats. This study is an evaluation of the stabilizing and threatening factors surrounding Luyia today. Two sociolinguistic surveys were administered to Luyia speakers in Kenya. One was a general demographics questionnaire that provided valuable information about language use patterns, and the other addressed the language representation in media, the relationship between language and government, the language habits of young people, changing attitudes about language and cultural identity, and the relationship between language and financial, social, and educational success. From the results of these conclusions, many threatening factors can be identified. Urbanization is the biggest threat to indigenous languages. In multi-ethnic urban areas like Nairobi, Swahili is the dominant language, and children may not learn the language of their parents’ ethnicity. A lack of representation in written media, movies, and television threaten the language. Additionally, the results of this survey suggest that negative social attitudes about indigenous languages are beginning to form amongst Kenyans. Despite these struggles, Luyia has many stabilizing factors. The multilingual culture of Kenya is beneficial to indigenous languages; intermarriage and other daily interactions with speakers of other languages may promote the social norm of multilingualism; however, there is also the possibility that the parents may speak Swahili in the family, so the children will not learn either parent’s language. Additionally, the improvement of rural education options has protected Luyia so far.
Cold calling a company is inherently a difficult task. It is widely known among salesmen that being friendly can lead to higher rates of ‘successful’ sales. Cold callers wishing to successfully land another meeting, pitch a service, or sell a product want to know some of the other contributing factors that they could improve upon that would ultimately lead to a ‘successful’ call. This research seeks to identify other contributing factors to ‘successful’ sales by analyzing both audio and transcript data for ‘successful’ and ‘unsuccessful’ sales calls. To find the most predictive features, we will compare results of various machine learning algorithms on various feature sets. The feature vectors will be constructed using metrics from both audio and transcript data such as speech rate, sentiment, psychological word categories, pitch, energy, frequency spectrums, etc. By increasing the accuracy of call outcome prediction, companies and their salesmen can tailor their approach to the customer. This could provide a deeper, more positive customer experience, which ultimately leads to more sales for the company.
The effects of cultural awareness, social dominance, and empathy on social cognition  
Amanda Rhim and Lisa Bauer

Judges more frequently rely on misleading intuitive reactions (Guthrie et al., 2001). To be impartial decision-makers, individuals must be able to believe that people of color’s experiences are significant (Matias, 2015). The goal of the study was to examine the relationship between exposure to diversity and judicial sentencing. This was accomplished by administering 6 pre-post questionnaires, watching a diversity training video, followed by two violent crime vignettes to measure how participants sentence Black relative to White defendants. 60 undergraduates (n=60) were recruited from the University of Missouri. After obtaining informed consent and demographic questionnaire, surveys were administered to gauge participants’ attitudes towards group-based inequality using the Social Dominance Scale (Pratto et al., 1994), cultural awareness using the Expanded Cultural Intelligence Scale (Van Dyne, 2012), and empathic capacity using the Empathy Quotient Scale (Loewen, 2010). A two and a half minute animated video presented concepts of inclusion. The participants were randomly assigned to one of three experimental groups (n=20): a Black presenter, a White presenter, or no presenter giving various statistics on diversity. Participants were then asked to complete a filler activity of math problems. Participants then provided a sentence for the defendants in two crime vignettes and completed the three questionnaires again. Data collection is still in process. Each participant was given a score corresponding to his or her response to the question of how long the defendant should be incarcerated (sentence). A 3 (video presentation) x 2 (race of defendant) analysis of variance (ANOVA) was conducted on the sentence scores. A one-way ANOVA examined what effect the video presenter’s race had on changes in participants’ response to the questionnaires. Correlational analyses examined the pre-training scale scores and sentence length.

This project was completed to fulfill a Capstone requirement.
Efficiency of soil additives on phosphorus removal from stormwater runoff in bioretention cells

William Riley, Demmi Christensen, Chloe Gossett, Shelby Sample, Lindsey Sommerfeldt, Elizabeth Taylor and Enos Inniss

In 2001, Allen Davis and his colleagues at the University of Maryland published their research paper, “Laboratory Study of Biological Retention for Urban Stormwater Management,” concluding that bioretention is a viable option for reducing concentrations of heavy metals, nitrogen, ammonium, and phosphorus in stormwater runoff. Davis’ paper states that “bioretention design requires a sandy loam soil or a texture near sandy loam,” yet most of Missouri is known to have soils high in clay, and therefore the bioretention cells may treat stormwater runoff differently due to the change in surrounding conditions. In an attempt to improve bioretention design for Missouri, this project explores the effects of various soil additives (gypsum, mulch, biochar, compost, and drinking water treatment residuals) on the removal of phosphorus, a nutrient abundant in runoff causing eutrophication & poor water quality in surface waters. To evaluate these additives, separate pilot-scale containers having a soil mix containing one of the respective additives were placed outside of the Grissum Building in Columbia to receive actual storm events, and a set of bench-scale containers were placed in the lab to receive controlled, synthetic storm events. Levels of phosphate for select storm events were tested using spectrophotometry to determine the amount retained in the soil. To date, it appears that these bioretention cells serve more as a source of phosphate rather than a sink. However, our data corroborate with further studies by Allen Davis stating that changes in the bioretention design can help to curb the release of phosphate from these systems.
Erin Robbins
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Junior
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Faculty Mentor: Dr. Ashley Woodson, Learning, Teaching & Curriculum

Finding your roots
Erin Robbins and Ashley Woodson

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Interactive contribution of mother and father attachment to mothers’ sensitive caregiving

Rachael Robinson, Emma Pursley and Ashley Groh

Mothers’ sensitive responding to infant signals has enduring predictive significance for children’s socioemotional development (Raby et al., 2015). Thus, understanding factors that contribute to maternal sensitivity is important for promoting children’s positive adjustment. Meta-analytic evidence indicates that maternal attachment is a robust predictor of sensitive caregiving (Zeegers et al., 2017) but the association’s magnitude is small, suggesting that other factors might affect this association. Because fathers are playing an increasing role in caregiving responsibilities (Day & Lamb, 2004) and mothers look to their significant other for support (Gouveia, Costa, & Schulz, 2015), fathers’ attachment might contribute to maternal sensitivity by moderating the link between mothers’ attachment and sensitivity. This study will examine the direct and interactive significance of fathers’ attachment for maternal sensitivity to distress. Procedure: Mothers and their 6-month-old infants (N=140) visited the lab and participated in a free-play context. Within one week, fathers completed the Attachment Script Assessment (Waters & Rodrigues-Doolabh, 2004), the measure of adult attachment in this study. Results: Data for this study was analyzed using a regression analysis. Maternal sensitivity to distress was regressed on mothers’ attachment security, fathers’ attachment security, and the interaction between mothers’ and fathers’ attachment security. This model was significant, F(5, 42) = X, p < .05, and accounted for 30% of the variance. A significant interaction (b = -.25, p < .05, one-tailed) was probed using simple slopes analysis (Aiken & West, 1991) which indicated that at lower levels of paternal attachment security, maternal attachment security was positively associated with maternal sensitivity (b = 0.05, p < .05, one-tailed). Thus, contrary to prediction, when fathers were less secure, secure mothers appeared to compensate by providing higher levels of sensitive care.
The significance of mothers’ attachment representations for maternal sensitivity in distressing versus non-distressing caregiving contexts
Rachael Robinson, Anna Wright and Ashley Groh

Although previous meta-analytic evidence indicates that mothers’ attachment representations are a robust predictor of maternal sensitivity (Van IJzendoorn, 1995), the magnitude of this association is surprisingly small. Some attachment scholars have argued that the attachment system is a bio-behavioral stress regulatory system, and thus, associations between attachment and sensitivity might be stronger in distressing caregiving contexts (Thompson, 1997). However, it remains unknown whether mothers’ attachment representations are more strongly associated with their sensitive caregiving behavior during distressing (versus non-distressing) caregiving contexts. This study addressed this important gap in the literature by examining whether mothers’ attachment is more strongly associated with sensitivity in distressing versus non-distressing contexts. The sample for this study comprised 140 mothers of six-month-old infants. Mother-infant dyads were video recorded during a free play interaction and during the Still-Face Procedure (Tronick et al., 1978) which has been used in prior research to examine mothers’ responding to infant distress (Groh et al., 2017). Two separate coding teams coded maternal sensitivity in the distressing and non-distressing caregiving contexts. Within one week of the first laboratory visit, mothers completed the Attachment Script Assessment, the measure of adult attachment used in this study. A linear regression was conducted with mothers’ attachment variation regressed on maternal sensitivity to distress and non-distress. The full model was significant, F(2, 24) = 2.33, p < .05 (one-tailed), and accounted for 16% of the variance. As expected, mothers’ attachment security was positively associated with their sensitivity to distress (b = .51, p < .05, one-tailed) and mothers’ attachment security was not significantly associated with their sensitivity to non-distress (b = -.21, p = .21, one-tailed).
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Biological Sciences

Faculty Mentor: Dr. James Birchler, Biological Sciences
Funding Source: NIH Initiative for Maximizing Student Diversity (IMSD-EXPRESS)

Utilizing a B chromosome translocation to manipulate transgene copy number
Alana Rodney, Nathan Swyers, Nathaniel Graham, and James A. Birchler

The B chromosome is an extra chromosome found in maize that has no vital genetic information or phenotypic effect on the plant; therefore, the maize B chromosome provides a platform for the accumulation of transgenes in crops. The B chromosome contains a site on the long arm distal tip, which is required for the accumulation mechanism, allowing the B chromosome to survive in certain lines of maize. This accumulation mechanism could be utilized to increase the copy number of transgenes located on a B chromosome. A minichromosome is a small chromosome within the genome of the plant created through top down truncation from a B chromosome. In this study, a translocation of the long arm of the B chromosome was discovered attached to chromosome 1, resulting from a truncated B chromosome. When present on the chromosome 1, the accumulation mechanism, behavior in genetic crosses will be more consistent and predictable than when using normal B chromosomes. If the segregation is possible, the copy number of mini chromosomes can be increased significantly without the presence of the B chromosome by instead utilizing the chromosome 1 with the B tip attached. Plants were germinated and prepared for Florescent In- situ hybridization, which fluorescently labels DNA of interest using probes. Once probed the plants were screened under a fluorescence microscope for the presence of the long arm of chromosome 1 or mini chromosomes. Preliminary results show two plants homozygous for the long 1 chromosome, as well as plants that have the translocation and multiple B chromosomes.
Correlation of osteoarthritic knee cartilage metabolic response to load
Alexander R. Rodriguez, Riley L. Short, Caitlyn M. Cassimatis, James A. Keeney, James L. Cook and Aaron M. Stoker

Osteoarthritis (OA) is a degenerative joint disease and is characterized by complex biochemical and metabolic responses. It has been theorized that joint loading is one of the factors that drives the progression of OA. This study was designed to test the hypothesis that with increased application of load to OA cartilage, there will be an increased number of strong correlations (R>0.7) among degradative and inflammatory biomarkers produced by the tissue. With IRB approval, osteochondral explants were created from tissues normally discarded from patients after undergoing knee arthroplasty. Explants were placed into groups based on load during culture (no load, 0.5 MPa load, 1.0 MPa load, 1.5 MPa load, or 2.5 MPa) and cultured for 3 days. Media collected on day 3 were tested for degradative and inflammatory biomarkers. Correlations among tissue biomarkers were determined using the Pearson correlation with significance set at p<0.05. A correlation of R>0.7 was considered to be a strong correlation for these analyses. As magnitude of load applied to the cartilage tissue increased, there was a corresponding increase in strength and significance of correlations between the cytokines tested, MMPs tested, as well as, between the cytokines and MMPs tested in this study. Osteoarthritic cartilage metabolism is significantly affected by load with many responses being determined by magnitude of loading. Clinically relevant activity modifications and load-altering orthotics or surgeries may serve as effective disease modifying strategies at the cellular level.
Video immersion and the effects on attitudes related to death

In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity seems to suggest a desire for spaces where death can be discussed. With the development of virtual reality simulations arises the possibility of a new space where death can be explored. Virtual reality could prove useful in simulating end-of-life experiences and emotions to help individuals cope with fears or anxiety. Our interdisciplinary research team is exploring the effects of video immersion on an individual’s willingness to discuss death. Experiencing an immersive video based on mortality themes might increase thoughts about death and yet, potentially decrease death-related anxiety. Previous research has shown that graphic images have the power to elicit death anxiety, while other studies suggest that people are more comfortable addressing and discussing mortality through the use of metaphor and symbolic imagery than by addressing death outright. Therefore, our original video includes images such as birds, bats, waves, lush foliage, and expansive scenery, in addition to first-person footage of a mock burial. By including both graphic and symbolic material, we will examine whether the video will have a universal impact not directed toward a specific understanding of mortality. In our study (N= 48), roughly half of the participants completed personality and attitude surveys before watching the video, while the other half completed their surveys in two parts: before watching the video and after watching the video. In doing so, we hope to gain a better understanding of how observing and experiencing art may influence attitudes related to mortality.
Bone repair has become a major clinical development. Traditional methods for repair replace lost bone with bone tissue from a donor or use biocompatible bone cements as filler material. The concerns with these methods are that there are limited amounts of donor tissue available, patients have complications at the donor site, and bone cements may leak and have poor mechanical properties. Therefore, there is a need for a bone replacement material that is biocompatible, will not decrease the mechanical properties of bone, and will promote new bone tissue growth. A material of interest is Hydroxyapatite (HA). HA is the main inorganic mineral of the bone and is responsible for the hardness and rigidity of the bone. HA is osteoconductive, biocompatible, and non-immunogenic. Another material of interest is decellularized tissue which acts as the Extracellular Matrix (ECM) material. Hydroxyapatite nanoparticles (HANP) can be conjugated to the ECM. An added benefit of the ECM is that as it degrades, it coordinates a complex biochemical remodeling response. For example, ECM components harbor cryptic matrikines (cryptic segments of larger proteins) and smaller proteins, all of which act as chemoattractants for progenitor cell populations and stimulate the release of growth factors to further enhance bone generation. We synthesized and characterized biomimetic HANP. Our biocompatibility tests indicated that our HANP are non-toxic and display the potential to stimulate new bone tissue growth on the nanoparticle surface. The conjugation of HANP to decellularized tissue may lead to a better injectable construct to recapitulate bone.
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Faculty Mentor: Dr. Caixia Wan, Bioengineering
Funding Source: College of Engineering Undergraduate Research Option

2, 3-butanediol from switchgrass via simultaneous saccharification and fermentation
Daniel Rothermich, Zhu Chen and Caixia Wan

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
The role of photography and writing on attitudes related to death
Annalee Roustio, Kendra Easton, Jarrod Russo, Luci Cook, Lorena Fernandez and Jamie Arndt, Katina Bitsicas, Tyler Jimenez, Alexandria Lewis and LuAnne Roth

In the early 2000s, Death Cafes began gaining popularity and attention, spreading globally. This rising popularity suggests widespread and multicultural desire to discuss feelings surrounding the topic of death. Mortality is commonly the focus of various artistic expressions and previous research has shown that producing art through an art therapy class reduced death anxiety and increased willingness to discuss death-related topics. Our multi-disciplinary team is exploring the effects of providing individuals with the opportunity to address the topic of mortality via artistic expression. We are interested in extending current research to explore if creating art in response to mortality-based prompts influences death anxiety and related attitudes. In the study, participants (N = 100 to date) first complete a survey that assesses individual personality traits (e.g., meaning in life, personal need for structure, religiosity, fear of death). Participants are then given 5 days to respond to three prompts that encourage personal reflection on death by either taking photos or writing. A control condition has participants take a photo in response to prompts based on mundane activities. Upon responding to the prompts, participants complete a post-survey that includes measures of meaning in life, the cognitive availability of death-related thoughts, and death anxiety, followed by a debriefing. By exploring whether individual personality traits influence the effectiveness of taking photos or writing about mortality, we can gain a better understanding of whether creating art is a useful way of addressing mortality for everyone or only for certain individuals. In doing so, this study will provide insight into ways that people might productively address and cope with mortality.
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Visual and linguistic perception and wellbeing
Alison Salamun, Jake Womick and Laura King

Worldviews are often thought to help people better understand and interpret the world around them. Evidence suggests that worldviews play a role in meaning in life. For example, previous research has found that the worldview of religious faith shares a strong positive relationship with the experience of MIL. The specific worldview focused on in this study is that of Rightwing Authoritarianism. Rightwing authoritarianism (RWA) involves submission to a strong leader, endorsement of hierarchical social structures, strict conformity to social conventions and traditions, and aggression towards out-groups perceived as violating these conventions. Previous correlational studies have shown significant correlations between RWA and MIL, among non-college adults (N=2340, r=.33, p<.001) and college students (N=1266, r=.21, p<.001). The goal of this study is to test whether primes of RWA affect MIL. Participants completed a survey on Amazon Mechanical Turk (MTurk). The survey measured participant’s need for cognition (REI), Meaning in Life (MLQ-P), Rightwing Authoritarianism (RWA scale) and mood. Participants were randomly assigned to conditions where they read either an authoritarian passage, an egalitarian passage, or a control passage. Using SPSS software, we then calculated the correlations among all measures collapsed across conditions. Then, t-tests compared scores on meaning in life and mood across conditions. We then examined whether a condition effect was moderated by pre-existing levels of RWA. These data show that participants exposed to authoritarian ideals in the passages will rate their MIL higher compared to those exposed to egalitarian ideals. Such results provide causal evidence for the correlational association already established.

This project was completed to fulfill a Capstone requirement.
Osteoarthritis, which causes severe pain and can decrease quality of life, is one of the most common forms of arthritis. It cannot be reversed, however, understanding how cartilage slowly degrades over time could lead to earlier diagnosis and treatment before joint replacement is necessary. The goal of this project is to evaluate the mechanical and biological response of articular cartilage to variations in loading by performing a computational analysis using the FEBio software package. Diarthrodial joint health is affected by the mechanical loading it must transmit, including sub- and super-physiologic loading. Initially, biomechanical testing of cadaver cartilage explants was performed and eventually compared to the computational analysis values. FEBio can accurately model required materials for articular cartilage. Specifically, a biphasic material is used to model the porous medium of the cartilage that consists of a mixture of a solid matrix and an interstitial fluid. FEBio can be used to predict various parameters of cartilage tested under indenting stress. Using our model generated in the FEBio Suite, the characteristics of several samples were calculated, including the permeability and stiffness. Based on our results, we found that using our model generated a curve fit closer in correlation to the actual test data than if we had predicted the parameters manually.
Efficiency of soil additives on phosphorus removal from stormwater runoff in bioretention cells
Shelby Sample, Demmi Christensen, Chloe Gossett, William Riley, Lindsey Sommerfeldt, Elizabeth Taylor and Enos Inniss

In 2001, Allen Davis and his colleagues at the University of Maryland published their research paper, “Laboratory Study of Biological Retention for Urban Stormwater Management,” concluding that bioretention is a viable option for reducing concentrations of heavy metals, nitrogen, ammonium, and phosphorus in stormwater runoff. Davis’ paper states that “bioretention design requires a sandy loam soil or a texture near sandy loam,” yet most of Missouri is known to have soils high in clay, and therefore the bioretention cells may treat stormwater runoff differently due to the change in surrounding conditions. In an attempt to improve bioretention design for Missouri, this project explores the effects of various soil additives (gypsum, mulch, biochar, compost, and drinking water treatment residuals) on the removal of phosphorus, a nutrient abundant in runoff causing eutrophication & poor water quality in surface waters. To evaluate these additives, separate pilot-scale containers having a soil mix containing one of the respective additives were placed outside of the Grissum Building in Columbia to receive actual storm events, and a set of bench-scale containers were placed in the lab to receive controlled, synthetic storm events. Levels of phosphate for select storm events were tested using spectrophotometry to determine the amount retained in the soil. To date, it appears that these bioretention cells serve more as a source of phosphate rather than a sink. However, our data corroborate with further studies by Allen Davis stating that changes in the bioretention design can help to curb the release of phosphate from these systems.
Rainfall has a significant impact on runoff and soil erosion. Field studies to measure these responses are often difficult due to the variable nature of rainfall, in timing, areal coverage, and changing intensity. Laboratory studies using gravity rainfall simulators can overcome the challenges of timing, but it can be difficult to properly mimic natural rainfall characteristics with respect to droplet size and intensity. Naturally occurring rainfall has a direct but nonlinear relationship between droplet size and rain rate. Mimicking such rainfall with gravity simulators is possible through various means, such as passing the falling droplets through screens to resize the droplet distribution and varying the pressure above drippers forming the drop sizes. However, simulating a variable rainfall event requires adjusting both a physical screen and an air inlet tube to control water pressure. Therefore, the goal of this semester project is to develop a functional model between the graphical coding software, LabView, and the rainfall simulator. The graphical coding matches the rainfall rate data coming from naturally occurring storms with the droplet size relationship developed using pertinent data from type II storms in the U.S. The primary obstacles when working with naturally occurring storms and a simulator is not only matching the variables with the simulator, but also matching the rate at which they change with the hardware of the simulator. The relation between droplet size and rain rate can be found from both data and correlations of rain rate and air inlet tube position. Based on this, the drop size was theorized and matched to the potentiometer indicating position vs drop size and rain rate. In all, the LabView program instructs the simulator to account for variable rainfall intensity with time, correctly positioning the air inlet tube as well as the sc
Examining the impact of Check-In/Check-Out and social skills training on student social skills
Sophia Sears, Lauren Norfleet, Stephen Kilgus and Katie Eklund

Previous research has supported the use of Tier 2 interventions to help address the needs of students with behavioral concerns, including social skills training (SST) and Check-In/Check-Out (CICO). The purpose of the current study was to examine Check-In/Check-Out and Social Skills Training and to discover which one, or a combination of, is most effective at improving student levels of social skills. The study was conducted at three elementary schools in the Midwest during the 2015-2016 school year. Participants ranged in age from 6 to 11 years old, in grades 1st through 5th. One third of the students received CICO, the second group received SST, and the final group received a combined CICO+SST intervention over 10-12 weeks. Overall results suggested that student levels of social skills across all three groups improved during the intervention. Additional evaluations will explore which group of students demonstrated the greatest benefit. Implications for practice, study limitations, and directions for future research will be discussed.
Daniel Shannon
Cleveland, TX
Senior
Civil & Environmental Engineering

Faculty Mentor: Dr. Enos Inniss, Civil & Environmental Engineering

A comparison of native vegetation raingardens and turfed bioretention cells and the importance of utilizing low impact development sites to mitigate stormwater problems.
Daniel Shannon and Enos Inniss

Raingardens and Bioretention basins are a type of “Green Engineering” aimed with the goal of reducing several issues that arrive every time it rains. These “low impact development” sites, LIDs, are a green approach for stormwater management that seeks to mimic the natural hydrology of a site using best management practices. As cities and suburbs grow and replace forests and agricultural land, increased stormwater runoff from impervious surfaces becomes a problem. Stormwater runoff from developed areas increases flooding and erosion; carries pollutants from streets, parking lots and even lawns into local streams and lakes; and leads to costly municipal improvements in stormwater treatment structures. By reducing stormwater runoff, raingardens can be a valuable part of changing these trends and while an individual raingarden or bioretention basin may seem like a small thing, collectively they produce substantial neighborhood and community environmental benefits. Two sites were compared and evaluated against each other to determine the benefits of a native vegetated raingarden versus a turfed bioretention basin. Raingarden systems behave similarly to natural and nonurban watersheds with diverse vegetation having extended root systems. They can be efficiently used to capture runoff, promote infiltration, promote evapotranspiration, recharge groundwater, protect stream channels downstream, reduce peak flow, and reduce pollutants as well the ability to convey, control, and improve stormwater through infiltration, sedimentation, and filtration. It was found that the two stormwater LID sites have various advantages with few disadvantages.
Impact of individual differences in dopamine levels on feedback anticipation
Shreya Sharma, Xi Ren, Fernando Valle-Inclan and Steven Hackley

The Stimulus-Preceding Negativity (SPN) is a brain wave that specifically reflects motivationally relevant stimuli (Brunia et al., 2011). It arises from different brain regions such as the prefrontal cortex, inferior parietal lobe, and right insular cortex (Brunia et al., 2003). SPN gradually becomes smaller as participants learn a task that has a cue for a reward, indicating that SPN specifically reflects anticipatory activity in cortical parts of the reward system (Moris et al., 2013). In patients with Parkinson’s disease (PD), SPN amplitude is significantly decreased (Mattox et al., 2006). This suggests that SPN amplitude potentially decreases due to lower dopamine levels. However, it is unclear if dopamine is the true source of the abnormal SPN wave, or whether it is the result of other neurotransmitter abnormalities which affect PD patients. The spontaneous-eye blink rate (sEBR) is a widely accepted non-invasive method to measure dopaminergic activity and was used to address this uncertainty (Colzato et al., 2009). Healthy young adults participated in a feedback-learning task. During each trial, participants were instructed to replicate a template demonstrating the duration of four key presses. Feedback was given 2.5 s after the final key press, and SPN was recorded during the pre-feedback delay period. All participants were given questionnaires to assess their level of impulsivity, burnout, and risk for depression. Amplitude of SPN was compared with sEBR. These results were analyzed for trends and patterns in relation to the questionnaire responses. Preliminary results show patterns comparable to previous findings at this lab (Ren et al., 2017). Amplitude of SPN was directly correlated to sEBR and showed a significant interaction for the right pre-frontal SPNs. The correlation between dopaminergic activity and SPN amplitude is a critical finding in order to use SPN as a measure of anticipation in respect to the dopaminergic reward system.

This project was completed to fulfill a Capstone requirement.
Lesson planning has long been upheld as a central component of teaching, however, studying the ways in which teachers plan is difficult because much of teachers’ planning occurs in their heads. Furthermore, although teacher education programs continue to emphasize the creation of lesson plans, many teachers report that they do not create such plans once they graduate from their teacher preparation programs. This study is part of a larger design and development project called the Two-Minute Teacher’s Guide (TMTG). TMTG is a collection of digital educative curriculum materials and accompanying lesson plans for algebra teachers. The TMTG team is developing both the lesson plans and the digital materials to encourage teachers to enact small, incremental changes to their practice to improve students’ learning of algebra. The intent of the TMTG materials is to provide teachers with resources that better align with their actual lesson planning practices. Thus, in the present study, we sought to better understand secondary mathematics teachers’ lesson planning practices. In particular, we examined their orientations toward curriculum materials, their existing lesson planning practices, and the aspects of new curriculum materials to which they attended. We utilized a qualitative interview study design which entailed conducting interviews during which we introduced each participant to a new lesson planning resource (a novel lesson plan format and a video-based lesson resource). As the participants interacted with the resources we questioned their perceptions of them with regard to their own planning practices. We found that each of the participants differed in their planning practices and also differed with regard to the aspects of lesson resources to which they attended (e.g., content and superficial elements). The findings will inform the continued development of the TMTG materials and also provide insight into teachers’ current planning practices.
Katharine Sharp  
De Kalb, MO  
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Animal Science

Faculty Mentor: Dr. William Lamberson, Animal Science  
Funding Source: CAFNR On Campus Research Internship (Dudley & Virgie Alexander Scholarship)

*Effects of oxytocin on voluntary water consumption*
Katharine Sharp, Maria Haag, Danielle Magee, Abigail Greenwalt and William Lamberson

C57BR/CDJ mice have been observed to sometimes have poor maternal ability. The deficiency ranges from lack of milk letdown to actually eating all of the pups in a litter. Furthermore, previous work in C57BR/CDJ has shown an increase in water consumption which has been previously connected to oxytocin deficiency. The purpose of this study is to evaluate the effects of exogenous oxytocin administration on maternal care levels and water consumption. Both C57BR/CDJ and C57BL/CDJ dams were paired with males, then put into single cages when mating plugs were identified. These females were weighed, and daily water consumption data were collected using custom water bottles for the duration of gestation. Following parturition, oxytocin was administered every four hours for the next three days. During this period water consumption data and observations on maternal care levels were also collected. The results of this work will be presented at the Undergraduate Research Spring Forum.
Toxic masculinity in popular music
Grant Sharples and Joan Hermsen

I am analyzing toxic masculinity in modern popular music. For a sample, I am using the top 100 streamed songs on Spotify in 2017. I created an Excel spreadsheet in which I noted a predominantly male/female songwriting team, genre, lyrical themes, and a lyrical sample. Currently, I’m working on an essay in which I observe problematic details in individual songs to shed light on a larger picture regarding toxic masculinity.
Aleks Shin  
Columbia, MO

Sophomore  
Biological Sciences

Faculty Mentor: Dr. Kuanыш Kabyтаev, Pathology & Anatomical Sciences

*Development of a LC/MS assay for glycated Albumin*

A. Shin, S. M. Connolly, R. R. Little and K. Kabyтаev

As a standard for measuring long term blood glucose levels, glycated hemoglobin (A1c) is the preferred clinical measurement. However, substantial factors such as reliance on erythrocyte lifespan, renal complications, anemic effects and the genetic variability of hemoglobin limit the efficacy of A1c measurement. Glycated albumin (GA) has been considered as an alternative to monitoring glycemic control where A1c is not accurate or useful such as Gestational Diabetes, End Stage Renal Disease, etc. Presented is a high performance liquid chromatography/mass spectrometry (HPLC/MS) method utilizing multiple reaction monitoring (MRM) for GA quantitation in a protease digested sample. For the method, a QTRAP 6500+ (Sciex) coupled with Shimadzu HPLC system were used. The assay was initially developed using in-vitro glycated human serum albumin samples. The samples were reduced and alkylated with DTT/IAA, then digested with Glu-C enzyme. The information dependent acquisition was used to identify all glycated albumin sites. The MRM transitions of two peptides RQIKKQTALVE (521-531) and FKPLVEEPQNLIKQNCE (377-393) and their glycated forms (Lys-525 and Lys-378 accordingly) were chosen for quantitation. The developed protocol was further used for serum samples from subjects with and without diabetes. There was a linear correlation between our LC-MS/MS and the commercial Asahi Kasei (Tokyo, Japan) Lucica method for human serum samples, r² values were 0.91 and 0.86 for Lys-525 and Lys-378 sites respectively. The CV for human serum samples was 5.2%. In summary, we have developed and validated a novel method for glycated albumin quantitation in human serum samples.
A triple bottom line assessment: Sustainability of drinking water in central Missouri
Sequoia Shire and Enos Inniss

This triple bottom line comparative analysis was performed in order to better understand how standard municipal drinking water systems can potentially benefit from implementing sustainable practices and technologies. A triple bottom line approach looks at the potential social, environmental, and financial impacts of any given project. It has been stated that the most sustainable water systems would be ones that require a radical shift in treatment and structure. However, the cost associated with this is too extreme for small municipal water treatment facilities to reasonably consider. This assessment will be to construct a list of possible sustainable technologies and practices that can be introduced to standard operating drinking water systems. It is postulated that implementing these practices will produce better water quality overall and that the number of sustainable practices will correlate to water quality improvement. A triple bottom line index was created in order to better quantify and compare the facilities. Three financial criteria were selected; cost of chemicals throughout treatment, cost of energy consumed, and sludge disposal cost. This was then compared in dollars per gallons of water produced. The environmental impacts were compared based on overall water quality produced. This was done by comparing information given by the facilities in their annual water quality report. The social impacts were compared by taking into consideration water rates, regulatory compliance, and public opinion. A comparative analysis of Jefferson City, MO and Boonville, MO drinking water treatment facilities was completed for this report. These facilities were chosen due to their differences in size, management and water quality. The analysis suggests that the water treatment facilities benefit economically, environmentally, and socially by implementing sustainable practices. In many cases, implementation of practices to achieve a better water quality resulted in greater
Within the Ozark Highlands and Ouachita Mountains of Missouri, Arkansas, and Oklahoma, climatic shifts associated with glacial events, combined with the geology of the region, have shaped the contemporary patterns of genetic diversity for a wide variety of species. Within this region, previous studies suggest that the repeated warming and cooling climates of the Hypsithermal Interval and associated fluctuations have influenced the distribution of endemic species, such as the ringed salamander (Ambystoma annulatum). Here, we examined the patterns of genetic diversity for A. annulatum across its range. We predicted that patterns of genetic diversity in A. annulatum would be influenced by both the Hypsithermal Interval and the Arkansas River Valley, which separates the two highland regions. Using ~800bp sequence of mitochondrial DNA for 77 A. annulatum from 10 locations, we found 9 distinct haplotypes across the range. We found higher haplotype diversity in the southern Ozark Highlands, which is towards the center of the species’ distribution, than in the northern Ozarks and Ouachitas. No haplotypes were shared between highland regions and sequence diversity was low. Our results suggest that dispersal between highland regions is limited for A. annulatum and that this species exhibits the typical core-periphery dynamics of genetic diversity with the highest diversity being found in the southern Ozarks.

This project was completed to fulfill a Capstone requirement.
Evaluation of the effects of impact injury and compressional stresses on biomechanical properties and biological activity of human OA tissue

Riley Short and Aaron Stoker

Introduction: Osteoarthritis (OA) is the degeneration of cartilage and bone within a joint, and posttraumatic OA (PTOA) alone costs Americans 3 billion dollars annually. Therefore, there is a high need to understand the factors that drive the development of PTOA after injury. It is hypothesized that the combination of impact injury and cyclical compressive force applied during culture will cause a significant decrease in cell viability and a significant increase the production of OA related biomarkers compared to untreated controls or either stimulation alone.

Methods: With IRB approval, OA cartilage explants were harvested from tissues normally discarded during total knee arthroplasty. Biomechanical testing was performed on all explants, and then samples were randomly assigned to either the untreated control, impact injury (50% compression), compressive load (0.5MPa), or the combined impact injury\compressive load group. Tissues were cultured for six days, and media was collected on days three and six of culture for biomarker anlaysis. On day six of culture, the cartilage was tested for biomechanical properties, tissue viability, and extracellular matrix composition or histological evaluation. Significant differences between groups will be determined using ANOVA analysis with significance set at p<0.05.

Results: Final data will be presented on the poster.
Interactive big data visualization for traffic operations and management
Xiaofan Shu, Peng Jin and Yaw Adu-Gyamfi

This research leverages recent developments in high performance computing to develop a platform for seamless integration and visualization of traffic datasets. At the heart of this platform is an application center (“AppCenter”) which provides a non-programmatic GUI access to an underlying database and guides users to derive powerful analytical insights from the collated data. The “AppCenter” also hosts a user-friendly, interactive, web-based visualization toolbox to enable efficient visual data exploration and analytics. The toolbox design follows a big data visualization architecture which synergistically utilizes the power of distributed computing on the server side and GPU strengths of data rendering on the client end. In the “AppCenter”, traffic managers will be able to configure routes and perform customized analysis such as traffic queue detection or monitoring, computing congestion hours, travel time reliability or speed performance, etc. The framework developed is compared with traditional data visualization platforms such as Tableau to evaluate its strengths and limitations.
Krista Shucart
Florissant, MO

Faculty Mentor: Dr. Mannie Liscum, Biological Sciences

The influence of post-translational modifications on phot-1-mediated physiology
Krista Shucart, Brittany Cruzan Johnson, Johanna Morrow, Kyle Willenburg
and Mannie Liscum

Phototropin1 is a blue light photoreceptor that is involved in a variety of functions, two of which are phototropism and leaf movement. Phototropism is the bending of plants toward or away from a light source. Both phototropism and leaf movement maximize photosynthetic light capture and positively impact growth optimization in plants. The structure of phot1 is critical for its function; it is composed of amino-terminal sensory domain and a carboxyl-terminal protein kinase output domain. Upon blue light absorption, there is a conformational change that causes the derepression of kinase domain, thus resulting in receptor autophosphorylation and downstream signaling. A protein, NONPHOTOTROPHIC HYPTOCOTYL3 (NPH3) has been identified as a phototropin-interacting protein that is necessary for the bending response. NPH3 functions as a substrate adapter in a Cullin3-Ring Ubiquitin ligase complex, which is responsible for ubiquitinating the phot1. In this study we further characterize the effect of these post-translational modifications of specific phot1-mediated functions by performing phototropic and leaf movement assays on several mutants of phot1 and nph3 in the model plant, Arabidopsis thaliana.

This project was completed to fulfill a Capstone requirement.
Adrian Siefkas
Columbia, MO

Senior
Political Science

Faculty Mentor: Dr. Michael Wahman, Political Science; Dr. William Horner, Political Science

Information and communication technologies and democracy in Latin America
Adrian Siefkas, William Horner and Michael Wahman

At the outset, the introduction of Information and Communication Technologies (ICT) excited people about the positive implications they could have for democracy. Since, the literature on ICT in authoritarian regimes has shown that ICT are not as liberalizing as some first thought. Scholars have pointed to the benefits that ICT present to the public sphere, but ultimately, regimes that have wanted to manipulate ICT to their advantage have done so. This study takes the often-researched topic of the impact of ICT on democracy and brings it into the theater of Latin America, which has a rich history of democratic transition and whose democratic institutions are challenged by forces like populism and corruption. Most of the literature on ICT manipulation focuses on authoritarian regimes, but Latin America illustrates that democracies also participate in manipulating ICT to their advantage. In this study, I analyze ICT manipulation and the democratic environments in the states of Mexico, Ecuador, Colombia, Venezuela, and Brazil. I argue that there are distinct forms of manipulation within these countries and that we should not expect all forms to have similar impacts on democratic attitudes and behavior. The central research question of this study examines how online propaganda interacts with the relationship between individual internet usage and democratic attitudes and behavior across the five Latin American states. I expect states that employ online propaganda to show a negative relationship between internet usage and democratic attitudes and behavior. This is because I expect online propaganda to be effective in spreading a pro-regime message due to its imperceptible nature.

This project was completed to fulfill a Capstone requirement.
Metabolic mapping of normal canine humeral head
Karissa Simon, Jessee Kruse, James Cook and Aaron Stoker

Introduction: There is significant heterogeneity in the forces applied to articular cartilage across the surface of the joint. There is variability in force application across the surface of the joint, resulting in heterogeneity of cartilage tissue thickness, cellularity, and matrix composition. However, the heterogeneity of biomarker production by the tissue across the surface of the joint has not been studied. Therefore, this study was designed to determine the biomarker production of osteochondral tissue at specific location across the surface of the humoral head. It is theorized that there will be significant variation in the production of these biomarkers across the surface of the joint.

Methods: With ACUC approval, tissue was collected from the humeral head of seven canines euthanatized for reason unrelated to this study. Osteochondral plugs (n=95) were created using a OATS harvester, and the location of each plug was mapped to the location of harvest. The plugs were cultured for 3 days at 3 degC. Humeral tissue explants were tested for GAG content and media was tested for nitric oxide, MMPs, cytokines, MMP activity, and PGE2. Data was collected and ranked based on level of production and given a score from 1-8. Maps were created based on rankings for all seven canines. These maps were summed and re-ranked based on each biomarker. Trends in areas of elevated production were analyzed in correspondence to areas receiving highest load based on these maps. Results: Data analysis and evaluations are still being performed and finalized. Finalized data will be presented on the poster.
Purification and refolding of protein subunit of an enzyme required for fatty acid synthesis in plants
Jayce Simoncic, Tara C. Marcink, Yan C. Fulcher, Jay Thelen and Steven R.Van Doren

Fatty acid synthesis in plants is extremely important to provide oils for food, fuel, and chemicals. It is vital to understand the fatty acid synthesis pathway in plants to maximize plant oil production for Earth's growing population. Past research has shown that biotin attachment domain-containing (BADC) gene family and its counterpart biotin carboxyl carrier protein (BCCP) regulate the activity of acetyl CoA carboxylase, which is the first step of fatty acid synthesis (Salie, 2016). BCCP2 is a subunit of an enzyme that regulates fatty acid synthesis in plants. The first step in understanding this complex process is to purify and examine the pH-dependent folding tendencies of BCCP2, which may be relevant to the oscillation in pH that the enzyme between daylight and night time conditions. BCCP2 was expressed in *E. coli* with minimal media conditions, purifying by nickel column purification and on-the-column refolding, analyzing with SDS-Page gel electrophoresis, and visualizing through NMR. It was found that BCCP2 was able to be purified and visualized in both soluble and insoluble fractions. This was seen by the matching NMR overlays of both fractions of BCCP2. Further studies were then conducted to compare the pH dependence of BCCP2 by visualizing with NMR. The NMR data supports the hypothesis of BCCP2 unfolding as it drops through neutral pH. TREND software showed a strong increase in unfolding at pH 6.8 and below.
Comparison of injured and non-injured intervertebral discs
Anna Skrade, James Stannard and Aaron Stoker

Introduction: Intervertebral disc (IVD) degeneration is associated with debilitating low back pain. IVD degeneration is a multi-factorial disease and degeneration can lead to a loss of function and pain. The pathobiology of IVD degeneration is poorly understood at this time. Therefore, the purpose of this study was to develop a novel model for IVD degeneration. We hypothesized that injured IVD will show lower levels of cell viability and altered extracellular matrix over a period of 21 days.

Methods: With IACUC approval, tails were collected from healthy, mature Sprague Dawley rats (n=4). Whole organ explants consisting of cranial vertebral body, cartilage endplate, IVD, cartilage endplate, and caudal vertebral body were then harvested. Explants were randomly assigned to either an injured (n=12) or uninjured (n=12) group. Injured explants were insulted with a 20G needle nucleotomy with an aspiration of 0.5 ml. Uninjured explants received no insult. Explants were harvest at day 14 (n=12) and day 21 (n=12) for cell viability and extracellular matrix analysis. Media was collected every 3 days for biomarker analysis.

Results: Data analysis is still being performed. Finalized data will be presented on the poster.

Discussion: From the results of this study, we plan to replicate degenerative-like changes in IVD in hopes of developing an optimal model for study of disc disease. We plan to assess the effects of injury to the annulus fibrosus and nucleus pulposus by using outcome measures such as cell viability, proteoglycan content, collagen content, and media biomarker concentration.
Documenting Luyia Together: Explorations of Tiriki Grammar
Patrick Skrivan, Autumn McLain, Rebecca Grollemund and Michael R. Marlo

Tiriki is an understudied member of the Luyia language cluster that is spoken in Vihiga County in western Kenya by a community of approximately 200,000 people. This poster presents the combined work of two student researchers on the ASH: Documenting Luyia Together team to describe the Tiriki language during the 2017-2018 academic year. Autumn McLain’s research has focused on the tonal patterns of nouns in the Tiriki lexicon, based primarily on data collected by Prof. Michael Marlo in 2016 and subsequently processed and compiled by other members of the ASH team in 2016-2017. McLain has developed a classification of the tone patterns found on Tiriki nouns. For instance, the four nouns *mu-limi* ‘farmer’, *mú-lína* ‘friend’, *mú-híní* ‘stick for threshing grain’, and *mu-lamwá* ‘sister-in-law’ all have high tones (indicated by acute accent marks) on different positions of the word. In total, McLain has identified around 8 tonal classes of nouns in Tiriki. Ongoing and future work includes comparing the isolation form of nouns with the pronunciation of nouns in phrases because some tonal classes are distinguished from each other only when the noun is combined with another word, such as a possessive marker. Patrick Skrivan’s primary research activity has been the development of a chapter on the structure of Tiriki nouns and noun phrases. He has identified the morphological and semantic properties of the many noun classes of Tiriki, which are signified with a prefix on the noun. For instance, the examples in the paragraphs above all have a *mu*-prefix which is found in class 1 to indicate humans and in class 3 to indicate a variety of semantic types including trees and body parts. Skrivan provides detailed description of noun modifiers and the way in which they agree with the head noun of the phrase.
Ashlee Slack
Sedalia, MO

Faculty Mentor: Dr. Anna Wehrwein, School of Visual Studies

Joint/compound
Ashlee Slack and Anna Wehrwein

This work is propelled by the investigation of everyday occurrences - what is typically given little to no attention, what goes unacknowledged - and how the overlooked contains power. My work pulls from the aesthetic vocabulary of Conceptual Art and Minimalism in order to address themes of power, whiteness, and facade. Common household products such as latex house paint, spackling, and bleach are applied directly on the wall in order to subtly alter the surface. The inherent banality of these materials is compelling because of their implicit power, and by adhering them to a white wall I enact a repetitive and redactive gesture. The futility of this act addresses the issue of the unseen, allowing the work maintain a transitory nature: the wall is consistently altered until the piece is completely removed, leaving a vacancy. The viewer may walk away with a heightened sense of awareness as they consider what they are not initially seeing, or will ever see. The shifts in the consistency of the wall implicate the materials used as well as the conventional white walls of our domestic and gallery spaces. This brings into question the constructed environment itself and creates a connection, both visual and political, between the pervasive power of whiteness.
Caileigh Smith
Klamath Falls, OR

Senior
Nutritional Sciences

Faculty Mentor: Dr. Steve Ball, Nutrition & Exercise Physiology

*Tradional vs. zoned playground at recess for physical activity in youth*
Caileigh Smith and Steve Ball

**INTRODUCTION:** Only 21.6% of youth (age 6-19) met the minimum recommendation of 60 min of moderate to vigorous physical activity on at least 5 days/wk. A “zoned” playground (ZP), or structured playground, may be more effective at providing physical activity opportunities over a traditional playground (TP).

**PURPOSE:** The purpose of this study was to compare physical activity of youth on a TP versus a ZP during recess.

**METHODS:** YMCA summer camp youth (N=91; 37 boys, 54 girls) average age 8.6 yr. participated in the study over an eight-week period. Pedometer, Fitbit steps/time, and SO-PLAY data were collected for 30 minutes during recess for 10 days (TP) and 12 days (ZP). TP and ZP were alternated every two weeks. During ZP, the same six zones were implemented and included, four square, basketball, hoops, walking track, flag tag, and prison tag.

**RESULTS:** Pedometer step counts, FitBit steps/time (intensity), and SO-PLAY systematic observations of physical activity were all significantly higher (p < .05) for ZP.

**CONCLUSION:** Zoned playgrounds appear to increase physical activity of youth over traditional playgrounds during recess. Future research should investigate the efficacy of zoning on increasing physical activity of the least active youth.
Caitlyn Smith
Chesterfield, MO

Senior
Biological Sciences

Faculty Mentor: Dr. Casey Holliday, Pathology & Anatomical Sciences; Dr. Kevin Middleton, Pathology & Anatomical Sciences

Bending properties of the lower temporal bar in ducks and its significance for cranial biomechanics
Caitlyn J. Smith, Alida M. Bailleul, Kevin M. Middleton and Casey M. Holliday

Few species evolved skulls as derived as ducks and other anseriform birds, which employ rapid, dexterous movements of the palate and jaws to feed. Despite their exceptional behavior and morphology, little is known about the structure and biomechanics of their jaw muscles, cranial joints, and linkages that facilitate cranial kinesis. The lower temporal bar (quadratojugal and jugal) links the quadrate and the upper beak and is flexible, but the structural properties underlying this flexibility remain unclear. We dissected the lower temporal bars from a sample of Mallard ducks. One side was fixed, imaged in microCT, and followed by histological sectioning at three focal areas. The contralateral side was tested in three-point bending following standard protocols to estimate whole element stiffness. We found the lower temporal bar was less mineralized than the quadrate overall, and became less dense rostrally. Second moments of area show that the lower temporal bar is about six times more resistant to bending about the mediolateral axis. Histologically, the lower temporal bar is homogenously constructed and resembles an avian mineralized tendon instead of cranial intramembranous bone. The Young’s moduli of the element are intermediate between mammalian fetal bone and haversian bone. We conclude that the flexibility of the lower temporal bar of ducks results from several changes to the shape and composition of the bone. This suggests birds may employ a diversity of modifications to skeletal tissues to facilitate flexibility in the bones of the feeding apparatus.

This project was completed to fulfill a Capstone requirement.
The effect of landscape on raccoon sex biased dispersal pattern
Emily L. Smith, Matthew E. Gompper and Lori S. Eggert

Sex biased dispersal is a phenomenon observed over a wide variety of taxa that has been suggested as a mechanism of inbreeding avoidance. Within mammals’ males are typically the dispersing sex which suggests that this might also hold true for raccoons (*Procyon lotor*). We tested whether the landscape and/or sex had a strong influence on raccoon gene flow. We used microsatellite genotypes data of raccoons in 10 populations to investigate the effects of landscape barrier, such as I-70, on raccoon gene flow among populations. We hypothesized that if there are landscape barriers that interfere with gene flow, then males would disperse further from the natal site than females. We analyzed the data for males and females separately and together to test for differences in patterns of genetic differentiation and structure. We did not find support that I-70 was a barrier for both sexes together; however, we found support for a difference in gene flow based on sex, with females staying closer to their natal sites than males. Further research will use mitochondrial DNA to enhance these findings.

This project was completed to fulfill a Capstone requirement.
Bukusu is a Bantu language spoken in Bungoma County, Kenya. With 1.4 million members (2009 Kenya Census), the Bukusu community is the largest member of the Luyia cluster of western Kenya and eastern Uganda. This presentation describes results of research carried out by several members of the ASH: Documenting Luyia Together team during the 2017-2018 academic year to document Bukusu, based on original data.

Elizabeth Kujath has co-authored a chapter describing noun phrases, building on work by Erik Platner and Emily Raney in summer 2017. Bukusu nouns fall into many different classes that mark singular vs. plural differences as well as other semantic differences. Observe the six different classes that the root -ndu takes: omuu-ndu ‘person,’ aβaa-ndu ‘people,’ sisii-ndu ‘thing,’ βiβii-ndu ‘things,’ axaa-ndu ‘tiny person/thing,’ βuβuu-ndu ‘place.’Nominal modifiers agree with the noun, usually taking on a prefix similar to the noun’s: ómúú-ndú ómu -βoofu ‘big person.’

Building on the research of Sarah Pribe and Alexa Thein in summer 2017, Clarabelle Fields has co-authored a study of the structure of verbs. This includes describing the prefixes and suffixes in the verb such as subject agreement markers, markers of tense and aspect, and suffixes that refer to a location.

Katrina Smith has written a description of basic syntax, focusing on word order. For example, in kámátúunda kakúsiβwa xúsóóko ‘Fruits are sold at the market’ the subject precedes the verb and the location is formed using a locative noun class marker xu- ‘at’. She is also studying the different forms of suffixes found in Bukusu verbs. For example, the causative suffix has a short form -y with most verbs, e.g. xuu-aand-y-a ‘to make stick’ (cf. xuu-aand-a ‘to stick’), but has a long form -isy with short verbs, e.g. xuu-kw-isy-a ‘to make fall’ (cf. xuu-kw-a ‘to fall’).
The relationship between emotional/rational and intuitive/deliberative decision processes and their relative contributions to decision quality, satisfaction, and regret

Lindsay Smith and Laura Scherer

Dual process theories make distinctions between Type 1 processes, which are faster, and intuitive, and Type 2 processes, which are slower and more deliberative (Evans, 2008). This suggests that emotions are used more readily in decisions that are made quickly rather than slowly (Epstein, 1994). This study analyzed the extent to which these decision dimensions – emotional vs. rational and fast/intuitive vs. slow/deliberative – are related. It was hypothesized that a deliberative process of thinking would cause participants to make better quality decisions and feel more satisfied and less regretful. Participants were randomly assigned to make a hypothetical medical decision and were assigned a deliberative decision-making strategy or a control condition with no specific decision-making instructions and were then questioned on a number of variables. Decisions were rated as intuitive/fast vs. deliberative/slow and emotional vs. rational, which were only weakly related, ($r = -.099, p < .001$). The emotional/rational rating was more strongly related to decision quality ($r = .16, p < .001$) than the fast/slow rating ($r = -.05, p = .06$). Participants who deliberated felt more satisfied compared to the control condition, and felt less regret, (deliberation $r = .29, p < .001$, regret $r = -.08, p < .01$). However, the emotional/rational rating was more strongly related to decision satisfaction ($r = .26, p < .001$) and regret ($r = -.27, p < .001$) than the fast/slow rating (satisfaction $r = -.06, p = .04$; regret $r = .04, p = .17$). Participants’ made fast “intuitive” decisions that they believed were rational and made slower “deliberative” decisions that they believed were driven by emotions. Moreover, the emotional/rational dimension predicted decision quality, satisfaction, and regret better than the intuitive/deliberative dimension. Overall, emotional decisions, but not necessarily intuitive decisions, were objectively worse in quality, and associated with less satisfaction and more regret.

This project was completed to fulfill a Capstone requirement.
Validation of a candidate locus influencing diet-dependent lifespan extension in *Drosophila melanogaster*
Sam Smith, Enoch Ng'oma and Elizabeth King

Lifespan extension under nutrient limitation is a common pattern among eukaryotes. Dietary restriction, a reduction of nutrient intake without starvation or malnutrition, was first shown to lengthen life in rodents and has since proved to extend lifespan in a diverse set of organisms. Lifespan and other life history traits are determined in part by genetic factors. When many genetic factors and the environment determine traits, it can be difficult to identify the individual loci involved. One approach is to use mapping populations in model organisms such as *Drosophila melanogaster* to identify potentially causative loci. A previous study found a putative locus influencing the degree of lifespan extension under dietary restriction on chromosome 3R. While suggestive, this locus did not reach statistical significance. This raises the question of whether or not the previously identified candidate locus on chromosome 3R truly influences the degree of lifespan extension under dietary restriction in *Drosophila melanogaster*. In this study, we compare the lifespan phenotype in genotypes B4 and B7 on chromosome 3R by targeting 25 RILs that have the B4 genotype and 25 with the B7 genotype at the putative QTL location. For each RIL, we reared 24 female and 6 male *D. melanogaster* on each of two food treatments, control and dietary restriction. By using quantitative trait locus mapping (QTL) to analyze our results, we predict to will find a significant association between the founder genotype at the putative QTL and the degree of lifespan extension under dietary restriction. Based on previous results, it’s predicted that the B4 genotype will show less lifespan extension than the B4 genotype.

*This project was completed to fulfill a Capstone requirement.*
Genetic analysis of immune gene expression in mutants of an Arabidopsis corepressor family
Samantha Smith, Christopher Garner and Walter Gassmann

Regulation of the plant immune system is important for controlling specificity and amplitude of responses to pathogens, and in preventing autoimmunity. Failure to control these processes can result in a reduction in fitness. In previous work, we reported that Arabidopsis SRFR1, a negative regulator of effector-triggered immunity, represses transcription of the TIR-NBS-LRR gene SNC1. Given the evolutionary similarity between SRFR1 and yeast SSN6, a protein that functions as a transcriptional repressor in a complex with a corepressor, we hypothesized that SRFR1 may interact with a transcriptional corepressor. To test this hypothesis, we crossed a SRFR1 mutant to mutants of the TOPELESS family, a transcriptional corepressor family in Arabidopsis. From these crosses, we observed a genetic interaction between SRFR1 and TOPELESS RELATED 2 (TPR2) and TPR3. In a srfr1 tpr2 double mutant we observed increased expression of SNC1 relative to srfr1. Expression was increased even further in a srfr1 tpr2 tpr3 triple mutant. However, no change in SNC1 expression was observed in a tpr2 tpr3 double mutant with wild type SRFR1. In order to determine if mutation in SRFR1 is necessary to observe increased SNC1 in tpr mutants, higher order tpr mutants will be made. Previous work has shown functional redundancy within the TOPELESS family, thus we hypothesized that functional redundancy with TPR4 is the cause for no increase in SNC1 expression in the tpr2 tpr3 double mutant. In order to test this, we have crossed the tpr2 tpr3 double mutant with a tpr4 single mutant in order to obtain a tpr2 tpr3 tpr4 triple mutant. Progress toward creation of this triple mutant and analysis of SNC1 expression in this genetic background will be presented.
In 2001, Allen Davis and his colleagues at the University of Maryland published their research paper, “Laboratory Study of Biological Retention for Urban Stormwater Management,” concluding that bioretention is a viable option for reducing concentrations of heavy metals, nitrogen, ammonium, and phosphorus in stormwater runoff. Davis’ paper states that “bioretention design requires a sandy loam soil or a texture near sandy loam,” yet most of Missouri is known to have soils high in clay, and therefore the bioretention cells may treat stormwater runoff differently due to the change in surrounding conditions. In an attempt to improve bioretention design for Missouri, this project explores the effects of various soil additives (gypsum, mulch, biochar, compost, and drinking water treatment residuals) on the removal of phosphorus, a nutrient abundant in runoff causing eutrophication & poor water quality in surface waters. To evaluate these additives, separate pilot-scale containers having a soil mix containing one of the respective additives were placed outside of the Grissum Building in Columbia to receive actual storm events, and a set of bench-scale containers were placed in the lab to receive controlled, synthetic storm events. Levels of phosphate for select storm events were tested using spectrophotometry to determine the amount retained in the soil. To date, it appears that these bioretention cells serve more as a source of phosphate rather than a sink. However, our data corroborate with further studies by Allen Davis stating that changes in the bioretention design can help to curb the release of phosphate from these systems.
Experimental test of mini chromosome transfer in haploid maize
Rami Soukieh, Nathan Swyers and James Birchler

Minichromosomes have promising potential in overcoming the challenges involved with generating transgenic plants. Preliminary evidence indicates that minichromosomes can be potentially transferred to haploids of many target lines when the minichromosomes are incorporated into a haploid inducer line. Such a procedure would greatly expedite the transfer of transgenes to multiple lines. Conventional genome manipulations generally depend on the random insertion of genes, and six or more generations of backcrossing are required to create an inbred line with a new transgene. After finishing the entire backcrossing process to create the needed line, an additional generation of self pollination is required to make the transgene homozygous. Even then, the line would not be completely homozygous due to linkage drag. However, the use of engineered minichromosomes would allow for accurate gene insertions into a single independent chromosome, creating completely homozygous lines in two generations. If minichromosomes could be transferred to haploid lines and then have the chromosomes doubled, the production of a homozygous line with added transgenes could be produced more quickly. The project involves a proof of concept using a minichromosome in an inducer that was crossed to a target line. The progeny are being screened for haploids with the minichromosome using selectable markers on the minichromosome and cytological verification. The success of this experiment could result in improved methods of crop modifications, thus allowing for advancements in biofortification and genomic manipulation of crops.

This project was completed to fulfill a Capstone requirement.
Cold calling a company is inherently a difficult task. It is widely known among salesmen that being friendly can lead to higher rates of ‘successful’ sales. Cold callers wishing to successfully land another meeting, pitch a service, or sell a product want to know some of the other contributing factors that they could improve upon that would ultimately lead to a ‘successful’ call. This research seeks to identify other contributing factors to ‘successful’ sales by analyzing both audio and transcript data for ‘successful’ and ‘unsuccessful’ sales calls. To find the most predictive features, we will compare results of various machine learning algorithms on various feature sets. The feature vectors will be constructed using metrics from both audio and transcript data such as speech rate, sentiment, psychological word categories, pitch, energy, frequency spectrums, etc. By increasing the accuracy of call outcome prediction, companies and their salesmen can tailor their approach to the customer. This could provide a deeper, more positive customer experience, which ultimately leads to more sales for the company.
In today’s world, media and social media have a growing presence that can influence voter decisions in a myriad of ways. The Pew Research Center suggests that a majority of U.S. voters get information about candidates and elections from social media. Studies suggest that voters use social media through a variety of platforms daily, often many times per day. As a result of this changing landscape, candidates must adapt their campaigns to engage in this new media arena. Using original data from Donald Trump and Hillary Clinton’s Twitter archives, articles from The New York Times and The Washington Post and records of Google Trends, this study seeks to analyze the impact that social media, specifically Twitter, can have on political candidates’ agenda setting and reverse agenda setting methods. I begin by analyzing each individual tweet from both primary 2016 presidential candidates and coding it to reflect the subject manner. I then selected three periods for each candidate when polling numbers dropped, signaling a negative period of the candidates’ campaigns. In comparing the averages during these times, this study finds evidence of candidates’ varying agenda setting via Twitter during times of turbulence in the campaign. When these periods were analyzed along with mention of candidates’ Twitter accounts in The New York Times and The Washington Post, this study ultimately found that Twitter played a role in reverse agenda setting mainstream news media outlets. Finally, when comparing Tweet trends to Google Trends based on the publics’ Google Searches, the study found significant evidence that Twitter and specifically candidates’ individual tweets can have a reverse agenda setting effect, showing a substantial increase in searches for terms relating to specific tweets.

*This project was completed to fulfill a Capstone requirement.*
Politics and news media are deeply intertwined, and political news coverage is often the subject of discussion and criticism. Throughout recent years of a volatile political climate, biases and accuracy of news media are continuously questioned. This study examines how the current political climate influences the 18- to 24-year-old Youth and Young Adult (YAYA) market’s attitudes and behaviors surrounding the news. This study explored the following research questions: What are the YAYA market’s attitudes towards politics and political news? What are their news consumption preferences? What are the motivations behind their news consumption? A survey was developed and distributed to a national respondent panel that resulted in a sample comprised of 722 complete responses, providing data to reveal the perceptions surrounding politics and news.

This project was completed to fulfill a Capstone requirement.
Influence of diet on the diversity of the *Drosophila melanogaste* microbiome
Caroline Statler and Elizabeth King

Many studies involving the microbiome have demonstrated the crucial role microbes play in the overall well-being of their host organisms. A well-sustained community of gut bacteria helps to provide nutrients, protect against harmful bacteria, and regulate the immune system. It has also been shown that the immune system and food intake of an organism together regulate the structure and diversity of the microbiome. Understanding the mechanics behind the relationship between the host and its associated microbiome allows for a better understanding of how factors like diet shape human health. The fruit fly *Drosophila melanogaster* (*D. melanogaster*) provides a practical model from which much can be learned and later applied to studies in humans. Previous studies with *D. melanogaster* have established that changes in diet induce changes in the density and diversity of bacterial species in the gut. To establish the effect of diet alone on our *D. melanogaster* lab population's microbiome, this project examines the effect of three different constant diets (high yeast, low yeast, and high sugar) on the diversity of the microbiome over one lifetime. In this study, 140 flies were raised on each diet, with half being sampled after 7 days and a half being sampled after 14 days. The sampling process included the dissection of guts from the flies and later DNA extraction and 16S sequencing. Based on previous *D. melanogaster* microbiome studies, we expected that the high sugar diet would decrease the total diversity of bacteria and an increase in bacteria of the genus *Providencia*. Additionally, we predicted that the low yeast diet would result in a higher proportion of *Commensalibacter* intestine bacteria than the control (high yeast diet). Results of this study have yet to be determined, as the 16S sequencing required to analyze changes in the microbiome is still in progress.
Identifying bacterial isolates from the Oak Ridge Nuclear Reservation in Tennessee
Keith Steiger Jr., Kara B. De Leon, Erica L-W. Majumder and Judy D. Wall

The Oak Ridge, TN site was first opened to provide enriched uranium for the Manhattan project and remained open to aid in thermonuclear production during the Cold War. Once radioactive processing ceased, the waste was dumped into nearby evaporation ponds, filled with gravel, and converted to a parking lot, which is still there today. The objective of this project was to isolate and identify bacteria from uncontaminated groundwater near the nuclear waste site in Oak Ridge, TN so that interaction studies could be designed to characterize communities of microbes and predict the effects of exposure to nuclear waste on the activity of these communities. The source of the samples was a well within the background area 2km from the contaminated ponds. A variety of media was inoculated with groundwater, attempting to maximize the diversity of isolates. Serial dilutions and plating on solidified medium resulted in 59 aerobic and 33 anaerobic isolates. For the identification of the genus or species of the isolates, we sequenced the conserved 16S ribosomal RNA gene for comparison with the available library of known sequences. So far 19 isolates have been sequenced, 11 aerobic and 8 anaerobic, the genera found include: *Pseudomonas, Leucobacter, Lysinibacillus*, and *Rhizobium*. The characterization of metabolic activity is in progress, identification of the isolates will lead into the characterization of communities.
Defense and developmental defects in dynamin-related protein network are independent of Flagellin Sensing 2
Hayley Stiers, Gayani Ekanayake and Antje Heese

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
American Mentacide: A philosophy of self-destruction
Ryan Stockton and Stephen Graves

The purpose of this study is to explore the concept of Mentacide in American history and its effects on contemporary African Americans. It’s defined as the systemic, deliberate destruction of a group’s collective mind with the aim of group termination. It utilizes institutions to destroy a peoples collective mind by penetrating and perpetuating alien culture, values, belief systems, or ideas for the purpose of group destruction. Mentacide is designed to reduce African Americans to a state of subservience that is essential for their psychological and social oppression. Additionally, it reduces them to a state of profound psychological incompetence in order to neutralize the community as self-directing antagonists. By implanting ideas or through subliminal suggestions of behavior that would ordinarily be rejected as unacceptable or abnormal, Mentacide not only undermines racial awareness, but also makes the African American population desperate enough to destroy themselves. This study uses a qualitative casual research methodology to demonstrate how the affects of Mentacide shape contemporary behavior within the African American community. Mentacide generally affects four areas: (1) behavior control, (2) thought control, (3) emotional control, and (4) information control. Economically, Mentacide in America is based in the socialization process within American capitalist institutions that break down the traditional value systems of people newly introduced to a culture and replacing them with values that are self-defeating. Ultimately, this paper examines the concept of Mentacide as a system of psychological intervention in which the oppressor injects their own thoughts and words into the minds and mouths of the oppressed.
Determining rate of macroinvertebrate predation on *Ambystoma maculatum* throughout larval development  

Piper Stretz, Jacob J. Burkhart and Lori S. Eggert

Understanding community interactions, such as predator-prey dynamics, is vital for determining species viability. Outside of larger macroinvertebrate predators, such as crayfish and dragonfly larvae, there is a paucity of information regarding small macroinvertebrate predator specificity within pond communities and predator effectiveness in consuming larval amphibians, such as Spotted Salamanders (*Ambystoma maculatum*), during aquatic life-stages. In this study, we examined the rate of macroinvertebrate predation of the *A. maculatum* at two points during larval development. We tested the individual effectiveness of seven macroinvertebrate predators belonging to the genera *Belostoma*, *Ranatra*, and *Notonecta*, or the families *Gyrinidae*, *Dytiscidae*, *Gomphidae*, and *Libellulidae* to consume *A. maculatum* at 1- and 3-weeks post-hatching (trial 1 and trial 2, respectively). In trial 1, we added 12 *A. maculatum* larvae and one randomly assigned predator per 38L aquarium, and counted the number of surviving larvae at 1, 2, 6, 12, and 24-hours post-predator addition. For trial 2, we added six larvae and one randomly assigned predator per aquarium and counted the number of surviving larvae at 1, 2, 6, 12, 24, 36, and 48-hours. We tested for significant difference in consumption rate among predator treatments using generalized linear models with a binomial error distribution. The results of each trial showed there was no significant difference in consumption rate among predators, and that mortality of larvae in predator treatments was not noticeably greater than the controls. Additionally, predator consumption of 3-week post-hatching larvae was lower than 1-week post-hatching larvae, suggesting that the size of *A. maculatum* could be an obstacle to predatory consumption. From these results, we conclude that the macroinvertebrate predators used in our study do not contribute significantly to predator-prey community interactions in habitats containing larval *A. maculatum*. Future work could investigate the role of competitive interactions among *A. maculatum* larvae and the tested macroinvertebrate predators.
Joseph Struttman
Union, MO

Senior
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Faculty Mentor: Dr. Paula McSteen, Biological Sciences

Reverse genetic approaches to understanding the role of auxin in maize development
Joseph Struttman, Diana Roberts Coats, Emily Bowen and Paula McSteen

The growth hormone auxin regulates nearly all aspects of plant development. Therefore, a better understanding of the genes controlling auxin biosynthesis, transport, and perception is fundamentally important to basic plant biology with applications in crop improvement. Previous phylogenetic and expression analysis has demonstrated both conservation and diversification of the role of auxin in maize and Arabidopsis development. We are using maize vegetative and reproductive development as a model to further understand how auxin regulates development using both forward and reverse genetic approaches. Reverse genetic analyses using transposon insertions and CRISPR technology coupled with higher order mutant phenotyping are revealing a more complex network than previously expected. Results from the ZmPIN and ZmTIR/AFB gene families, involved in auxin transport and perception respectively, will be presented.
Olivia Styron  
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Faculty Mentor: Dr. Rocio Rivera, Animal Science  
Funding Source: F21C Reproductive Biology Cluster

**Effects of endometriosis on imprinted DNA methylation in rat embryos:**  
*Optimization of bisulfite mutagenesis assays*  
Olivia Styron, Kathy Timms and Rocio Melissa Rivera

Endometriosis is a disease that causes uterine tissue to grow outside of the uterus, leading to pain, gastrointestinal and menstrual irregularities, and reduced fecundity. The causes of endometriosis are currently unclear, but affect 1/10 women in the U.S., often in familial clusters. We hypothesize that the multigenerational/transgenerational-reduced fecundity observed in endometriosis is due to epimutations at the DNA methylation level in the offspring – in particular at imprinted domains. Imprinting control regions (ICR) are differentially methylated regions of DNA, which control allele-specific expression of a subset of mammalian genes involved in growth and development of the conceptus. The goal of this project is to determine if endometriosis affects methylation imprints in 8-cell and blastocyst stage rat embryos, and if this effect is multi/transgenerational. Unlike human and mouse, rat ICRs have not been well characterized. The first step of this project was to locate homologous regions of DNA in the rat using murine genomic coordinates. Next, primers for the bisulfite mutagenized DNA were designed to amplify regions within the ICRs for each gene of interest, including Igf2r, Nnat, Gtl2, KvDMR1, and Peg3. Rat embryos at the 8-cell stage have 48 picograms of DNA, while blastocysts have ~360 picograms of DNA, thus creating a challenge for bisulfite mutagenesis analysis. Bisulfite mutagenesis can result in ~90% DNA degradation. We are currently optimizing the DNA isolation procedures, PCR conditions, and restriction digests using control (tail) DNA. To improve the chance of success, we will increase the amount of initial template with genomic plant (Maize/Arabidopsis) DNA prior to bisulfite mutagenesis. Amplicons will be sent for Sanger sequencing and methylation status of the ICRs will be determined. To avoid mutagenizing the DNA, we will also use 5meC antibody bound magnetic beads to capture methylated genomic DNA. This will be followed by quantitative PCR of the above-mentioned ICRs.
Correlation of osteoarthritic cartilage’s initial metabolism to the tissue’s metabolic response to impact injury
Jack J. Sudekum, Riley L. Short, Elizabeth A. Fletcher, James A. Keeney, James P. Stannard, James L. Cook and Aaron M. Stoker

Osteoarthritis (OA) is the leading cause of disability in the United States. Typically, the disease progresses from a focal lesion, and there is heterogeneity in the metabolism of the cartilage tissue across the surface of the tissue. It is not clear how these changes in tissue metabolism effect the tissue’s response to impact injury applied to the tissue. This study was designed to determine if there is a strong correlation between the tissue’s initial in vitro metabolism and the metabolism of the tissue in response to impact injury. It was hypothesized explants that produce high levels of inflammatory and degradative biomarkers will have a significantly higher increase in biomarker production in response to impact injury compared to low producing tissues. Methods: All procedures were performed with IRB approval (IRB# 1208392). Explants were taken from patients undergoing knee arthroplasty. The explants were cultured for 2 days prior to application of compressive injury at 50% strain at 100% strain/second. Pre-culture media was collected for biomarker analysis. Tissues were cultured for 6 days after injury, and media was changed on day 3, and collected on day 3 and 6 for biomarker analysis. Media was tested for inflammatory and degradative biomarkers. Results: Assays and data analysis for this study are ongoing and will be presented on the poster.
Memories and our confidence in their accuracy remain an important factor within many domains in our lives regarding attitudes, judgements, and behaviors. It is common to consider memory the sum of two processes. The explicit memory process results in outputs coupled with conscious recollective experience. The memories accompanied with conscious recollective experience we henceforth classify as “Remembered”. The second mode is an implicit memory system whose output memories are signaled by an absence of recollective experience. In the absence of recollective experience, we instead find a general feeling of familiarity. These implicit memories without recollective experience can be explicitly denoted as “Know”. One straightforward approach of assessing whether there are two memory systems is to ask people whether they remember or know memoranda, and seeing how the patterns of responses vary different memoranda types. Indeed, perhaps the best evidence for two processes with this approach comes from Gardiner and Java, who had people study words and nonword strings (e.g., “mafe”, “gleb”). Gardiner and Java found people indicated that they “Remembered” words but “Knew” nonwords, and the pattern was a complete crossover interaction. Gardiner and Java also found that for new words and nonwords, that is items that were not previously studied, there was no difference in response rates. In our view, this crossover interaction is the most constraining and persuasive behavioral result for two processes. It rules out alternatives, such as those based on shifts in criteria-for-response as there are no effects of item type for new items. In the last decade, there has been a “replication crisis” in which many previous findings in psychological science have been difficult to replicate. Given the importance and constraint in the Gardiner and Java, a replication is wise. And that is the goal of this research.

This project was completed to fulfill a Capstone requirement.
Microbial lipids produced from lignocellulosic biomass are considered an alternative to vegetable oil for producing biodiesel and fatty acid derivatives. However, microbial lipid production has low titer and productivity largely due to the low sugar concentration and inhibitory compounds in lignocellulosic biomass-based hydrolysate. To address these problems, a novel pretreatment based on an acidified, aqueous deep eutectic solvent was developed in this study to pretreat switchgrass, which was followed by the preparation of sugar hydrolysate from the pretreated switchgrass. Under optimized conditions, about 70% lignin and xylan can be removed during pretreatment, while more than 90% glucan was preserved. Two-dimensional HSQC NMR revealed that lignin recovered experienced partial cleavage of ether bonds. When the sugar hydrolysate prepared from the pretreated switchgrass was used as substrate, a lipid titer as high as 19.1 g/L and a productivity of 4.78 g/L h⁻¹ were reached by Lipomyces tetrasporus. Overall, this study demonstrated a new process for cost-effective lipid production from lignocellulosic biomass.
Student roles in active learning environment
Clarissa Swanson, Kiersten Timmer and Terrell Morton

This qualitative research study explores the roles students take on in an active learning teaching environment. Our participants for this study are students that are enrolled in a graduate level statistics course housed within science-focused department. Drawing on research literature in consultation with our data - focus group interviews and observations - we highlight four different roles enacted by students. These student roles are Active Teacher, Passive Teacher, Active Learner and Passive Learner. Each student role performed comes with its own opportunities, challenges and potentials related to their understanding of statistics. These findings initiate conversations on the importance of recognizing and unpacking students’ perception and understanding of their engagement within an active learning model and how it influences their use statistics within their graduate science experiences.
“Dignity” is a recurring word in opinions written by United States Supreme Court Justices. In particular, the justices invoke dignity in cases that protect same-sex marriage and abortion. However, the justices disagree on the exact meaning of “dignity,” as demonstrated in Justice Thomas’ debate with Justice Kennedy in Obergefell v. Hodges, the case that legalized same-sex marriage. Given the fundamental role of dignity in transformative cases, the meaning of this term is important for understanding the development and implications of certain individual rights. This thesis offers a definition of “dignity” by referring to opinions written by the Supreme Court Justices. I contend the meaning of “dignity” has dramatically developed over time. Whereas “dignity” originally stemmed from individual self-governance based on natural law principles, today some justices define “dignity” as the ability to govern one’s self by making personal, intimate decisions. I also conclude this modern definition of “dignity” is concerning, because it is not guided by the moral principles found within the natural law.

This project was completed to fulfill a Capstone requirement.
Targeted protein-metal nanocomposites for cancer drug delivery
Andrew Tarim, Abilash Gangula, Ajit Zambre, Anandhi Upendran and Raghuraman Kannan

Biocompatible and biodegradable human serum albumin (HSA) nanoparticles (NPs) and non-toxic gold (Au) NPs have been recently accepted as targeted drug delivery platforms for cancer treatment, enabling enhanced bioavailability of therapeutic agents at below-standard concentrations while simultaneously diminishing systemic side effects. Despite these progressions in nanomedicine, the effectiveness of a heterogenous protein- and metal-derived nanocomposite has yet to be explored. To investigate the preceding, we seek to produce surface-conjoined HSA and Au NPs capable of carrying both targeting and chemotherapeutic agents discriminately to cancer sites in a dual-nanotransport system. Herein, we successfully prepared previously optimized HSA NPs and subsequently conjugated Erbitux® (Cetuximab, or Cet), an epidermal growth factor receptor (EGFR) antagonist, or Herceptin® (Trastuzumab, or Tra), a therapeutic targeting agent for Human Epidermal growth factor Receptor 2-positive (HER2+) metastatic breast cancer, to the HSA NPs, generating HSA-Cet NP and HSA-Tra NP, respectively. In conjunction, adopted Au NP synthesis was followed by the attachment of Rubex®/Adriamycin® (Doxorubicin, or Dox), a non-specific antimitotic drug, thus forming AuRad™-Dox NPs. Lastly, attainment of dual protein-metal nanocomposites occurred by coupling target-selective HSA-Cet or HSA-Tra NPs with chemotherapeutic AuRad™-DOX NPs. Sufficient functionalization efficiency of the HSA and the Au intermediates was confirmed by protein estimation assay and fluorescence absorbance analysis, respectively. Presence of the nanoconstructs was supported by routine physiochemical characterization techniques, such as dynamic light scattering (DLS) and zeta potential measurements, and transmission electron microscopy (TEM) imaging. By examining the in vitro cytotoxicities of these targeted nanosystems in Dox-resilient breast cancer cell lines, and comparing them to corresponding cancer therapy standards, we can begin to understand their anticancer utility and, more profoundly, apply this passive and bioinert nanodelivery scheme to other disease states.
This presentation aims to present the results of a comparative study of the Luyia cluster of Bantu languages spoken in western Kenya and eastern Uganda. We propose a new classification of Luyia using phylogenetic methods. Our study is currently based on a 200 word list of basic vocabulary that is known to be reliable for historical linguistic studies, representing 37 language varieties from the Luyia cluster, the closest neighbors to Luyia, as well as a few more distantly related languages that function as controls. To build trees showing the relatedness between language varieties, we identified cognate sets for each entry by applying the Comparative Method and then applied the Neighbor-Net algorithm with representations displaying relatedness between languages. Our goal is to give a state-of-the-art comprehensive picture of the internal relationships among Luyia varieties in Kenya and Uganda, and the relationships between Luyia and its closest neighbors, including Ganda, Gwere, and Soga to the west, and Gusii and Kuria to the south. Our results are broadly consistent with past classifications by Mould (1976, 1981) and Williams (1973), but refine our understanding of the relatedness of the target languages by employing more extensive data from more languages within the Luyia cluster and others in the region.
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Faculty Mentor: Dr. Neil Fox, School of Natural Resources
Funding Source: CAFNR On Campus Research Internship (Dudley & Virgie Alexander Scholarship)

Using weather radar to detect Mayfly emergence from the Mississippi River at La Crosse, WI (KARX)
Emma Thomas and Neil Fox

Weather radar has been known to detect various phenomena extending beyond strictly meteorological phenomena, including anything from airborne animals to flying insects. This study focuses on the latter, specifically on mayflies. Mayflies have been known to emerge in large masses and interfere with travel and the everyday life of individuals living close to the hatch locations by way of completely covering bridges and other objects. Therefore, the purpose of this study is to examine how radar can be used to detect the presence of mayfly emergences occurring over a nearby body of water and identify characteristics associated with the hatches. This particular study used radar data in the months June and July from July 1996 to July 2017 from La Crosse, Wisconsin (KARX), which is adjacent to the Mississippi River. In addition to determining the days in which mayfly hatches could be identified using weather radar, this study also explores whether or not there is any correlation between average monthly temperature and the frequency of hatches that occurred in a given month. Preliminary results have indicated that there is an observable time frame for which mayfly emergences appear on the radar and that July appears to contain the most total identifiable mayfly hatches when compared to June. Overall, this study evaluates the use of weather radar to identify mayfly hatches and analyzes the various characteristics corresponding to these hatches. Furthermore, as this study progresses the potential for a climatological relationship will continue to be explored. Thus, subsequent work will explore whether site temperature regimes are associated with the timing and intensity of emergences across the years, which then can be used as an indicator of climate change.
Differences in adolescent disclosure to mothers and fathers in intact versus non-intact families
Kristin Thompson, Sonia Giron and Nicole Campione-Barr

Adolescents generally disclose more to mothers than fathers, and daughters are more likely to disclose information than sons. However, research has investigated intact families, and there are mixed findings on adolescent disclosure in non-intact families. According to social domain theory, adolescents disclose different types of information to different people across three domains: moral (issues of fairness and equality), conventional (social norms or rules), and personal (issues entirely up to individuals’ discretion). This study examines differences in domain of adolescent disclosure to mothers and fathers in intact versus non-intact families based on adolescent gender. The sample contained 122 predominantly White, middle-class first-born adolescents (61 female) in 8th-10th grade. 88 intact and 33 non-intact (i.e. divorced, widowed, separated, never married and not cohabiting) families participated. Disclosure was assessed using a revised version of Smetana et al.’s (2006) measure, in which adolescents reported frequency of their disclosure about 7 personal, 3 conventional, and 3 moral items to each parent, all with acceptable reliability. Responses were rated on a 5-point scale ranging from 1 (never tell) to 5 (always tell). A 2 (Parent Gender) X 2 (Adolescent Gender) X 2 (Martial Status) X 3 (Domain) repeated measures ANOVA was conducted. There was a significant Parent Gender X Marital Status X Domain interaction (F(2, 78) = 7.30, p < .001). Follow-up t-tests revealed the following patterns of results: teens disclose about moral issues more to mothers than fathers, only in intact families. Adolescents disclose personal issues more to mothers than fathers, regardless of marital status. There was also a significant Parent Gender X Adolescent Gender X Domain interaction (F(2, 78) = 5.79, p = .01). T-tests revealed that while both boys and girls disclose more to mothers than fathers about personal issues, girls disclose moral issues more to mothers than fathers, regardless of marital status.

This project was completed to fulfill a Capstone requirement.
Student roles in active learning environment
Kiersten Timmer, Claire Swanson and Terrell Morton

This qualitative research study explores the roles students take on in an active learning teaching environment. Our participants for this study are students that are enrolled in a graduate level statistics course housed within science-focused department. Drawing on research literature in consultation with our data - focus group interviews and observations - we highlight four different roles enacted by students. These student roles are Active Teacher, Passive Teacher, Active Learner and Passive Learner. Each student role performed comes with its own opportunities, challenges and potentials related to their understanding of statistics. These findings initiate conversations on the importance of recognizing and unpacking students’ perception and understanding of their engagement within an active learning model and how it influences their use statistics within their graduate science experiences.
For the past five years, women aged 20-21 were asked to determine their fundamental frequency using the freeware speech analysis program PRAAT. They were also asked to find their vocal range using this software as well as a virtual piano or standard piano keyboard. This data was analyzed for apparent changes in fundamental frequency over time. As has been reported by Decoster and Debruyne (2000) and Russell, Penny, and Pemberton (1995) regarding changes in female fundamental frequency, this data supported the idea that fundamental frequency has decreased in recent history. Median frequency decreased from 294 Hz to 220 Hz with piano keyboard correlates of D4 (above C4/middle C) to A3. Further analysis of changes in vocal range over time will also be included in this study, as well as analysis of additional physical changes in women that may influence fundamental frequency.
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Oral ingestion of menthol in mice with dysphagia due to ALS  
Shahadah Triche, Kate Osman and Teresa Lever

Research abstract withheld at the request of the faculty mentor for proprietary purposes.

This project was completed to fulfill a Capstone requirement.
Mindfulness, defined as a clear awareness of thoughts, emotions, actions, and surroundings (Brown et al., 2007; Mishra, 2004), has been associated with enhanced self-regulation (Brown et al., 2007). System justification theory refers to an individual’s perception of the current social system as fair, legitimate, and justified, and motivation to maintain the current structure of the system (Jost & Banaji, 1994). This current study examined how compassion meditation and system threat might affect system justification (SJ) and negative racial attitudes (NRA), and whether internal motivation to control prejudice (IMCP) moderated effects.

A sample of 212 Psychology 1000 students who self-identified as White/European American participated. There were three phases of the study session. In the first phase, participants answered a 10-minute survey on demographics, compassion, bias awareness, and empathic concern. Participants then were randomly assigned to listen to a compassion meditation or “mind-wandering” (control) audio-recording. In phase three, participants were randomly assigned to read about a race-related and non-race-related vignette. The SJ, NRA, and IMCP of White European Americans toward African Americans was measured. IMCP was negatively correlated with SJ, r = -.32, p < .01, and NRA, r = -.68, p < .01. IMCP was a significant predictor of SJ in each vignette condition. Participants that reported greater system justification also expressed more NRA, r = .26, p < .01. In addition, data suggested that for the race-related passage, participants tended to express less support for the stratified system after listening to a compassion meditation recording as compared to listening to the control audio. For those reading the non-race-related passage, the mindfulness conditions reported similar levels of SJ.

This project was completed to fulfill a Capstone requirement.
Examining young children's language ideologies
Lauren Vannatter and Angie Zapata

This research examines the existing language ideologies in a Midwest, general education elementary classroom. Previous studies have provided in depth analyses of the language ideologies among linguistically diverse high school and middle school students, leaving questions regarding how young children, including those who identify as English-dominant, make sense of their languaging practices. Drawing from a larger study examining how teachers and students cultivate translingual literacies in their classroom through linguistically diverse poetry picture books, we utilized a constant-comparative method to analyze focus students’ pre- and post- interview data. Interviews were audio recorded and transcribed. Based on our analysis, we have identified two overarching themes that identify how children understand their own and others’ languaging practices. Students are eager to grow their language awareness and demonstrate great curiosity for languages other than their own, yet they live in tension between monolingual expectations in school and their aesthetic appreciation for language diversity, especially in writing. The data suggests that children come to school with pre-existing ideologies about language that teachers can access to enhance students reading and writing development and to challenge monolingual norms in language and literacy instruction.
Panacea’s Glass: Mobile cloud framework for communication in mass casualty disaster triage
Aidan Verhulst, John Gillis, Ashley Bartels, Mihai Popescu, Stephen Barnes, Jennifer Doty, Dena Higbee, Salman Ahmad and Prasad Calyam

Mobile Ad Hoc Networks can overcome lack of the infrastructure due to a disaster incident, but can also be subject to severe node failures/ high mobility that degrade performance of the common routing solutions such as WiFi 802.11s (HWMP) mesh routing standard. Geographic routing is a desirable approach in this scenario due its low application level throughput overhead and high network mobility/failures tolerance. However, it does not guarantee packets delivery due to the local minimum problem. We will overcome inefficiency in geographical routing. Our portable infrastructure independent platform solution detects geographic routing zones on satellite imagery where it is unlikely to have mobile devices and thus connectivity for disaster communications. Advanced detectors today are based on deep learning -we will use machine learning algorithms over satellite imagery available at the mobile edge servers (e.g. Raspberry Pi or Intel NUC) to learn geographic areas where a MANET is used.
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vSocial: Social virtual reality learning environment to train youth with Autism Spectrum Disorder
Weston Verhulst, Sai Shreya Nuguri, Songjie Wang, Srinivas Abhinay Jangati, Zhihai He and Prasad Calyam

This project investigates and develops vSocial, a Virtual Reality Learning Environment (VRLE) for children with Autism Spectrum Disorder (ASD), based on iSocial, an existing desktop-based learning application. vSocial offers a VRLE to children with ASD via the ability to simulate real world scenarios in a carefully controlled environment. The novelty of this work lies in the combination of social networking in VR via a high-speed connectivity implementing powerful, low latency server connectivity. In this poster, we present our latest development efforts in creating a set of user-friendly, high-speed, low-latency immersive learning units for geographically-separated students using a vSocial user portal. Specifically, we show our preliminary results on how the vSocial portal provides an instructor with a more efficient and centralized access to curriculum content and performance monitoring of the students progress in the social VR sessions.
Heavy alcohol use is associated with several problems (e.g., drinking and driving, violence), and constructs such as impulsivity (Dick et al., 2011), and explicit/implicit associations of alcohol (Reich, Below, & Goldman, 2011) have been associated with heavy usage. According to a dual process model, explicit and implicit associations should affect heavy drinking in different ways (Smith & DeCoster, 2000). Thush et al. (2008) demonstrated that explicit positive associations were better predictors of drinking in those with high working memory capacity, whereas implicit positive associations were stronger predictors of drinking in those with low memory capacity. Burton, Pedersen, and McCarthy (2012) found that urgency, an impulsive trait, moderated the association between implicit associations and alcohol use. The present study tested whether intoxicated impulsivity moderates the association between implicit and explicit associations of alcohol using an alcohol administration paradigm. Participants (n= 161) completed several questionnaires/tasks at baseline, were administered alcohol or placebo, and then completed task/questionnaire packets on the ascending/descending curve of the BAC. Our results indicated that intoxicated impulsivity did not moderate the effect of explicit or implicit associations regardless of valence or BAC curve limb. We found partial support for a dual process model using an impulsivity questionnaire at baseline. The association between positive explicit associations and binge drinking was moderated by trait impulsivity (b = .19, p < 0.001). There was also a significant interaction between trait impulsivity and negative explicit associations (b = 0.13, p< 0.01). Our results generally support the dual process model, but don't extend support for this model to intoxicated impulsivity. Future research should test whether the dual process model affects in-the-moment decisions under intoxication, an important aspect of this theory.

This project was completed to fulfill a Capstone requirement.
Bullying has become a pervasive problem among school aged-youth. According to recent data from the United States Department of Education, approximately 1 in 5 students report being victimized within American schools. Two of the most common predictors among youth that experience prolonged victimization are social and communication skills deficits. Therefore, it’s critical to examine the relationship between social skills instruction and youth who have been identified with low social skills. The current study highlights data and outcomes from a larger project that is a collaboration from the Mizzou Ed Bully Prevention Lab, Boone County Mental Health Coalition, and 9 partner elementary schools. Schools used a teacher-reported behavior checklist to identify students who may be at-risk for bullying involvement due to low social or communication skills. Additionally, teachers and students completed a pre/post survey related to skill development and bullying involvement. Overall, 439 students in grades K-5 were involved in the study, where they received eight weeks of targeted, small group instruction in response skills related to bullying scenarios presented through an interactive curriculum called Cool School. Based on pre/post analyses, teachers reported significant increases in prosocial behaviors, emotion regulation, and academic competence; where students reported significant increases in prosocial behaviors, academic self-efficacy, and decreases in victimization. This study demonstrates that targeted, skill-based instruction can increase prosocial behaviors and academic outcomes, while decreasing victimization. Therefore, educational stakeholders should begin to emphasize the importance of social and emotional learning as a critical component of students’ daily curriculum.
Moving work zones are commonly utilized for road maintenance such as striping, sweeping, and pothole patching. When these work zone vehicles are in operation, warning is given to passing drivers through the use of arrow boards, signs, and flashing lights. Additionally, warning vehicles in these moving work zones are often equipped with a Truck-Mounted Attenuator (TMA) which helps lessen impact from collisions. Collisions with TMAs may be caused by driver inattention. In an attempt to obtain drivers’ attention and reduce the number of crashes in moving work zones, the idea of using an alternate colored light (green light), as opposed to the traditional amber and white lights, was proposed. To study the effectiveness of using a green light on construction vehicles, a driving simulator study was utilized. Study participants drove through multiple work zones containing construction vehicles with different light patterns. The light patterns included the traditional amber and white light pattern, the proposed green light only light pattern, and two alternate light patterns that utilized green lights combined with the traditional amber and white lights. Study participants’ reactions to each light pattern, including their change in speed and how quickly they merged away from the TMA, were observed. Additionally, participants were asked to complete a survey regarding their experience with the different light patterns at the end of the study. In addition to the simulator study, a field study was conducted to observe speeds and merging behavior when drivers encountered TMAs with the different light patterns on Missouri roads. The results of both of these studies were analyzed and it was determined that all light patterns, including the traditional light pattern and the proposed light pattern using only green lights, were effective. There was not one light pattern that was clearly superior to another.
Characterizing conductance variations in model crab cardiac ganglion large cells
Jing Wang, Pranit Samarth, Daniel R. Kick, David J. Schulz and Satish S. Nair

The crustacean cardiac ganglion (CG) network in Cancer borealis consists coordinates the rhythmic bursting of the heart muscle contractions to control the circulation of blood. Although the network consists only nine cells, five ‘large cell’ motor neurons (LCs) and four small endogenous pacemaker cells (SCs), the role of the large cells with variable sets of conductances, in coordinating the features of the network rhythm remain unclear. We developed an improved multi-compartmental biophysical model for the LCs that better represents the morphology including locations of SC-LC synapses. The nominal model used reported conductance data including from our own current measurements. Earlier, we reported single cell model predictions about correlations among conductances that preserved LC response characteristics. The revised LC model is used to first investigate potential distributions of conductances in multiple compartments to preserve the same passive and current injections properties. The set of single LC models from such a study will then enable an investigation of correlations between maximal current conductances, both within a single compartment and across compartments that preserve response characteristics at the single LC level. These LC models with variable underlying conductances are then used in network models to study the effect of variations in the underlying conductances, and of the LC-SC feedback, on the features of the network rhythm.
Experiments and enhancements of streaming clustering
Yiqing Wang, Omar Ibrahim and James Keller

Clustering is one of the most important unsupervised learning methods to explore unlabeled data. Although a large number of researchers have been applying traditional clustering techniques, only few approaches deal with streaming data clustering, that is, features that are produced continuously. Our research project seeks to find an approach to cluster streaming data and validate the goodness of clustering results. Firstly, I compared the feasibilities of different internal clustering validation measures and decided to use Xie-Beni and Davies-Bouldin indices in an existing clustering algorithm, which was developed by my mentors, Professor Keller and Omar Ibrahim, his PhD student. After that, I generated the videos to view the behaviors of Xie-Beni and Davies-Bouldin indices as the data points come in to the algorithm. Then, we extended our research by running tests with the real datasets provided by University of Eastern Finland. I also tested our algorithm with high-dimensional datasets (32 - 1024 dimensions). The results show us that the algorithm has a good performance in dealing with high-dimensional real datasets. I also used a time series dataset to test the algorithm ability in drift detection, and the result shows the algorithm's robustness in detecting drifts in the data. This test gave us confidence to apply the algorithm in big time series data. For now, we have done extensive experiments to cluster different datasets and to validate the goodness of clustering results. In the next step, we want to explore new enhancements of our existing clustering approach. For example, using it with very large datasets and verifying its ability to work with big streaming datasets. Also, developing a new incremental cluster validity index is one of our goals. This enhancement can help us to apply our algorithm in very big real world datasets and fill in the vacancy in the study of clustering.
What factor(s) most influence student academic achievement when socioeconomic status changes over time?
Caiden Webb, Laura Brusati, Madeline Dingman, Precious Hardy, Shannise Jones and Stephen Whitney

Measures of class such as Social Economic Status (SES) are continually one of the largest predictors of student academic achievement. What is less studied is how SES works in increasing or decreasing academic achievement. Our study examined students who changed SES over a four-year period and improved one standard deviation in reading. We compared these cases with students who did not increase in SES and were below one standard deviation in reading growth between first and fifth grade. The data utilized the ECLS K-8 nationally represented longitudinal data set. There were 1,156 students in the non-moving SES, below one standard deviation growth group and 106 students in the improved-SES and improved-reading group. We examined approaches to learning, self-control, parental academic expectations, parental support for education, school level problems, and neighborhood problems. Our results indicated a significant difference in neighborhood problems between the two groups. No other comparison was significant. The results may indicate that SES acts as a suppressor on academic achievement. One explanation is that cases which improve in SES are starting with strong individual and family contexts but academic achievement is suppressed due to the stress of low income. When SES improves, the rich contextual support for academics allows reading to improve dramatically. Both individual and family level variables did not change over time when SES improved. Further, only one of the external variables changed when SES changed, neighborhood problems. That may indicate a move within school districts, but to a different neighborhood with less problems. These findings may demonstrate that the context of academic achievement is set early in a student’s school career. This supports the importance of early childhood education.
Lucky Lake is a granite-related tungsten-zinc-lead deposit located ~ 60 km southeast of Cantung, one of the largest tungsten deposits in the world. Lucky Lake is unusual due to its base-metal enrichment relative to other tungsten deposits of the region. There is also the potential for gold and silver in its ores, due to the deposit’s location within the overlap of the Canadian tungsten belt and the Tintina gold-silver-bismuth province, which stretches across Alaska into northwestern Canada. The goal of this research is to document the relative timing and pressure-temperature-geochemical conditions of tungsten and base-metal deposition. This study employs a variety of geochemical techniques to decipher the nature of the ores, including: petrographic, cathodoluminescent and ore microscopy of thin and polished sections; SEM analysis of ore and gangue mineralogy; and fluid inclusion microthermometry of ore-related minerals. In particular, detailed SEM analysis of the ore minerals will document the trace and minor element character of the Zn-Pb event and will permit us to test the idea of involvement of gold-bearing fluids in the hydrothermal system. Results to date indicate that tungsten ± copper mineralization was deposited early from magmatic-related fluids like those at Cantung (~ 430 to 590 degC). Fluid inclusions in ore-associated quartz suggest that zinc mineralization (followed closely by lead sulfide deposition) was the result of a later event(s) at lower temperatures of ~ 300 to 240 degC from fluids with salinities < 5 wt. % equivalent NaCl. The Lucky Lake deposit’s zinc and lead enrichments appear to be related to a later hydrothermal overprint not observed in the world-class Cantung mine’s ores. Recognition of this late-stage epithermal event has implications for regional exploration for zinc-lead ores elsewhere in northwestern Canada.
Evaluation of green lights on TMAs
Colby Wedwick, Elizabeth Farr, Jacob Kaltenbronn, Eunice Wang and Carlos Sun

Moving work zones are commonly utilized for road maintenance such as striping, sweeping, and pothole patching. When these work zone vehicles are in operation, warning is given to passing drivers through the use of arrow boards, signs, and flashing lights. Additionally, warning vehicles in these moving work zones are often equipped with a Truck-Mounted Attenuator (TMA) which helps lessen impact from collisions. Collisions with TMAs may be caused by driver inattention. In an attempt to obtain drivers’ attention and reduce the number of crashes in moving work zones, the idea of using an alternate colored light (green light), as opposed to the traditional amber and white lights, was proposed. To study the effectiveness of using a green light on construction vehicles, a driving simulator study was utilized. Study participants drove through multiple work zones containing construction vehicles with different light patterns. The light patterns included the traditional amber and white light pattern, the proposed green light only light pattern, and two alternate light patterns that utilized green lights combined with the traditional amber and white lights. Study participants’ reactions to each light pattern, including their change in speed and how quickly they merged away from the TMA, were observed. Additionally, participants were asked to complete a survey regarding their experience with the different light patterns at the end of the study. In addition to the simulator study, a field study was conducted to observe speeds and merging behavior when drivers encountered TMAs with the different light patterns on Missouri roads. The results of both of these studies were analyzed and it was determined that all light patterns, including the traditional light pattern and the proposed light pattern using only green lights, were effective. There was not one light pattern that was clearly superior to another.
Fillers (e.g., “um” and “uh”) are used frequently in the speech of both children and adults. Some have argued that fillers are used for pragmatic purposes in conversation, to signal to the listener that there will be a delay in speech (Clark & Fox Tree, 2002). Whether or not this is the case, it is clear that fillers increase the duration of an utterance, allowing extra time for linguistic planning. In individuals who stutter, however, the stuttering also serves to increase utterance duration and planning time by slowing the production of the utterance. The purpose of this study was to compare the frequency and duration of filler use in children who stutter (CWS) and children who do not stutter (CWNS) across four speaking tasks. Twelve CWS and 12 CWNS were pair-matched on age and gender. All participants performed within normal limits on a series of speech sound and language measures. Children completed four tasks: Divergent Categorical Naming, Sentence Completion, Sentence Formulation, and a conversation language sample. The frequency of filler use and the duration of the fillers were analyzed for each task. Findings revealed that the tasks varied in the amount of fillers produced, with the language sample containing the most fillers for both groups. Of importance, the sentence formulation task resulted in the production of significantly fewer fillers for the CWS group than the CWNS group. Results are interpreted in the context of the role that stuttered disfluencies may play in increasing an utterance’s duration, thereby increasing planning time and reducing the need for filler use.
Influence of physical activity or sedentary home cage conditions on diet preference and consumption patterns in a model of palatability-driven feeding

Valerie N. Weise, Jenna R. Lee, Anna M. Tamasi, Melissa A. Tapia, Emily L. Bathe, Jane R. Nelson and Matthew J. Will

Obesity continues to be an epidemic in America and the present study aims to understand the underlying mechanisms and relationship between food and exercise rewards. Specifically, we are assessing palatability driven feeding, a behavior that precedes obesity. The study will examine both male and female rats and the influence of physical activity within an opioid mediated animal model of palatability feeding (Pecina & Berridge, 2005; Will et. al, 2009). One week prior to surgery, rats will be housed in cages with either access to a voluntary running wheel (RUN) or no running wheel (SED). Following one week in these conditions, rats will have cannulae implanted targeted above the nucleus accumbens. Following 5 days of post-op recovery, rat will be given daily 2-hour access to high-fat and high-carbohydrate diet for 6 days in novel feeding chambers. Following the baseline phase, rats will begin receiving intra-accumbens injections of the opioid antagonist naltrexone (0, 20µg, 50µg/0.5µl) or the µ-opioid agonist DAMGO (0, 0.0025µg, 0.025µg, 0.25/0.5µl) and then given access to both high-carbohydrate and a high-fat diet for 2 hrs. Drug treatments will be administered in a counterbalanced order. Daily body weight, consumption of home cage chow, running distance and duration, will be recorded. We are expecting a dose response of drugs - higher levels of DAMGO should elicit higher amounts of feeding on the rats preferred diet, and higher levels of naltrexone should diminish feeding of the preferred diet. Additionally, we expect to see rats in the RUN condition have diminished effects of DAMGO compared to rats in SED condition; the reward from the RUN treatment substituting for the rewarding properties of the preferred diet. The current proposed study would reveal the nature by which physical activity levels can alter motivation to consume palatable food.

This project was completed to fulfill a Capstone requirement.
PARP inhibitors and targeted radiation therapy: An innovative approach for prostate cancer treatment
Reneise M. White, Tammy L. Rold, Nkemakonam C. Okoye and Timothy J. Hoffman

The American Cancer Society projects that there will be 29,430 deaths from prostate cancer (PC) in 2018. For this reason, our lab is evaluating $^{177}$Lu-RM2 as a viable targeted radiation therapy (TRT) agent that causes DNA damage. Recently, Poly (ADP-Ribose) Polymerase inhibitors (PARPi’s) have been shown to be beneficial in treating other cancers by inhibiting the repair of DNA damage. Thus, our lab is investigating the use of TRT in combination with FDA approved PARPi’s in order to decrease prostate cancer cell survival. Human prostate cancer cells (PC3) were plated the day before treatment. Cells were treated with TRT (5uCi-40uCi) for 4 hours. After 4 hours, TRT was removed and either Olaparib (0.25uM-1.5uM) or Rucaparib (0.5uM-2.0uM) was added into fresh media followed by 24 hour incubation. 53BP1 foci were analyzed to assess DNA damage. For clonogenic plates, media containing PARPi was refreshed every 3-5 days with cells fixed at 12-14 days. The surviving fraction of PC cells was determined. DNA damage assessed using the 53BP1 marker indicates that Olaparib is superior to Rucaparib when cells are treated with TRT (40uCi) and PARPi (1 uM). This data suggests that Olaparib + TRT would be more cytotoxic than Rucaparib + TRT based on observed DNA damage. Clonogenicity data reveals that Rucaparib + TRT is superior to Olaparib + TRT in achieving overall prostate cancer cell kill. Expansion of this study to include additional PC cell lines will validate these preliminary findings.
The role of thioredoxins in the oxidative stress response in a sulfate-reducing bacterium
Fawn Whittle, Erica L-W. Majumder and Judy D. Wall

Desulfovibrio vulgaris Hildenborough (DvH) is an anaerobic sulfate-reducing bacterium found in various environments including oil pipelines and heavy metal-contaminated sites. Oxidative stress, induced by reactive oxygen species (ROS), is harmful to DvH. Our research focuses on the role of thioredoxin proteins in the oxidative stress response of DvH. Thioredoxins are disulfide isomerases that are known to be involved in the oxidative stress response in other bacterial species. DvH has two thioredoxins. One, known as Trx1, has a highly conserved active site with homologs seen in many other organisms. The other, known as Trx3, has an unusual active site. Thioredoxins reduce cellular disulfide bonds by use of two cysteine residues in the active site. In Trx3, these cysteines have a unique spatial relationship not seen in Trx1. We propose to construct markerless deletion mutants for the two thioredoxins and three thioredoxin reductases in DvH and test the viability of these mutants under hydrogen peroxide-induced oxidative stress. We predict that if the thioredoxins or thioredoxin reductases are deleted, we will see a decrease in cell viability in these mutants when stressed compared to the parental strain. We also predict that there may be differences between the observed phenotypes of the Trx1 and Trx3 mutants because of their differing active sites and therefore different substrate proteins. Our experiments will confirm if thioredoxins have a role in the oxidative stress response of DvH, providing a basis for further research into the mechanisms of this role.
Finite element analysis of the savannah monitor, Varanus exanthematicus, and its implications for Lepidosaur cranial kinesis

Alec T. Wilken, Kevin M. Middleton, Kaleb C. Sellers, Ian N. Cost, Rachel E. Rozin and Casey M. Holliday

Many lizards, birds and other vertebrates exhibit cranial kinesis or movement among skull bones. Although the skeletal anatomy of some cranial joints are understood, how these joints are built histologically and how they are loaded during feeding remains poorly understood. To determine the impact of soft, connective tissues in the skulls of kinetic vertebrates we developed a Finite Element model of Varanus exanthematicus that mimics different types of kinetic linkages including fused, synovial and ligamentous joint types. Muscle force magnitudes were calculated from physiological cross-sectional area estimates, muscle attachments were mapped and several muscle force load patterns were created using Boneload computational methods. These load cases allowed us to better elucidate the role of the protractor and pterygoideus musculature in the palate as well as the skull in general. These load cases were applied to models with different soft tissue linkages to better learn the role of soft tissues and the protractor musculature in cranial kinesis. Modeling joints as non-bony soft tissues produced deformations that more closely approximated known in vivo feeding kinematics. This concordance affirms the model's ability to mimic feeding mechanics; therefore, the methods used to develop the varanid model can be used to test hypotheses about the functional and evolutionary variation of cranial kinesis in not only lepidosaurs but also other vertebrates.
The Portrait
Ben Willis-Teff

I work in film because I believe the medium most closely mirrors life. Great films – stories – take us to the edge of our beliefs and threads just enough truth to let the audience suspend reality for the sake of being entertained. When I am filming, I look for the images that are in my subconscious; the images and emotions that came to me even before I put the words to the script. A painter does the same thing; they transfer their subconscious to the canvas. The screen is my canvas. I originally thought of the idea to write The Portrait as I was traveling through Spain. I attended a bullfight. A violent, emotional, red image came to me, and I thought of somehow incorporating this image into a painting. The idea morphed into film, because I wanted to explain how an artist could paint such an image. Painting is an anxiety-provoking endeavor. The solitary exactitude of painting can take a toll on an artist, especially if the artist’s reality is suspect. My protagonist is such a fragile being. His vision of life is his art as art is his life. His passion takes him to the edge of reality. My antagonist is a normal, rational being, chosen to contrast the artist. I want the audience to wonder why she was chosen. How could she not see his madness and if she did see it, what made her participate in his scheme? I want the audience to wonder if there is a way to bring him back. I want the filmgoer on the edge of the seat, suspending belief while willing the images into the brain. I believe the film creates the art in the mind of the viewer.

This project was completed to fulfill a Capstone requirement.
Twenty percent of all sexual crimes are committed by youths (Pastore & Maguire, 2007). Research indicates that these crimes have multiple correlates and causes (i.e., individual, peer, family, academic) in the youth's social-ecological environment (Ronis & Borduin, 2007). However, little attention had been given to whether the correlates and causes differ by youths' racial and ethnic backgrounds. In addition, the mechanisms underlying such differences have not been examined, despite there being considerable racial and ethnic diversity among juvenile sexual offenders. The present study evaluated (a) differences between African American, Hispanic/Latino, and White juvenile sexual offenders on key individual and social-ecological characteristics and (b) mediators of these variables. African American (n = 68), Hispanic/Latino (n = 36), and White (n = 20) males aged 11-17 years (N = 124) with adjudicated sexual offenses completed measures assessing: (a) deviant sexual interests, (b) family functioning, (c) parenting practices, (d) school performance and (e) deviant peer associations. Between-groups differences on social-ecological characteristics were evaluated using ANOVA. Then, bootstrapping with confidence intervals was used to detect mediators for differences. Latino youths reported significantly fewer deviant sexual interests than African American or White youths. Moreover, African American youths had significantly higher grades than Latino youths, and White youths had significantly higher levels of adaptability than did Latino youths. These between-groups difference were mediated by deviant peer associations, parental communication, and parental discipline. The results of the present study indicate that there were several differences between African American, Hispanic/Latino, and White youths on key social-ecological variables while differences did not emerge for several other social-ecological variables. Furthermore, there were several variables that mediated differences between African American, Hispanic/Latino, and White youths on these social-ecological characteristics. Together, these results suggest that racial and ethnic background may play a key role for tailoring ecological interventions for juvenile sex offenders.
Adolescents’ gender and communication style: Effects on young adults’ educational and career choice
Megan Wilson, Saivaroon Gajagowni, Tateanna McCaskill, Sophie Endacott and Amanda Rose

Psychologists have long been interested in why people choose a particular college major or occupation. Much research has been done to try to pinpoint factors that play a role in these choices (Lent & Brown, 2013, Betz & Hackett, 1981). However, relatively little research has addressed the role of communication style. In this research, we test whether adolescents’ communication style impacts their later college major or career choice. The original data collections included a sample of 642 adolescents in 2007-2009. The youth brought a friend to the lab to complete various tasks, including a joint decision-making task in which participants planned a party. From this task, communication style was coded using methods similar to previous studies (Leaper, 1991). Thought units were coded as Collaborate, Oblige, Inform, Control, Affiliative/Off-topic, and other. Girls were found to produce more collaborative and oblige statements than boys. The current data collection involves following up on these participants who are now young adults (ages 21-26). To date, 225 have completed an online questionnaire, and recruitment continues. Of relevance to the present study, the questionnaire assesses educational and vocational experiences. Data from The Bureau of Labor and the National Center of Education is used to classify educational and vocational choices as male-typed, female-typed, or gender neutral. Data analysis is currently underway. Multiple regressions analysis is used to test whether adolescents’ communication predicted later educational/vocational choices, and meditational analyses to test whether adolescent communication helps account for gender differences in young adults’ educational/vocational choices. Youth with particularly sex-typed styles are expected to avoid educational/career choices typical of the other gender. Of particular interest, communication style is expected to play a role in women’s avoidance of male-dominated fields, including STEM. There are negative implications for individuals and society when qualified women avoid male-dominated fields, making this especially important.

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Chronic pain (CP) is generally defined as a pain, which persists beyond the time typical for healing an injury, which is more than 3 to 6 months. Once pain becomes chronic, it will not resolve to an acute or pre-acute stage. Individuals who suffer from chronic pain are more likely to experience greater symptoms of negative affect. However, we are uncertain whether the relationship between chronic pain and negative affect are consistent across chronic pain conditions. For this study, we examined behavioral data from three groups (healthy controls, chronic low back pain, and fibromyalgia [HC, CLBP, FM]) to identify if chronic pain type influences the degree to which individuals experience negative affect. Specifically, we wanted to discover if chronic pain groups (FM and CLBP) experience different levels of negative affect emotions. The data from 156 participants across three groups were analyzed for this study (HC=42, CLBP=79, FM=35) mostly from the Columbia, MO area. As part of the study, all participants completed a series of questionnaires that provided demographic and pain-related mood information. The results from an ANOVA of demographic variables revealed no differences among the groups in regards to ethnicity and education. However, there were significant sex and age differences among groups. Further, results from ANOVAs identified discrete group differences on various measures of negative affect. In general, both CP groups had poorer ratings than HCs, and FM individuals had significantly worse ratings than the CLBP group. The findings from this study suggest that chronic pain adversely enhances negative affect compared to healthy controls. Moreover, the results indicate that the experience of chronic pain varies with condition. Our results are consistent with the need for the development of group dependent, if not individually tailored, treatment approaches. This research is supported via a NIH-NINR grant: R01 NR015314-01A1.

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Blurred Lines: Student led discussions on sexual violence in the Black community
India Woods, Brittany Fults and Velma Buckner

Blurred Lines was an interactive program, which addressed the biases and myths regarding relationship violence, rape culture, and sexual assault in the Black Community. This was a scenario-based educational opportunity which directly confronted and aimed to eliminate misconceptions that are embedded within Black communities, in regard to what violence looks like and who is affected. Further, we presented this creation of the program, as well as the effects of the program, and encouraged other leaders at multiple institutions to implement similar plans. We challenged these leaders to look into the ways in which their institutions addressed relationship violence, rape culture, and sexual assault and to attempt to make changes where they are needed.
The significance of mothers’ attachment representations for maternal sensitivity in distressing versus non-distressing caregiving contexts
Anna M. Wright, Rachael Robinson and Ashley M. Groh

Although previous meta-analytic evidence indicates that mothers’ attachment representations are a robust predictor of maternal sensitivity (Van IJzendoorn, 1995), the magnitude of this association is surprisingly small. Some attachment scholars have argued that the attachment system is a bio-behavioral stress regulatory system, and thus, associations between attachment and sensitivity might be stronger in distressing caregiving contexts (Thompson, 1997). However, it remains unknown whether mothers’ attachment representations are more strongly associated with their sensitive caregiving behavior during distressing (versus non-distressing) caregiving contexts. This study addressed this important gap in the literature by examining whether mothers’ attachment is more strongly associated with sensitivity in distressing versus non-distressing contexts. The sample for this study comprised 140 mothers of six-month-old infants. Mother-infant dyads were video recorded during a free play interaction and during the Still-Face Procedure (Tronick et al., 1978) which has been used in prior research to examine mothers’ responding to infant distress (Groh et al., 2017). Two separate coding teams coded maternal sensitivity in the distressing and non-distressing caregiving contexts. Within one week of the first laboratory visit, mothers completed the Attachment Script Assessment, the measure of adult attachment used in this study. A linear regression was conducted with mothers’ attachment variation regressed on maternal sensitivity to distress and non-distress. The full model was significant, F(2, 24) = 2.33, p < .05 (one-tailed), and accounted for 16% of the variance. As expected, mothers’ attachment security was positively associated with their sensitivity to distress (b = .51, p < .05, one-tailed) and mothers’ attachment security was not significantly associated with their sensitivity to non-distress (b = -.21, p = .21, one-tailed).

This project was completed to fulfill a Capstone requirement.
On August 9, 2014, Michael Brown, a black male resident of St. Louis County, was shot by Darren Wilson, a white police officer of the Ferguson Police Department. Unrest and outrage ensued, and it reached a climax when on November 24, 2014, Wilson was acquitted of his murder of Mike Brown. Newspapers the day after blasted pictures of fire and violence on their front pages. “Arson, riots erupt in Ferguson,” read the *St. Louis Post-Dispatch*. “Fury boils over,” from the *New York Times*. The *New York Post* followed up with pictures of flames, labeling it “streets of rage.” “Tears, then violence,” was the headline for the *Miami Herald*. It is with no doubt that the news media has played a part in the public’s perception of social issues and events. Media “constitutes a crucial site for the construction of reality,” defining what is normal and abnormal (Boykoff 2006). As a result, media coverage is important to understand, as it shapes how movements develop and form (Boykoff 2006). But news media has had a history of being criticized for not covering news fairly. Many in the black community, backed by research, have claimed “the ways in which African American criminal suspects are depicted imply that they are likely to be particularly violent or threatening” (Oliver 2003). However, news media is not one, uniform entity. Not only are there simply different types of news media, but some journalists are better at covering things than other journalists. To label and generalize media as just one would be quite unfair. What this research does is specifically look at the media coverage of the Ferguson unrest and compare and contrast different types of media coverage and the frames they employed. Along the way, we analyze the impact the coverages have on readers, conclude what went wrong and what went right, and explore how media coverage of social events like the Ferguson protests can improve.
Understanding transitivity of preferences when agents make inconsistent choices in 10.5-month-old infants
Julie Youngers and Yuyan Luo

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Does intrinsic interest promote meaning in life?  
Ziyue Yu, Jake Womick and Laura A. King

The meaning-as-information approach predicts that meaning in life (MIL) ought to be responsive to rewarding stimuli in the environment, particularly to changes in dopamine in the brain’s reward centers (Heintzelman & King, 2014). Research on the neuroscience of intrinsic motivation supports that intrinsically interesting tasks are associated with activation of the striatum, suggesting that such tasks involve “rewards” from within (Kang, 2009; Lee & Reeve, 2017). The present study tested whether exposure to intrinsically interesting stimuli promotes MIL, positive mood, and life satisfaction. 425 adults were recruited on Amazon Mechanical Turk to complete online studies. First, participants completed established measures of theoretically relevant individual differences and then were randomly assigned to one of two conditions. In the experimental group, participants read questions previously identified (Kang et al., 2009) as intrinsically interesting and curiosity-provoking. In the control group, the questions had been identified as not intrinsically interesting. For each question, participants rated how curious they were about the answer. Next participants completed the dependent measures in counterbalanced order, including, the presence of meaning subscale of the Meaning in Life Questionnaire and the Satisfaction with Life Scale. Participants rated how much they were currently feeling positive affect and for negative affect (Diener, Smith, & Fujita, 1995). Finally, participants rated their surprise at the answers and completed a recall test for the questions. T-tests will examine whether condition affected MIL, mood, and SWLS. In addition, regression analyses will be used to test whether condition moderated the relationships among the dependent measures. If exposure to intrinsically interesting stimuli enhances MIL (and not PA or SWL) this would provide support for the idea that intrinsically rewarding stimuli are (perhaps uniquely) relevant to the experience of MIL.

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Identifying regulators of the Fe homeostasis network via a yeast 1 hybrid
Christopher Zachary, Sammuel MacInturf and David Mendoza-Coatzl

Research abstract withheld at the request of the faculty mentor for proprietary purposes.
Gustatory receptors (Gr) are a family of transmembrane proteins that have been extensively studied in the context of insect taste and odor sensory systems. A recent study identified Gr28bD, a member of the *Drosophila* Gr family, as a key player in thermosensation. Very little is known about the structure and function of Gr28bD, other than having a putative seven-transmembrane domain architecture. In a previous study, we showed that Gr28bD exhibits a non-inactivating, temperature dependent, cation non-specific current, when expressed in *Xenopus laevis* oocytes. Here, we identified and tested Grs from other *Drosophila* species and discovered that their temperature response varies across species. By comparing the Gr28bD sequence with these orthologs, we identified functional domains. We then generated various chimeric constructs and obtained proteins with distinct properties, including temperature dependence. We expect these results to aid in the design of new thermogenetic tools for extrinsic neuronal control.

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Faculty Mentor: Dr. Rainer Glaser, Chemistry
Funding Source: Life Sciences Undergraduate Research Opportunity Program (LS UROP)

Confronting the complexity of nonlinear systems: Acid-dependency of the Fe-catalyzed Belousov-Zhabotinsky oscillating reaction
Ethan Zars, Marco Delaros, Carmen Chicone and Rainer Glaser

The Belousov-Zhabotinsky oscillating reaction (BZR) is the model oscillating reaction in the field of non-linear chemical dynamics. The BZR consists of the metal-catalyzed bromate oxidation of a dicarboxylic acid in dilute sulfuric acid. We study the bromate oxidation of malonic acid catalyzed by the Fe(II)/Fe(III) couple. Oscillations are visible because of the colors associated with the different oxidation states of the metal species: Red Fe(II) and blue Fe(III). We have been studying the BZR with experimental measurements, mathematical modeling, and mechanistic analysis. In the laboratory, we found experimental conditions that allowed for the reliable reproduction of BZ reactions with variations of selected parameters (sulfuric acid concentration and pH) and the video-recording of the reactions. The analysis of the videos involves several layers of mathematical modeling. Color analysis of the video frames as a function of time gives time traces associated with characteristic colors. Extrema analysis of the time traces allowed for the extraction of timing information and, specifically, the period times $PT(t_i)$, oxidation times $OT(t_i)$, and reduction times $RT(t_i)$ over time. The results of the kinetic analysis have allowed us to refine the mechanistic understanding of the oscillating reactions. Kinetic simulations have implicated the step returning bromide ions to the solution in causing the effect of acidity on oscillation parameters. Dissociation of the phenanthroline ligands surrounding the catalyst and protonation of the organic substrate may be involved in determining the rate of this step. We will highlight new results on the acidity dependence of key parameters describing the oscillating reactions catalyzed by the Fe(II)/Fe(III) redox couple.
**Jiajun Zhou**  
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Faculty Mentor: Dr. Clintin Davis-Stober, Psychological Sciences

*The use of improper linear models in the take-the-best heuristics*

Jiajun Zhou and Clintin Davis-Stober

Major Purpose: The well-known Take the Best (TTB) heuristic (Gigerenzer and Goldstein 1996) has been found to perform well in choice tasks (e.g., Border, 2001). In fitting existing data, TTB will be as successful as any linear model if the cue validities and weights in the linear model have the same orders (Martignon & Hoffrage, 2002). However, it is improper to use linear model if people don’t know the cue validities. Hence, the improper model of strategy selection is constructed. We considered the weighting scheme provided in Davis-Stober, Dana (2010), which is an n*p matrix of cue where p is the number of informational cues. We also investigate the weighting schema assigning a weight of 0 to all predictors except one and a compensatory weighting rule assigning all weights equally. Each condition of the model will be evaluated and compared to look how people weight selection schemes using the TTB heuristic.

Procedure: Our simulation was applied to the environment that predicts the population of German cities by nine different cues. The dataset contained 83 observations by 9 cue predictors and the actual population of each German city. The dataset was split into two subsets: test and training set. In the training set, we evaluated the parameters of each model (weighting vectors, validities) and in the test set, we applied the estimated parameters to predict, for each model, the paired comparisons of populations. We randomly selected two observations from the test set and repeated 1,000 times to investigate results.

Conclusion: In sum, we found that the models are differentially influenced by the information that the training set provided. The predictive accuracy of the model of the linear representation have the same performance as the TTB model and we can conclude that it is the linear representation of the TTB model.

*This project was completed to fulfill a Capstone requirement.*
Development of genetic systems for heavy metal-resistant environmental isolate Paenibacillus strain
Jennifer J Zulovich, Grant M Zane, Michael P Thorgersen, Michael W W Adams and Judy D Wall

Heavy metals are a concern in contaminated environmental sites due to their detrimental effects to the local flora and fauna. Possible solutions to these problems can oftentimes be found by studying the local populations of microbes that survive, or may even thrive, under these harsh conditions. Isolated strains of bacteria from a heavy metal impacted site have been identified by screening for those that could tolerate a mixture of metals which is typically inhibitory. Strains that grew well were identified as strains of interest for further characterization. The goal of this project is to further develop the genetic system of one of the Paenibacillus strains of interest and generate mutant strains. Previous work has shown that this strain is transformable using an adapted protocol originally for Gram-positive Bacillus subtilis and the plasmid pBAV1K-T5-gf. We are currently in the process of generating an argH deletion strain. This will serve the purpose of both testing if mutant strains can be generated for further characterization, and to test for an arginine auxotrophic strain.