MID-SURE

July 24 2019

Mid-Michigan Symposium for Undergraduate Research Experiences

WELCOME

Thank you for attending the 2019 Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE) at Michigan State University. Our goal is to provide a forum for undergraduates in the region to share and discuss their research as well as create networking opportunities with graduate schools and researchers.

Undergraduate students from diverse academic disciplines will present their outstanding research and creative endeavors at Mid-SURE. 406 students from more than 100 different institutions are participating in this year's event. These students are mentored by more than 350 faculty members, post-doctoral researchers, and graduate students.

As one of the nation's leading research institutions, MSU offers a breadth of experiences and opportunities that actively engage students in their education. Through undergraduate research and creative activities, students work closely with leading scholars to gain in-depth knowledge about their fields of study and have opportunities to apply classroom learning to real-life situations.

We encourage the student participants, faculty members, research mentors, and guests to walk around the forum and learn about the impressive work of our next generation of scholars and researchers. Thank you for joining us.

MID-SURE PLANNING COMMITTEE

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Elahé Crockett
REPID Program Director

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Cover image designed by Jenna Jia
Graduate Design major and member of the Design Center of MSU

UNDERGRADUATE RESEARCH AT MSU

MSU UNDERGRADUATE RESEARCH INITIATIVE

Michigan State University's **Undergraduate Research Initiative** strives to increase opportunities for students to engage in research, scholarship, and creative activity and expand the pool of faculty and partners engaging students in their scholarly work. The Undergraduate Research Office annually disperses undergraduate research grants, sponsors professional development workshops, awards undergraduate research travel grants, and creates materials to promote undergraduate research. The office sponsors two undergraduate research forums annually: the University Undergraduate Research and Arts Forum (UURAF), held each April, and Mid-SURE, held each summer. For more information about MSU's undergraduate research initiative, visit urca.msu.edu.

PARTNER PROGRAMS

Mid-SURE is a collaborative effort between the Undergraduate Research Office, BEACON, EnSURE, REPID, and SROP. Program descriptions and contact information are provided below.

BEACON

The **BEACON Center for the Study of Evolution in Action** approaches evolution in an innovative way, bringing together biologists, computer scientists, and engineers to study evolution as it happens and apply this knowledge to solve real-world problems. BEACON is an NSF Science and Technology Center, headquartered at Michigan State University with partners at North Carolina A & T State University, University of Idaho, University of Texas at Austin, and University of Washington. For more information about undergraduate research opportunities in BEACON, contact Dr. Judi Brown Clarke, Diversity Director, at jbc@msu.edu.

ENGINEERING SUMMER UNDERGRADUATE RESEARCH EXPERIENCE

The Michigan State University College of Engineering sponsors **EnSURE,** which is designed to engage high achieving students in faculty-mentored research. Students are paired with faculty in one of eight engineering departments and engage in 10 weeks of full-time research activities, ranging from "bench science" in a laboratory to on-site fieldwork and computational modeling. Students are exposed to a variety of research activities and participate in weekly professional development activities designed to help students understand and prepare for graduate studies. For more information, contact Dr. Katy Luchini Colbry, Director of Graduate Initiatives and Coordinator of EnSURE, at colbryka@msu.edu.

REPID PROGRAM

The **Research Education Program to Increase Diversity in Health Researchers (REPID)** program provides research training and enrichment experience for MSU undergraduate, graduate, and medical health professional students from underrepresented, minority, and disadvantaged groups. The program aims to increase the number and diversity of researchers in health-related research by providing a supportive environment for accomplishment and advancement with the goal of preparing students to pursue research careers in cardiovascular, pulmonary and hematologic disciplines. REPID is funded through support from the National Heart, Lung, and Blood Institute. For more information, contact Dr. Elahé Crockett, Program Director, at repid@msu.edu, or visit www.repid.msu.edu.

SUMMER RESEARCH OPPORTUNITIES PROGRAM

The **Summer Research Opportunities Program (SROP)** is a gateway to graduate education at Michigan State University. The goal of the program is to increase the number of domestic under-represented students who wish to pursue graduate study. The program helps to prepare undergraduate students for graduate study through intensive research experiences with faculty mentors and professional development activities that give students a competitive advantage. For more information, contact Steven D. Thomas, Program Manager at the Graduate School, at deshawn@grd.msu.edu.

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*Abstracts are chronological by presentation number

SCHEDULE OF EVENTS

All events occur on the 4th floor of Spartan Stadium.

TIME	EVENT	LOCATION
10:00 AM – 11:15 AM	Presenter Check-In & Set-Up	Huntington Club – 4th Floor Lobby
11:30 AM – 12:45 PM	Session A Presentations	Huntington Club – Main Floor
1:00 PM – 2:15 PM	Session B Presentations	Huntington Club – Main Floor
2:30 PM – 3:45 PM	Session C Presentations	Huntington Club – Main Floor
11:30 AM – 4:00 PM	Graduate School Fair	Huntington Club – Main Floor

Poster Presentation Schedule

Students will only be present at their poster during the following assigned times:

CATEGORY	SESSION	TIME
Agriculture & Animal Science	A	11:30 AM – 12:45 PM
Biochemistry & Microbiology	B	1:00 PM – 2:15 PM
Biosystems & Agricultural Engineering	C	2:30 PM – 3:45 PM
Cell Biology, Genetics, & Genomics	B	1:00 PM – 2:15 PM
Chemical Engineering & Materials Sciences	C	2:30 PM – 3:45 PM
Civil & Environmental Engineering	C	2:30 PM – 3:45 PM
Computer Science & Engineering	C	2:30 PM – 3:45 PM
Communication Arts & Sciences	A	11:30 AM – 12:45 PM
Electrical & Computer Engineering	C	2:30 PM – 3:45 PM
Environmental Sciences & Natural Resources	A	11:30 AM – 12:45 PM
Epidemiology & Public Health	A	11:30 AM – 12:45 PM
Integrative Biology	A	11:30 AM – 12:45 PM
Mechanical Engineering	C	2:30 PM – 3:45 PM
Pharmacology & Toxicology	B	1:00 PM – 2:15 PM
Physical & Mathematical Sciences	C	2:30 PM – 3:45 PM
Social Sciences	A	11:30 AM – 12:45 PM

GRADUATE SCHOOL FAIR

We are pleased to incorporate a graduate school fair into Mid-SURE. Students who are interested in pursuing graduate school are encouraged to connect with representatives from the following institutions/departments:

INSTITUTION	DEPARTMENT
Michigan School of Professional Psychology	Office of Admissions
Michigan State University	College of Engineering
Michigan State University	Osteopathic – PhD Program
Michigan State University	Institute for Global Health
Michigan State University	Microbiology & Molecular Genetics
Michigan State University	The Graduate School
Michigan Technological University	The Graduate School
Northwestern University	IBiS Graduate Program
The Ohio State University	College of Engineering
Rensselaer Polytechnic Institute	Graduate Admissions
University of Kansas	Self Graduate Fellowship
Van Andel Institute	Graduate Program

Monitoring Host Plant Volatiles in Genotypically Variant Ash (Fraxinus Spp.) that were Artificially Infested with Emerald Ash Borer (Coleoptera: Buprestidae) Larvae
Minali Bhatt, Michael Martinson, Josie Griffith
Category & Time: Agriculture & Animal Science, Section 1, 11:30 AM - 12:45 PM
Poster: 1
Mentor: Therese Poland, Toby Petrice, Robert Stanley

Emerald ash borer (EAB) is an invasive beetle that has been decimating ash tree populations within continental North America, starting in 2002 in southeastern Michigan. EAB affects ash trees in both the adult and larval stages, where the larvae feed on the phloem of the tree while the adults feed on the leaves; the larval stage of EAB is significantly more detrimental than adult feeding. The effort to understand the interaction between EAB and its host plants is an important process, especially with the addition of five species of ash (Fraxinus spp.) listed as critically endangered on the IUCN Red List in 2017. Although mortality rates of North American ash species are extremely high, some genotypes manage to persist on the landscape for years after all other ash have died. Grafted individuals of several of these genotypes were artificially infested with EAB larvae and tree volatile attractants were monitored at several intervals after the infestation. Volatile attractants from infested trees and uninfested trees (i.e., controls) were collected using adsorbent powder and vacuum pump systems. The volatiles were then extracted from the absorbent powder and run using a gas chromatograph mass spectrometer. Volatiles from infested and uninfested trees will be catalogued and compared to help identify potential volatiles that could indicate EAB preference. This information will be useful for identifying and developing North American ash varieties that are resistant to emerald ash borer.

The Effects of Planting Population and Soil Fertility on Tar Spot of Corn
Evan Buckner
Category & Time: Agriculture & Animal Science, Section 1, 11:30 AM - 12:45 PM
Poster: 2
Mentor: Martin Chilvers

The disease tar spot of corn was first described in Mexico by Maublanc in 1904 as being caused by the fungi Phyllachora maydis and Coniothyrium phyllachorae. Subsequently a third fungus Monographella maydis was indicated to be part of the disease complex by Muller and Samuels in 1984. In 2015, Ruhl et al. identified the first incidence of tar spot in the United States in Indiana and Illinois, but only found a single causal organism, Phyllachora maydis. With recent identification in Michigan in 2016, farmers reported a 50 bushel per acre loss with recent studies projecting up to 50% yield loss in the United States. With most corn varieties being very susceptible to disease, studies have been initiated to screen for variety resistance. Additionally, fungicide trials for the management of this disease are also in their infancy. Little is known about the epidemiology of this disease, and how factors such as planting populations and soil fertility may influence disease progression. We hypothesize that lower plant populations will slow spread of the disease infection and applying low rates of nitrogen will not induce pathogenicity. To test these hypotheses an experiment examining the effect of plant population and an experiment studying the influence of nitrogen rates were established in both Allegan and Montcalm county. The planting population trial consisted of four plant populations of 28, 34, 40 and 46 thousand plants per acre. The soil fertility trial consisted of three rates of nitrogen of 80, 160, and 240 lbs per acre.

Both studies were established on two corn hybrids of differing susceptibility to tar spot. Through these studies we hope to determine the influence of plant population and nitrogen rates on tar spot disease development.

The Effects of Juvenile Social Play on Fitness in Spotted Hyenas
Jessica Calvario
Category & Time: Agriculture & Animal Science, Section 1, 11:30 AM - 12:45 PM
Poster: 3
Mentor: Kay Holekamp, Tracy Montgomery

Social play is virtually ubiquitous among young animals. Social play behavior provides positive behavioral outcomes and is critical to the normal development of juveniles. It is well known that there are costs and benefits of play behavior. Some of the costs of play behavior include reduced time spent foraging, energy expenditure, injuries/deaths from accidents and elicited aggression, and increased predation risk due to reduced vigilance. Some hypotheses about the benefits to play behavior include enhancing motor abilities, training for unexpected events, practicing for adult skills, and strengthening social skills. Here, we focus on how juvenile social play affects fitness using spotted hyenas (Crocuta crocuta) as our model system. Spotted hyenas perform high rates of social play while juveniles, and even adult hyenas engage in social play. We hypothesize that juvenile social play enhances fitness, and thus we predict that individuals who play more as cubs are more likely to survive to reproductive maturity, enjoy greater longevity, and ultimately have higher reproductive success than individuals who play less as cubs. We use data from the Mara Hyena Project, namely focal animal surveys (FAS) conducted in 1988-2003 on individual cubs between the ages of 0-24 months in the Maasai Mara National Reserve in Kenya. Data were extracted from the collected field notes and entered into an MS Access database. We then used a generalized linear mixed model to investigate the relationship between juvenile social play and fitness in spotted hyenas.

Variability of Seed Microbiomes of the Common Bean (Phaseolus Vulgaris L.)
Jacqueline Carroll
Category & Time: Agriculture & Animal Science, Section 1, 11:30 AM - 12:45 PM
Poster: 4
Mentor: Ashley Shade

Numerous studies have shown the importance of plant microbiomes in plant fitness, along with revealing that plants vertically transmit their microbiota to the next generation via the seed. Thus, the seed is considered as the starting point of microbiome assembly within plants. Plant microbiomes are also heavily influenced by the genotype of the host plant and environmental factors such as nutrient availability and drought. These stressors have been shown to translate on a microbial level, as changes in environment can be reflected in changes of microbiome composition. Plants may selectively preserve certain members of their microbiota within their seeds when grown under stressful conditions, leading to a natural question regarding the effects of environmental stresses on seed microbiome assembly and heritability between generations. The purpose of this study is to investigate and evaluate the variability of seed microbiomes of the common bean (Phaseolus vulgaris L. var, Red Hawk), and establish a

baseline for seed microbiome variation. The seeds were harvested from 3 plants grown within a growth chamber. Genomic DNA extractions are being conducted on four seeds per pod, three pods per plant, for a total of 36 seeds. Seed microbiota will be identified via PCR amplification of the 16S rRNA, gyrB, and ITS genes for bacteria, archaea, and fungi respectively. The composition and diversity of microbial communities associated with seeds will be explored through multi-media culture-based methods. The results of this study will provide important information regarding the structure and variation of seed microbiomes among seeds, pods, and plants.

Comparison of Total Radiographic Bone Aluminum Equivalences (RBAE) from Digital Radiographs to Bone Ash Content of the Equine Third Metacarpal
Brittney Emmert
Category & Time: Agriculture & Animal Science, Section 1, 11:30 AM - 12:45 PM
Poster: 5
Mentor: Brian Nielsen, Cara Robison

Previously, estimating bone mineral content (BMC) in horses with RBAE used film radiographs. As digital radiographs are now common, post-image processing distorts RBAE values, making it ideal to use unprocessed images. Results from digital radiographs have not been compared to actual BMC. This study compared bone measurements using calipers on bone to using imaging software on radiographs and compared RBAE values from raw radiographs to BMC from bone ash. Dorsal-palmar (DP) and lateral-medial (LM) digital radiographs were taken of 6 MCIII from equine cadavers with an Al stepwedge in the view. A cross-section from the midpoint of the bone was analyzed using imaging software. Total RBAE was measured by taking the intensity*area of the cross-section of bone and expressing it to a known volume of Al calculated from the intensity*area of the stepwedge. A cross- section of each bone corresponding to the area analyzed on the radiograph was excised. Cortical thicknesses and DP/LM inner and outer diameters were measured using calipers on each sample and imaging software on radiographs. Bone samples were ashed, which was then recorded as BMC. All cortex measurements except palmar trended toward being similar ($P<0.09$). LM outer diameter and DP/LM inner diameter were similar ($P<0.01$). DP outer diameter tended to be the same ($P=0.07$). Total RBAE compared to BMC showed a strong correlation ($P<0.01$). These results suggest that using digital radiographs for bone measurements is accurate, confirm the strong relationship between total RBAE and bone ash, and emphasize the need to use unprocessed radiographs for digital analysis.

The Increased Levels of Mast Cells in the GI Tract in Early Weaned Stressed Pigs
Jocelyn Garcia
Category & Time: Agriculture & Animal Science, Section 1, 11:30 AM - 12:45 PM
Poster: 6
Mentor: Adam Moeser

Early life adversity (ELA) is a significant risk for functional gastrointestinal disorders including irritated bowl syndrome (IBS) later in life. Previous studies using an animal model of ELA, early weaning stress, showed that early weaned pigs have higher blood levels of mast cell histamine following weaning stress suggesting that mast cell activation could be an important early mechanism for later life intestinal

disorders. Mast cells are well-known to be activated by allergens and pathogens, and play roles in immune responses, and tissue remodeling and wound healing, However, very little is known about intestinal mast cell activation in response to ELA. In order to gain a better understanding as to why there is an increase in activation of mast cells, we evaluated intestinal mast cell number and localization in the small intestine and colon of early weaned and later weaned (control) pigs at multiple time points. A computer software called ImageJ will be used to count the number of MCs within the ileum, jejunum, and the colon of twelve randomly selected weaned piglets. We plan to count the average of MCs from the accumulated data as well as the average area. We anticipate in finding a correlation between the number of MCs and the age of the pig models. This could be due to the model's sensitivity at their current age or their age itself. Our future findings can lead to therapeutics that will relieve gastrointestinal stress disorders in the long-term for both animals and humans.

Characterizing resistance to multiple SDHI fungicides in Botrytis cinerea using phenotypic and genotypic approaches
Lexi Heger
Category & Time: Agriculture & Animal Science, Section 2, 11:30 AM - 12:45 PM
Poster: 7
Mentor: Timothy Miles, Safa Alzohairy

The fungal pathogen Botrytis cinerea, causal agent of grey mold in over 200 dicotyledonous plants, is known as a high-risk pathogen for its rapid development of resistance to fungicides. The prompt introduction of FRAC 7 Succinate Dehydrogenase Inhibitor (SDHI) fungicides has given growers the ability to control some fungal pathogens, but repeated fungicide applications have created resistance in numerous B. cinerea populations. Resistance to these SDHI fungicides develops due to single point mutations that occur in one or more subunits of the SDH gene, B, C, or D, with mutations in SDHB being the most common. In this study, 15 isolates were collected in the years of 2014 and 2018 from various Michigan locations and analyzed as being sensitive or resistant to FRAC 7 fungicides (Fluopyram, Boscalid, Pyraziflumid, Kenja, Aprovia, and Fluxapyroxad) by amending media with 11 concentrations ranged from 0.01ppm-100ppm of each fungicide. The purpose of this study was (1) to determine the effective concentration (EC50) and the discriminatory dose for the six SDHI fungicides, (2) establish frequency of resistance and examine for cross-resistance between the tested SDHIs within various B. cinerea isolates, (3) and identify SNP mutations-associated with resistance within the isolates. Findings will assist in determining the genetic diversity of Botrytis populations and allow for the development of diagnostic assays to test for genetic resistance, which subsequently helps determine an effective fungicide spray program.

Steroid Keratopathy in Dogs
Kate Jongnarangsin
Category & Time: Agriculture & Animal Science, Section 2, 11:30 AM - 12:45 PM
Poster: 8
Mentor: Andras Komaromy

Topical corticosteroids are commonly used for the treatment of inflammatory eye diseases. Several case

reports describe occasional focal corneal opacification due to mineral and/or lipid deposits in the corneal stroma. Similar reports do not exist in dogs, despite the frequent use of topical corticosteroids in this species. The purpose of this study was to provide a detailed description of steroid keratopathy in an enclosed colony of dogs. Eighty six cases of Beagle dogs housed in a controlled environment at Michigan State University and with a history of topical corticosteroid use were followed over several months to years. These corticosteroids included the separate or combined application of dexamethasone, difluprednate, and triamcinolone acetonide. Detailed ophthalmic examination included slit lamp biomicroscopy, photography, corneal thickness measurement, and high-resolution imaging by optical coherence tomography. White, subepithelial, central corneal opacification was observed in eleven dogs following topical corticosteroid administration. The pattern and distribution of these deposits were similar in all affected dogs. Their appearance was suggestive of a lipid rather than mineral composition. Discontinuation of topical corticosteroid administration resulted in disappearance of the corneal opacification in two dogs. The use of topical dorzolamide hydrochloride-timolol maleate in combination with corticosteroids also resulted in resolution of the corneal changes in another two dogs. To the best of our knowledge, this case series represents the most detailed description of steroid keratopathy in dogs to date. Additional studies will be needed to characterize the corneal deposits further and to determine contributing factors, including genetics and diet.

Effects of Cold Stress on Arabidopsis Engineered to Emit Isoprene
Isaiah Kaufman
Category & Time: Agriculture & Animal Science, Section 2, 11:30 AM - 12:45 PM
Poster: 9
Mentor: Sarathi Wijetilleke, Thomas Sharkey

Isoprene is a monoterpene, and one of the most prolific organic molecules emitted by plants, with an estimated total of 500 Tg being emitted annually. It is well documented that isoprene aids in plant resistance to heat stress; however, the mechanism is not well understood. A recent study found that genes related to heat resilience were up-regulated in isoprene-emitting transgenic lines of Arabidopsis, while genes for salicylic acid biosynthesis were down-regulated. Salicylic acid is important for cold stress tolerance, so the suppression of genes of this pathway suggests that isoprene emitting plants may be more susceptible to damage from cold stress. To test this hypothesis, six Arabidopsis lines were used: wild-type Col-0, three transgenic lines expressing Eucalyptus globulus isoprene synthase, and two empty vector controls. The lines were first grown at 23°C for four weeks prior to transferring to a 4°C cold chamber; a subset of plants was subjected to a 30°C/24h heat treatment prior to cold stress induction. Control plants were maintained at 23°C throughout the duration of the experiment. The effects of cold stress were monitored every week by measuring projected and total leaf area, dry mass, photosynthesis, isoprene emission, stomatal conductance, and chlorophyll fluorescence. This study hopes to identify how cold stress affects isoprene-emitting plants, which will develop the understanding of how isoprene regulates plant response totemperature.

Effects of Above Ground Herbivory on the Soil Microbial Activity in the Bioenergy Crop Switchgrass
Amanda Lietz
Category & Time: Agriculture & Animal Science, Section 2, 11:30 AM - 12:45 PM

Poster: 10
Mentor: Matthew Reid, Douglas Landis, Lisa Tiemann

Switchgrass (Panicum virgatum) is a native prairie grass and a promising candidate for bioenergy production. As a perennial C4 grass, switchgrass has the potential to increase soil carbon stocks through carbon deposition belowground. One avenue of carbon transfer into soil is through arbuscular mycorrhizal fungi (AMF), which act symbiotically with the plant by providing water and nutrients in exchange for carbon. However, aboveground herbivores are likely to alter the allocation of carbon to AMF mutualists. We established a short-term growth chamber experiment to examine the effects of herbivory by fall armyworm (Spodoptera frugiperda) on switchgrass. Plants will be subject to two weeks with herbivory followed by a two week recovery period without herbivory. Analyses of the plant and microbe responses will be performed following both periods. This analysis will include mycorrhizal activity, soil microbial biomass, and soil enzyme activity. We hypothesize that herbivory would cause an increase of carbon allocation to the switchgrass roots; therefore, there would be an increase in AMF and soil microbial activity. The experiment is currently on-going. Altering soil carbon allocation due to herbivory could have an effect on the sustainability of switchgrass. The sustainability of switchgrass is a key component to its future success as a bioenergy crop.

Algae and Fungi Stress Resilience
Chasity Polk
Category & Time: Agriculture & Animal Science, Section 2, 11:30 AM - 12:45 PM
Poster: 11
Mentor: Zhiyan Du

Microalgae are efficient photosynthetic organisms whose lipids (oils), proteins and carbohydrates (sugars) can be used as food and high value nutrients. Their mutualistic relationship with fungi have been proven by the way the algae benefits its fungal partner by producing organic carbon compounds and molecules through photosynthesis. This research project aims to develop a comprehensive understanding of the benefits of the mutualistic relationship between fungi and algae, specifically for increasing the resilience of algae and fungi under environmental stresses. There are several aspects that played into this research, including the running of several experiments to test the stress resilience through processes such as gradual freeze (at -20℃), instant freeze (flash freeze with liquid nitrogen at -196℃), and Clorox brand bleach tests. This included the use of different strains of the widespread soil fungus, Mortierella, such as elongata (AG77) and green algae strains 21GR and CW15 to test their responses to different intense environmental conditions, including extreme cold and extreme heat. The expectations of this research are to enhance stress tolerance of the algae and fungi, with hopes to further advance their potential to be used as a biomass and fuel for later products.

Modeling Canopy Architecture in Maize
Christine Schafer
Category & Time: Agriculture & Animal Science, Section 2, 11:30 AM - 12:45 PM
Poster: 12
Mentor: Ruijuan Tan, Addie Thompson

Maize canopy architecture is important for light capture and weed prevention, which can potentially affect yield and biomass. As one of the essential components in maize canopy architecture, total leaf area estimation has been challenging. Measuring individual leaves to obtain total leaf area is too labor intensive and time consuming. A previously developed power function can be used to estimate total leaf area from total leaf number and the largest leaf area. However, in our 2018 field experiment, we obtained poor correlation between observed and expected 6th leaf area, indicating the power function may not be adequately calibrated. Therefore, the aim of this study is to calibrate the value of the essential constant in the power function. Our calibration panel, comprised of 41 different inbreds, were planted in East Lansing in 2019. Leaf number and individual leaf area will be recorded and fit into the power function. We expect that the calibrated essential constant can be applied to a larger and more diverse panel of inbreds and increase the accuracy of total leaf area estimation.

Investigation of Glottal Attack and Offset Times in Norm and Neurogenic Voice Disorder
Leigha Brown
Category & Time: Communication Arts & Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 15
Mentor: Maryam Naghibolhosseini, Dimitar Deliyski

High-speed videoendoscopy (HSV) can be used to study vocal fold vibratory characteristics and dynamics with high temporal resolution. The onset and offset of phonation are particularly important in better understanding the voice production mechanisms in voice disorders. In this work, glottal attack and offset times were measured from the HSV data for two vocally normal participants (one male and one female) and four participants with neurogenic voice disorders (four females). Of the four participants with voice disorders, two had spasmodic dysphonia and two had unilateral vocal fold paralysis. This study performs a visual segmentation of HSV data in connected speech (during a reading of the Rainbow Passage) to determine the durations of both glottal attack and offset times in six participants. A rater visually analyzed the data using a playback software and analyzed every vocalization of the Rainbow Passage. The mean glottal attack time ranged between 68-95 ms and the mean glottal offset time ranged between 77-108 ms for patients with voice disorders who were all female. The mean glottal attack time for the vocally normal female was shorter than those for all the patients (i.e., 59 ms) and the mean glottal offset time was 105 ms. The mean glottal attack and offset times for the vocally normal male participant were 84 and 121 ms, respectively, which were longer than those for the vocally normal female participant. More data is being collected to address the individual differences and the differences between norm and disorder.

Identifying Challenges of Transportation for Individuals with Physical Disabilities
Paige Cordts
Category & Time: Communication Arts & Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 16
Mentor: Tamara Bush, Shelia Cotten, Tongbin Qu

Individuals with physical disabilities face many challenges in modern society, one of the largest being

barriers related to transportation. The most common forms of transportation used by physically disabled individuals are personal vehicles, public transport, and paratransit services. However, all three of these have many constraints such as time needed for planning and travel, availability, and cost. Currently, few studies exist that identify specific challenges for individuals with physical disabilities related to transportation. Therefore, we designed a comprehensive survey to document individuals' current experiences with public transportation to gain a better understanding of modifications that can be made in order to increase accessibility. It is crucial that we gain understanding of what changes need to be made from the individuals who would most benefit from these changes. Survey results, thus far, indicate that the challenges of transportation impact the independence of respondents. Additionally, there is an overall experience of frustration using transport due to many different factors, such as tardiness, poor communication, and an inability or unwillingness to accommodate those with assistive devices. In the future, these data should be used when designing public transport systems or improving other modes of transport in order to improve accessibility for individuals with physical disabilities.

Rap on Flint
Lauren Crymes
Category & Time: Communication Arts & Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 17
Mentor: Geraldine Zeldes

The documentary project Rap on Flintplays with two definitions of rap: 1. A music genre characterized by words recited rapidly and rhythmically, and 2. A lengthy or impromptu conversation. This multimedia project – that includes a documentary film, a documentary radio series, and this website – will document the history of rap music in Flint, Michigan beginning in the late 1980s to the present, through archival research and in-depth interviews. The project is also meant to ignite a conversation about the political and socioeconomic influences that gave birth to the hustle and flow – the rhythms and rhymes – of the lyrics of Flint rappers. Like some 30 years ago, the rap songs of today mirror tragic circumstances. Yet, despite the lead water crisis and a myriad of other disasters faced by Flint residents, artistry continues to grow, bringing hope to Flint's future.

Between Comic and Canon: Analyzing Graphic Adaptations of British Literary Classics
Tyler Eyster
Category & Time: Communication Arts & Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 18
Mentor: Ian MacInnes

As an Albion College student conducting undergraduate research in English Literature, I have spent much of the past academic year examining adaptations of classic works of British literature which appear in graphic novel or 'comic-strip' formats. This involves an application of existing theories on adptation and aesthetics to an increasingly popular yet often overlooked form of literary adaptation. This work involves analyzing the source text and adaptations of nine canonical narratives and a selected number of poems with composition dates ranging between the 7th century AD and 1847. This work is meant to determine the impact such adaptations can have on content, meaning, and aesthetic response

as textual works are reinterpreted to incorporate visual elements. In this presentation I hope to shed light on the significance of these graphic narratives and what they might offer to the fields of literary studies, adaptation studies, and comics studies.

A Foundational Analysis of Effective Pipeline Programs: Optimizing metrics to change the narrative around Advertising and Public Relations
Jada Flowers, Dana Session, Christopher Thompson
Category & Time: Communication Arts & Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 19
Mentor: Ashley Sanders-Jackson, Teresa Mastin

The Advertising and Public Relations professions are inextricably involved in educating about, reflecting and establishing societal norms. Thus, it is critically important that the professionals who comprise these industries reflect the numerous cultures that comprise the United States and ultimately the global community. Among the Association of National Advertisers membership, only 6% of members are African American and 8% are Hispanic. Between 3.0 and 5.0 percent of students enrolled in the Michigan State University Advertising and Public Relations Program (MSU ADPR) are Latinx; 1.5-3.0 percentage are African American. ADPR students, staff, and faculty are designing a program to increase the number of under-represented students in the MSU ADPR program with the long-term goal of diversifying the Advertising and Public Relations industries. This study outlines how the project was developed in regards to assessing the experiences of current ADPR students in order to create a program that is directly tailored to improving the college transition and retention rate for students of similar backgrounds. Students and professors from the College of Communication Arts and Sciences (CAS) joined forces to identify the current successes as well as opportunities for growth relative to the college transition for underrepresented students by surveying the ADPR community for information regarding challenges and barriers. This is the first program employed by CAS to use a cohort-based pipeline program strategy to target under-represented high school students to influence matriculation and retention in ADPR academic programs and to diversity the Advertising and Public Relations professions. The pipeline structure is in place to establish a direct relationship with leaders in the ADPR industry to create employable candidates who will accurately reflect society within a field that attributes the lack of diversity to a scarcity of qualifiedapplicants.

Rap on Flint
Ben Goldman
Category & Time: Communication Arts & Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 20
Mentor: Geraldine Zeldes

The documentary project "Rap on Flint" plays with two definitions of rap: 1. a music genre charactarized by words recited rapidly and rhythmically, and 2. a lengthy or impromptu conversation.

Exploration of Reasons for Marginalization from the Family
Emily Lance
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 21
Mentor: Elizabeth Dorrance Hall

Marginalization is the process of moving to the periphery of one's family. Being marginalized often comes with harmful repercussions affecting the individual's mental and physical health. Marginalization from the family unit occurs for a variety of reasons. We sought to identify these specific reasons as well as determine if the marginalization stemmed from something the participant felt they could have controlled or not. Whether the type of distancing was the participant pulling away from family or the participant being pushed away was considered to help identify reasons for marginalization. We conducted a survey using a sample of adult marginalized family members (N=315). From this sample, responses to the question "Why do you think you are marginalized?" were coded based on reason for marginalization, controllability, and the type of distancing that was done. Results include the number of marginalized family members who provided each type of reason, whether most marginalized family members feel they have control over their marginalization or not, and the number of people who have experienced different types of distancing. Practical implications will be discussed.

Project Victory: Exploring Graduate School Opportunities Through Cost-Effective Virtual Reality Tech
Isaiah Morales
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 22
Mentor: Liza Potts

Given the wider access and lower technology costs, Virtual Reality (VR) is becoming a widely used medium to share information and provide immersive experiences. Because these barriers are no longer as cost prohibitive, VR is now an option for deploying low-cost outreach to underrepresented student groups (low income, first generation, minority, etc.). In this study, we examine the medium of VR to showcase content and inform prospective graduate students about opportunities for further education. Based on a study by Serviss in 2016, this project seeks to apply concepts of immersive experiences by developing a narrative that integrates video, audio, and a sense of place. In our data analysis, we measure the emotional responses of this VR experience as compared to the response of a traditional, slide-based presentation. We sought to answer whether VR can enhance the interest in graduate school programs amongst underrepresented students. This study argues that by developing Virtual Environments (VE), we can simulate the sense of place by creating a rich, immersive experience. Moreover, this study explores research on VR in the academy, and the positive impact of these partnerships. We describe the method of using low-cost Head Mounted Displays (HMDs), with a focus on accessibility, to simulate campus and town life at an academic institution. Finally, beyond the sentiment study, this project aims to build a framework that can be used by institutions to create meaningful experiences for underrepresented students, thus furthering the understanding of how to deploy VR in an effective and accessible manner.

Black Lives Do Not Matter: Accessing The Emotional and Psychological Effects of media on Flint Residents
Jessie Pink
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 23
Mentor: Nancy Rhodes

In "Environmental Justice in the 21st Century: Race still matters," Robert Bullard denotes environmental racism as environmental policy-making and decision-making that disadvantages and burdens people of color while bestowing onto Whites ecological benefits such as clean air and water. Indeed, marginalized racial and ethnic communities in the United States suffer disproportionately from environmental health risks. Based on a report conducted by the Center for Effective Government, people of color nationwide appear on average twice as likely as Whites to live near industrial facilities that produce concentrated pollution and contamination in their communities. Such environmental disparities generate disturbing health trends, as noted by the Center for Disease Control and Prevention, which reported that 11.2 percent of African American children and 4.0 percent of Mexican-American children nationwide are poisoned by lead, compared with 2.3 percent of White children. Certainly, academic literature on environmental racism detail the socioenvironmental effects on Black and Brown communities in the United States; however, the majority of research on the topic fails at capturing the voices of those marginalized racial and ethnic groups impacted by obscene environmental disparities. Creating space for marginalized racial and ethnic communities to detail their emotional and psychological responses to environmental disparities expands the academic catalog on environmental racism, revealing how the insidious phenomenon ruins innocent lives and continues the legacy of exploring Black and Brown bodies for profit. The goal of this study to examine the emotional and psychological responses of Flint residents as national media such as the New York Times covers the water contamination plaguing their community and determine if responses from Flint residents differ when local media such as the Detroit Public TV ("One Detroit") detail other issues impacting their community and actually seek solutions. In order to investigate the difference of emotional and psychological responses between national and local media, this study aims to conduct surveys with Flint residents who allowed either the New York Times or "One Detroit" to interview them. The study will use two different types of surveys: a long form (or surveys with space for the interviewee to respond) and Likert scale that ranks the interview satisfaction with media portrayal of them. Creating this focus group as well as distributing these types of surveys will produce a detail qualitative report that determines the overall impact of media on issues such as environmental racism.

Bitcoin & Governments: How Trust in this Cryptocurrency Reflects Desire for Governmental Reform
Shelby Pitts
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 24
Mentor: Rick Wash

Bitcoin is a complex sociotechnical system and a new, non-governmental currency. The rapid rise and fall of the value of the cryptocurrency has given it an infamous reputation. Many have given up on Bitcoin completely, but there are some who remain loyal and continue to have trust in it. My team and I

investigated one of the largest and most important Bitcoin online communities, the Bitcoin subreddit. I intend to study how the online community derives value in Bitcoin beyond its monetary value. Using qualitative content analysis, we seek to understand the beliefs articulated and negotiated by commenters during their efforts to understand Bitcoin. We constructed a codebook to evaluate how trust is formed and maintained in Bitcoin. My poster specifically focuses on Bitcoin in relation to current government systems, such as banking and its controversial regulations. My research involves how the growing allegiance to Bitcoin is symptomatic of eroding trust in governments, creating a desire to completely reform the system. Also, why those in the online community believe it can be used as a tool to empower the common man and regain autonomy; in addition to improving the overall state of the world. We expect to find people have a more radical view of the necessity for the government to phase out of the current banking system and eventually shift to Bitcoin completely.

MSU Support Staff Engagement: A Survey Study
Phylicia Richardson
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 25
Mentor: Ashley Sanders-Jackson, Gwen Wittenbaum

Work engagement is defined as whether an employee feels satisfied with their work outcome and if they have a sense of pride for their employer. Positive work engagement benefits both the company and its employees through increased productivity. Recently, MSU has implemented a closed Facebook group for Support Staff. Using data taken from a post-Facebook intervention survey of MSU employees, we describe the effect of a number of measures of engagement on job satisfaction and engagement. There were 141 benefits-eligible MSU Support Staff, that mainly consisted of white middle-age females who participated in the web-based survey. In order to do this, we regressed the Facebook group attitude and work-life balance on job satisfaction and worker engagement. Participants who reported a positive work-life balance also reported a positive response to feeling satisfied with their job and more engaged. There was no direct effect of engagement with the Facebook group attitude and job satisfaction or engagement. Results suggest that work-life balance is essential for support staff at MSU. A useful intervention may be considering structural of environmental factors to improve work-life balance for Support Staff.

An evaluation of the effects of media in the 2018 Marijuana Referendum
Alan Rojas
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 26
Mentor: Daniel Bergan

This research project aims to answer the question, "How impactful was news media coverage of Marijuana with the perception of individuals voting in the 2018 legalization referendum?" Additionally, this project asks "What frames have dominated the debate about legalizing recreational marijuana?" In order to answer this question, the research project used the 2018 Midterm election as a case study. Michigan's 2018 voting ballot included a referendum on Marijuana which called for the legalization of

recreational Marijuana, making it the first Midwest state to do so. Forty-two news articles covering Marijuana were collected from 10 different news outlets from Michigan. The dates of these articles range from when the proposal was added to the ballot June 1st 2018 until the end of the year, December 31 2018. It was found that the news articles had multiple different "frames" in total, but certain frames seemed to be the most prevalent. Further analysis demonstrated that the state news media decided to lean heavily on frames such as: "Recreational marijuana", "regulation", "law" "business", "legalization". Thirty-Three of the forty-two articles of the news coverage was also found to be considered neutral towards marijuana. Implications are discussed further. Keywords: Issue Framing, Marijuana, Media, Michigan, News, Polls, Public Policy.

Distortion Product Otoacoustic Emissions Phase Analysis
Cayce Warman
Category & Time: Communication Arts & Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 27
Mentor: Maryam Naghibolhosseini

Sound signals can be generated inside the cochlea by presenting two primary tones in the ear canal. These sounds can travel back toward the ear canal and be recorded by a sensitive microphone in the ear canal. The recorded emissions are called distortion product otoacoustic emissions (DPOAEs). The DPOAEs are made up of a combination of two components- the generator and reflection components. The generator component is due to the cochlea active mechanism and the reflection component is the reflection of the wave inside the cochlea due to cochlear irregularities. Measuring DPOAE with high-frequency resolution, the constructive and destructive interaction of the two components builds a pattern with multiple minima and maxima points. This pattern is called the fine structure. In this project, DPOAE signals were obtained from four normal hearing individuals. The two DPOAE components were extracted using a least square fit algorithm and their phases were used to estimate the points of minima and maxima. Points of minima and maxima were recorded across all stimuli levels and analyzed for frequency shifts. Frequency shifts in the places of maxima and minima across stimuli levels were found, which provide information about how the two primary tones interact inside the cochlea to generate the emissions. This work can enhance our understanding about the normal function of the cochlea.

Impact of Agriculture and Roadways on Fragmented Forests in Michigan
Maria Alvarez Zavala
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 30
Mentor: David Rothstein, Asia Dowtin

Human activity can alter the function and characteristics of natural land. In the Midwest there are many human-impacted forest fragments that are surrounded and thus influenced by nearby agriculture and roadways. Urbanization as one of the forms of human impact, causes forests to be fragmented. Vehicular emissions and waste debris related to urbanization can later be introduced in the environment and eventually be deposited on the forest and affect it. Agricultural land use can also impact natural landscapes as high amounts of fertilizers are applied to natural lands and can also be redistributed after

the fact. In high populated areas, these processes can then alter or disrupt natural cycles in native forest soils that are receptive to the deposition of high concentrations of foreign compounds. This study aims to characterize forest soil health from two woodlots in East Lansing, MI that are directly adjacent to agricultural land or a major freeway. In each woodlot, soil samples were collected from seven locations along three transects. All samples have been processed for soil acidification, macronutrient (K+, PO43-, Ca2+, Mg2+ and Na+) strength and bioavailability as well as quantification of carbon and nitrogen oxidation rates by native microbes in the forest patches. We expect to observe higher concentrations of salt ions near road edges and decrease farther into the forest site. We also predict that samples obtained from nearby agricultural fields will demonstrate higher soil acidification as a consequence of macronutrient leaching due to the high use of ammonium containing fertilizers in crops.

Albedo and Global Warming Potential on Perennial vs Annual Biofuel Crops
Isabel Arrocha
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 31
Mentor: Cheyenne Lei

Albedo is a biogeophysical climate forcing that can be used to quantify the global warming potential (GWP) of different activities. It is defined as the amount of solar radiation that is reflected back to the atmosphere versus the incident solar radiation of an object. GWP is a measure of an object's capability of adding or removing carbon dioxide (CO2) from the atmosphere. When a landscape sequesters CO2 a negative GWP is gained, while a positive GWP occurs when more CO2 is emitted to the atmosphere. When albedo is low, the object absorbs most of the radiation, which increases its temperature (and vice-versa), thus aiding in GWP prediction. This biogeophysical characteristic depends on several factors including cloud cover, greenhouse gases in the atmosphere, the type of soil and plant, as well as leaf area index, plant canopy, and land usage. The goal of this project is to determine, between perennial and annual crops, which has a higher albedo; this will help dictate which of crops for biofuel production have a lower GWP and is, therefore, more sustainable. Instantaneous short-wave radiation measurements were taken with a CNR4 net radiometer from May 30th to July 11th, 2019, of seven (7) biofuel crops (Corn, Sorghum, Miscanthus, Switchgrass, Prairie, Early Successional, and Native Grasses as a reference), in the Kellogg Biological Station. We hypothesize that perennial crops will have an overall higher albedo and lower GWP due to providing more cover for the soil temporally and provide more carbon sequestration than annual crops. Although there may not be large differences between perennial and annual crops in shorter time scales, the use of biofuel crops may help increase carbon sequestration in the land they are planted in.

Measuring Survivability and Reproduction in Daphnia and Ostracods under changing Salinities
Christopher Breen
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 32
Mentor: Abigail Cahill

To find if different salinities influence different invertebrates and if different animals are adapted to

saltwater. I will be taking water and sediment from two locations (the Whitehouse Nature Center and an inland salt marsh in Maple River, MI), swapping the invertebrates that live there, and recording survivorship, behavior/ movement and population growth. Having this data will give us a clearer picture on salinity's effect on macroinvertebrates, and a clearer picture of what can live in an inland salt marsh. Survivability in groups of differing macroinvertebrates will also be tested in these two environments.

Understanding Ecosystem Biogeochemical Controls on Time-Lagged Water Quality Responses to Land Use / Land Cover
Oscar Coronel
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 33
Mentor: Anthony Kendall, Sherry Martin

Change in land use causes biogeochemical changes in aquatic ecosystems; as land is changed from its natural state into land for various anthropogenic uses, the geochemical signal changes as well. Previous studies have often assumed that the surface water quality measured is representative of the current land use/land cover (LULC), but it has been demonstrated that the groundwater contributes a significant portion of the chemistry represented by previous land use. Studies of land use impact on surface water have not accounted for the biogeochemical dynamics contributed by the receiving ecosystem and assume that they are generally the same across aquatic ecosystems. The aim of this study is to identify which hydrologic conditions most accurately reflect land use after both groundwater and receiving water processing, and to identify which chemical assemblages best represent historical LULC. Land use in the study area, the Muskegon River Watershed, mostly consists of forest, followed by agricultural and urban. A combined total of 267 water samples were collected from streams, wetlands, and lakes and were designed to be representative of the whole watershed. The water chemistry of each sample was analyzed and recorded. R was used to conduct multiple linear regressions analyzing the water chemistry and LULC. We expect to find that LULC geochemical signals will be strongest in lakes, as streams tend to rapidly flush out chemical inputs and the biologic reactivity of wetlands may mute the LULC signal. Our results may also provide insights on the distortion of legacy land use signals.

Human Dimensions of Deer Management in East Lansing
Julie Moore
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 34
Mentor: Alexa Warwick

Within the City of East Lansing the topic of deer and deer management can be controversial. To date, East Lansing has been very proactive in their deer management actions. For example, the city prohibited the feeding of deer in 2014, a year prior to the first case of chronic wasting disease (CWD) in free-ranging white tailed deer in Michigan. Though there are currently no confirmed cases of CWD in East Lansing, there have been in neighboring cities, therefore the public awareness of deer has heightened. Our current study addresses the deer impacts on residents and the local ecosystem in East Lansing. We are analyzing trends in reported deer vehicle collisions, density of deer in city parks, changes in

vegetation, and public opinion surveys from citizens about deer impacts and management in East Lansing. The results will assist us in deciding the most pertinent impacts of deer on citizens of East Lansing, for the ease of future mitigation of those impacts by city officials.

Prevalence of Pests in New Zealand
Monica Oreilly, Lilly Kerchinsky, Katherine Karnoup
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 35
Mentor: Jeanette McGuire

Prior to the arrival of humans, the only mammals endemic to New Zealand were two species of fruit bats and marine mammals such as the New Zealand fur seal. In the absence of mammalian predators, many native birds evolved adaptations that are not conducive to co-existing with these mammals (e.g., being flightless, ground dwelling). The introduction of non-native mammals such as rats, possums, stoats, and weasels now threaten the lives of these birds, and many native bird populations are in drastic decline. The new initiative of "predator free 2050" serves to eradicate non-native mammalian predators from the mainland of New Zealand through collaborative efforts involving the government, iwi, local community organizations, and passionate individuals. To facilitate the work of a local community, a pilot study was conducted to observe the abundance and type of pests present in Resolution Bay and Endeavor Inlet. Consistent with recommended practices by the Department of Conservation (REF) ink card surveys, in each location we set four transect lines with five tunnels per transect (8 total transects, 40 tunnels in total). Ink cards were used to capture the footprints of mammals in the area to better direct the trapping efforts. We discuss our findings and future work.

Farmers' Attitudes and Practices: How are these changing with of climate change?
Ashlyn Royce
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 36
Mentor: Sandra Marquart-Pyatt, Riva Denny

Agriculture practices in the US Midwest are a large contributor to greenhouse gas emissions and nutrient run off, both of which are greatly increasing the effects of climate change around the world. Major effects of climate change, such as raising global temperatures and increased extreme weather occurrences, will directly impact farmers in multiple ways including their crop productivity. As a result, farmer decisions pertaining to their agricultural practices are crucial in the path to sustainable agriculture. This descriptive analysis will examine the relationship between farmers' environmental attitudes and use of four different practices that help alleviate the effect agriculture has on the environment, using 2016-2018 farmer survey data for four different states in the United States corn belt. The four practices being analyzed are: participation in conservation programs, type of tillage used, use of cover crops, and biodiversity strips. Particular attention will be paid to change in attitudes from 2016 to 2017, and if any attitude change caused any alterations in these practices in 2018. This research builds on the ongoing research examining farmer decision making with the effects of climate change becoming more apparent, all of which is aiming to increase the potential for farmers and agriculture to

adapt to current and future conditions caused by climate change and reduce modern agriculture contributions to climate change.

Nutrient Fluxes of Chronosequenced Jack Pine Stands
Mia White
Category & Time: Environmental Science & Natural Resources, Section 1, 11:30 AM - 12:45 PM
Poster: 37
Mentor: David Rothstein

Jack pine stands, (Pinus banksiana), are typically managed through clear-cut harvesting; however, this can be done through either stem-only or whole-tree harvest. Even though clear-cut management is ideal for the regeneration of fire-adapted species like jack pine, not much is known about the effects of stem-only vs. whole-tree harvesting on ecosystem nutrient budgets. We know that leaching losses of nutrients increase immediately following the harvest, but the duration of time post-harvest before nutrient leaching stabilizes is a critical uncertainty that will be addressed in this study. We will evaluate the leaching of nitrogen, sulfur, magnesium, calcium, potassium, and phosphorus from jack pine stands using one-meter deep lysimeters and soil samples. Data for nutrient budgets will be extrapolated with a hydrologic model parameterized with applicable data. We have selected six jack pine stands in Grayling, Michigan that covers a span of 59 years from the last harvest (youngest being 3 years and oldest being 59 years). We hypothesize that over time the concentration of nutrients will stabilize (characterized by minimum leaching) 40 or more years following a whole tree harvest. This study will lay down the foundation for the sustainability of whole tree harvesting of jack pine stands on the soil. I would like to acknowledge Summer Research Opportunity Program (SROP), Dr. David Rothstein, Dr. Asia Dowtin, Michigan State University (MSU), the MSU Forestry Department, and the Forestry Biogeochemistry lab.

The Impact of Office-Guidelines Applied to Practice Program on Rates of Evidenced-Based Medication Use and Atherosclerotic Cardiovascular Disease Risk Score.
Zane Alroshood
Category & Time: Epidemiology & Public Health, Section 1, 11:30 AM - 12:45 PM
Poster: 39
Mentor: Adesuwa Olomu, Elahe Crockett-Torabi

Introduction:Evidence Based Medication (EBM) has been widely recognized as a representation of the clinical expertise, the best available evidence in treatment of patients, and is associated with improved clinical outcomes. The Atherosclerotic Cardiovascular Disease (ASCVD) risk score has been used as a measure in treating and preventing cardiovascular disease (CVD). Our patient activation program; Office-Guidelines Applied to Practice(Office-GAP) trains patients and providers in Shared Decision-Making (SDM) and use of decision support tools (DSTs) to form strong patient-physician relationships and increase patient engagement and compliance with care. Mhealth texting (Care4life) has potential to activate patients and reinforce positive behavior. Hypothesis:Office-GAP Program/Care4life Programs will lead to improved 1) EBM use, and 2) decrease the ASCVD risk score. Methods/Results: The Office-GAP/Care4life program is a two-arm pilot study in the Michigan State University internal medicine residency clinic. Intervention arm includes 1) patient activation during a group visit, use of Office-GAP

Checklist, & DSTs Plus mhealth texting. The control arm includes use of mhealth, texting only. After initial group visit, patients on both arms were followed up at 2 and 4 months. In this study, 50 diabetic patients (25 intervention/25 control) who have completed the study will be evaluated for 1) rate of use of EBM for secondary prevention of CVD and 2) ASCVD risk score at baseline, 2, and 4 months. Conclusion: We anticipate that Office-GAP/(Care4life) program will increase use of EBM and lower ASCVD risk score.Support: Z.A. is a REPID scholar, supported by NIH-5—R25-HL108864 award to Elahé Crocket.

Associations between early life malnutrition and changes in liver metabolites: Implications for chronic disease

Victoria Granberry

Category & Time: Epidemiology & Public Health, Section 1, 11:30 AM - 12:45 PM
Poster: 40
Mentor: David Ferguson

Introduction: Growth restriction due to early-life malnutrition increases risk of chronic disease (e.g., cardiovascular disease) by 47%. Changes in liver metabolites may provide an understanding on the mechanisms through which this risk occurs. This experiment examined associations between changes in liver metabolite expression and malnutrition. Methods: FVB mouse pups were undernourished during gestation (GUN; n=3 litters) or lactation (PUN; n=3 litters) using a cross-fostering nutritive model along with control (CON; n=3 litters) group. All mice were weaned on postnatal day PN 21 and refed a control diet. Mice were euthanized on PN70. Livers were analyzed using untargeted LC-MS/MS metabolomics. Pathway analysis determined mechanisms by which growth restriction increases the risk of chronic disease. Results: Changes in liver metabolites between each nutrient state were all non-significant. However, PUN mice demonstrated slightly elevated glutathione levels versus CON and GUN mice at PN21. By PN70 levels of glutathione in PUN mice recovered. Discussion: The lack of significant findings suggests that early-life malnutrition alone is not sufficient to induce changes in liver metabolites of undernourished pups. Instead, other factors (e.g., stress) may be necessary. Future studies should assess changes in metabolites of undernourished pups following stress (e.g., hypoxia, starvation, maternal deprivation) to verify this hypothesis.

How does the level of physical activity prior to diagnosis influence current activity levels of patients diagnosed with Alzheimer?s Disease?

Allison Loch

Category & Time: Epidemiology & Public Health, Section 1, 11:30 AM - 12:45 PM
Poster: 41
Mentor: Andrea Bozoki

Alzheimer's Disease (AD) is a growing and incurable disease that inhibits motor and cognitive functioning. Both genetic and environmental factors impact the development of this disease. Physical activity (PA) has been found to slow the onset and progression of AD. Repetitive and purposeful PA done at least three times per week for greater than 15 minutes, can be useful to improve physiological, physical, and functional abilities. Recent studies have found that aerobic PA induces fibroblast growth

factor in the hippocampus which is otherwise reduced in aging brains. In relation, patients with AD that participate in regular aerobic PA have been found to have greater scores on the Mini-Mental State Exam (MMSE). This is attributed to the improvement of the hippocampus and other regions of the brain involved in memory storage as a result. Studies have also shown that lifestyle factors such as, substance use, dietary factors, and physical exercise, contribute to preventing the onset of AD. In this study, the researcher will be looking at how lifestyle habits such as, past physical activity levels, influence current physical activity levels of patients diagnosed with Alzheimer's Disease. An inventory will be taken about the patient's previous PA levels before their diagnosis of AD, along with an inventory of their current PA levels. After 4-6 weeks of exercise, the researcher will follow up with the patient or caregiver and a final inventory will be taken to determine the frequency of PA and the resulting benefit or change in the patient if any noticed.

Contamination in PVC plumbing
Sylvester Mcintosh
Category & Time: Epidemiology & Public Health, Section 1, 11:30 AM - 12:45 PM
Poster: 42
Mentor: Courtney Carignan

The Flint water crisis has brought to the forefront issues of drinking water contamination from both the quality of source waters and mobilization of lead from the pipes of distribution systems. This crisis has proven to be a pivotal point of research for medical doctors, public health professionals and environmentalists. Less recognized is that household plumbing can also be a source of lead into tap water. Originally, most homes were built using copper pipes containing high levels of lead solder. In the late 1980s, the use of lead solder to connect copper plumbing was banned after it was found to migrate from the solder into tap water. Modern indoor plumbing typically uses pipes made of polyvinyl chloride (PVC). While PVC is less expensive, it may leach trace amounts of vinyl chloride,phthalates, lead, and ETBE (ethyl-tert-buthyl-ether). Therefore, this project plans to investigate migration of such chemicals from PVC pipes to determine potential impacts of modern plumbing materials on the quality of tap water.

Moral Distress in Nurses: A qualitative study of nurses caring for patients who forego care due to economic barriers
Amarilis Santiago
Category & Time: Epidemiology & Public Health, Section 1, 11:30 AM - 12:45 PM
Poster: 43
Mentor: Douglas Olsen, Linda Keilman

In the US, nursing practice is guided by the American Nurses Association Code of Ethics that states healthcare is provided based on need, without prejudice toward a patient's individual characteristics, including financial burdens. Therefore, nurses caring for patients foregoing treatment due to financial constraints may experience moral distress (MD). MD encompasses morally challenging situations/events and the emotions arising from the experience of psychological distress often caused by constraints that prevent one from doing what is right (moral). The development of this pilot research is created to test

"What are the experiences of nurses in community practice with patients who forego treatment due to cost?". As part of the study, the team is going to employ a qualitative method that will focus on open-ended interviews with nurses. Approximately 20 nurses will be interviewed; interviews will be recorded and transcribed. Nurses will also be asked to fill out a Moral Distress Thermometer to describe their stress levels when feeling morally distressed. This data will allow the team to look for common themes. In all, the team hopes the results can be used to motivate advocacy by nurses on behalf of patietns foregoing care due to cost and to expand the research on the experiences of MD that nurses may undergo in the care of patients. Additionally, the team hopes to create effective practice policies related to advocacy for nurses and patients receiving care.

Multiple composite tissue product reconstructive approach
Neil Al-Saidi
Category & Time: Integrative Biology, Section 1, 11:30 AM - 12:45 PM
Poster: 48
Mentor: Abdalmajid Katranji

Multiple composite tissue product reconstructive approach can result in increasing the opportunities for functional and cosmetic results. Patients with complex injury, tissue defects, and compromised by infection and vascularity are often faced with the potential for permanent disabling defect. The plan was to perform a reconstruction that combined the use of Collagen, Bilayer, Conduit, and Reinforced composite tissue product. Nerves, tendon, bone, and skin were all repaired during the same procedure using Multiple Composite Tissue Products. The approach resulted in recovery of basic hand and wrist function with prevention of amputation in a significant case. This patient was able to regain significant amount of independent function as a result of this reconstructive approach. We conclude that a multiple composite tissue product approach is a safe and effective approach to be performed in a single procedure to regain functional and cosmetic results.

When and Why Do Symbiotic Bacteria Produce Tetrodotoxin?
Zahraa Al-Tameemi
Category & Time: Integrative Biology, Section 1, 11:30 AM - 12:45 PM
Poster: 49
Mentor: Heather Eisthen, Samantha Westcott

The evolutionary arms race between rough-skinned newts (Taricha granulosa) and their garter snake (Thamnophis sirtalis) predators has led to extreme levels of toxicity in some newt populations. Their source of toxicity is tetrodotoxin (TTX), a neurotoxin that blocks voltage-gated sodium channels, inhibiting action potentials. Previous work in our lab revealed that TTX is produced by bacteria on the newts' skin, including bacteria from the genera Pseudomonas and Aeromonas. However, the biosynthetic pathway and factors affecting TTX production remain unknown. Moreover, the reason why these bacteria produce TTX is not well understood. To start to solve these problems, we will determine the growth rate of TTX-producing bacteria by measuring the absorbance of broth cultures across consecutive time intervals to obtain growth curves. Additionally, we will quantify TTX production at

various time points along each growth curve using liquid chromatography–tandem mass spectrometry to identify the phases of their growth during which the bacteria start producing TTX. The results from these experiments will help us optimize future experiments and reveal details about the environmental conditions that encourage TTX production. Furthermore, knowing in which phase these bacteria produce TTX will help determine if it is a primary metabolite or a secondary metabolite, potentially providing insight into the reasons these bacteria produce it. Understanding when bacteria produce TTX and whether it is helping them survive and compete in their environment can help us better understand the role of these microbes as part of the newt skin microbiome.

Circuit-Specific Gene Expression Regulates Cocaine Seeking in Mice
Katie Brandel-Ankrapp
Category & Time: Integrative Biology, Section 1, 11:30 AM - 12:45 PM
Poster: 50
Mentor: Andrew Eagle

Neurons of the ventral hippocampus (vHPC) – a key memory region –project to the nucleus accumbens (NAc) - a significant reward center – and facilitate drug seeking behavior, a characteristic of addiction. Additionally, chronic cocaine leads to physiological changes within the vHPC-NAc circuit that reinforces seeking behavior, but the role of gene expression in this circuit is poorly understood. ΔFosB is a chronic activity-dependent transcription factor encoded by the FosB gene, regulating neuronal structure and function in the dorsal HPC and the NAc, underlying phenotypic psychiatric disorders. This makes ΔFosB a potential target for gene expression changes that may underlie addiction, however its role in the vHPC is unclear. We hypothesized that ΔFosB induction in vHPC-NAc is a key mechanism by which cocaine drives changes in physiology and provokes drug-seeking behavior. To address our hypothesis, we used CRISPR-mediated to produce a circuit-specific knockout of the FosB gene in vHPC-NAc neurons of mice. We found that this impaired cocaine seeking and reward. To determine whether ΔFosB was induced in this circuit, we gave mice chronic cocaine or saline (experimenter-administered injections) and used immunohistochemistry in harvested brains to identify circuit neurons expressing ΔFosB. We found that ΔFosB is indeed induced in this circuit and likely underlies the change in cocaine seeking behavior. Our findings suggest that ΔFosB is a key molecular handle induced by cocaine that drives long-term gene expression that may shape the function of this hippocampal circuit.

Isolation of Bacterial Strains from Soil Samples: Discovery of Antibiotic Resistant Gene Clusters
Sydney Brief
Category & Time: Integrative Biology, Section 1, 11:30 AM - 12:45 PM
Poster: 51
Mentor: Jeanette McGuire

Antibiotic resistance occurs with amplified and misuse of antibiotics, where bacteria not killed off by the antibiotic can evolve adaptations or resistance in order to survive. Due to short generation time and high mutation rate in bacteria, antibacterial resistance can occur rapidly resulting in increase and strength of infections, and possibly death. Advances in DNA sequencing technology gives hope for another boom in drug discovery. Diverse communities of microbes DNA in soils have the potential of

containing unknown compounds that would effectively kill bacteria and could then be used as new antibiotic. Samples were collected from locations in the North Island of New Zealand. New Zealand is a prime location for this type of exploratory research because of the rare and unique soil variations that are largely unexplored. After soil collection the conducted experiment was administered in a lab under controlled conditions and variables in order to isolate bacterial strains, extract natural products from the strains, and test these extracts for antibacterial activity. When cultured on agar plates grown with ampicillin, 17 total colonies between the 2018 and 2019 classes showed clear antibiotic resistant properties in the bacteria found in the soil samples. From the 2018 lab group, 15 novel gene clusters were identified with 6 of them being flagged as high interest. In the 2019 lab group two strains of bacteria from the pure cultures were found to have resistance and were sent out for further sequencing. After removing sequence adapters and low quality reads these processed reads will be assembled and analyzed to find the gene clusters responsible for creating the antibiotic compounds. Comparisons will be made to show the percentage of similarity between the novel strains and already known gene clusters. The gene clusters will then be cloned into a heterologous expression host and the molecules they produce that contribute to resistance will be extracted. If any strains are to be identified as novel the rights to the strains will likely be sold to a pharmaceutical company. This process will equip human populations with increased defense against the antibiotic resistance crisis.

Rats and mice differ in their motivation to seek social contact versus food
Cynthia Brown
Category & Time: Integrative Biology, Section 1, 11:30 AM - 12:45 PM
Poster: 52
Mentor: Christina Reppucci, Alexa Veenema

Animals are constantly faced with competing motivational drives for different stimuli. Survival of the animal depends on choosing which stimuli will benefit the animal most depending on its current needs. Animals can be influenced by a variety of factors including their internal states (e.g., loneliness, hunger) and external environment (e.g., stimulus salience). This study developed a novel behavioral paradigm to test the competition between two motivational drives and examined whether this competition is conserved across rodent species. First, we examined the effect of social isolation and/or hunger on the preference of male and female adolescent rats and mice to investigate a social stimulus (novel age-, sex-, and species-matched animal) versus a food stimulus (standard laboratory chow), when placed in a three-chamber apparatus. Rats showed a strong preference for the social stimulus, which was reduced when rats were food deprived compared to when sated. In contrast, mice did not show a stimulus preference when sated, but had a strong food preference when food deprived. Social isolation did not affect behavior in either species. Next, we determined whether the salience of the social stimulus would alter these preference patterns under sated conditions. Rats showed an attenuated preference for the social stimulus when it was their cagemate versus a novel animal, while mice exhibited a preference for the food stimulus when the social stimulus was their cagemate. Our future plan is to investigate the underlying neural circuits that can coordinate social motivation and food motivation in adolescent rats and mice.

Real-time Sonification of EEG
Katharine Bruce
Category & Time: Integrative Biology, Section 2, 11:30 AM - 12:45 PM
Poster: 53
Mentor: Patrick Bills

Recording and monitoring brain waves is an important diagnostic tool in medicine and crucial for neuroscience research. Currently, this is done by placing electrodes along the scalp which measure the voltage fluctuations in the tracts of neurons underlying them, amplifying this electrical activity, and then visualizing it as an electroencephalogram (EEG). An emerging practice in medicine is the use of EEG to monitor patients intraoperatively, which requires one person to watch the EEG recordings in real time and report significant changes. Relying on one person can be problematic if they become distracted, miss an important change, or even need to use the restroom. Sonifying - creating audible sound files from data - brain waves recorded with EEG, done effectively, could solve this problem. However, it has been difficult for the scientific community to create a standard and replicable method of transducing brain waves to sound due to most EEG technology being proprietary. This project explores tonic patterns that represent brain activity. Real-time data was collected using open source hardware and software from the OpenBCI project. Using an open-source system allowed for the modification of the visualization program to provide immediate audible feedback.

Antigenic Complementarity: Identifying Microbial Triggers of Type 1 Diabetes Using Protein Homology
Kaylie Chiles
Category & Time: Integrative Biology, Section 2, 11:30 AM - 12:45 PM
Poster: 54
Mentor: R Root-Bernstein

Type 1 diabetes mellitus (T1DM) afflicts over a million Americans, with an estimated 40,000 new cases every year. T1DM is characterized by the body's failure to produce insulin, which results from autoimmunity against pancreatic beta cells. The exact cause of this autoimmune attack is unknown, but the theory of antigenic complementarity provides a potential explanation. In the context of T1DM, this theory suggests that coinfection by two different microbes bearing antigens that mimic human insulin and the insulin receptor triggers the immune system to produce antibodies against these self-antigens. Homology searching yielded a list of bacteria and viruses with proteins that closely resemble insulin and its receptor. Top hits included clostridium compared to insulin and coxsackievirus compared to the insulin receptor. Blood serum from T1DM patients was analyzed for the presence of antibodies against clostridium and coxsackievirus; binding affinity of these antibodies for their complementary self-antigens was assessed. The degree to which antibodies bind to one another is determined using an enzyme-linked immunosorbent assay (ELISA), which provides a detectable color change to indicate binding. To ensure that binding between the serum antibodies (which are complementary to clostridia and coxsackievirus antigens) and the insulin and receptor self-antigens is not a fluke, negative controls were run to show lack of binding between the antibodies of interest and other targets. Binding between antibodies against microbial antigens and human insulin and insulin receptor proteins suggests that coinfection by clostridia and coxsackievirus may be a trigger for the autoimmune attack against the

body's insulin-producing cells.

CRF? Receptor Regulation of Anxiety-like Responses Following Long-Term Alcohol Withdrawal
Caitlan DeVries
Category & Time: Integrative Biology, Section 2, 11:30 AM - 12:45 PM
Poster: 55
Mentor: Glenn Valdez

Corticotropin-releasing factor (CRF) is one of the main regulators of anxiety during ethanol withdrawal. The CRF receptor subtypes appear to have a differential role in regulating anxiety, where CRF? receptor activation may increase stress-related behaviors and CRF? receptor activation alleviates this response. Previous research has demonstrated that urocortin 3 (Ucn 3), which selectively activates the CRF?? receptor, may reduce anxiety-like behavior during acute alcohol withdrawal. The current study sought to investigate the role of CRF? receptors in alleviating anxiety-like behaviors following protracted abstinence from ethanol. Female and male Wistar rats were fed an ethanol or control liquid diet for approximately 4 weeks. Upon removal of the diet, rats were assessed for signs of physical dependence and were then left undisturbed for 5 weeks. At the end of this abstinence period, rates were injected with Ucn 3 or vehicle and were then tested for anxiety-like behavior in the elevated plus maze. There was a significant interaction between ethanol diet condition and Ucn 3 dose on the percentage of time spent exploring the open arms. A post hoc Fisher's test showed that ethanol diet-fed rats spent significantly less time in the open arms, an effect that was reversed by injections of Ucn 3. Our findings support the hypothesis that activation of CRF? receptors decreases anxiety-like responses following long-term ethanol withdrawal.

Role of Serotonin 1A Receptors In Postpartum Maternal Behaviors in Laboratory Rats
Emma Ford
Category & Time: Integrative Biology, Section 2, 11:30 AM - 12:45 PM
Poster: 56
Mentor: Joseph Lonstein

Women's postpartum mental health is critical to the mother's ability to care for her child and provide the positive interactions for optimal childhood development. Unfortunately, many mothers are affected by postpartum depressive or anxiety disorders. We know very little about the brain mechanisms that contribute to postpartum depression and anxiety, and how these affective disorders can disrupt maternal caregiving. Selective serotonin reuptake inhibitors (SSRIs) remain the first-line drug therapy for mental health disorders throughout the postpartum period, despite the fact that there has been little research on how these SSRIs affect the brain's serotonin system in mothers differently than non-mothers. We know there are natural changes in the serotonin receptors within the brain throughout pregnancy and the postpartum period in female rats, including a sharp increase in expression of the serotonin 1A receptor in an area of the brain called the nucleus accumbens. The nucleus accumbens is critical for the processing of rewarding cues, such as pups, and we hypothesized that the natural increase in 1A receptor there across reproduction is involved in the selective attention to pup-related cues in new mothers. In this project, we are preventing the natural peripartum increase in the serotonin

1A receptor by injecting a viral vector that disrupts 1A receptor mRNA synthesis (or an inactive control substance) into the nucleus accumbens of pregnant female rats. After parturition, we are observing the depression-like, anxiety-like, and maternal caregiving behaviors in the two groups of mothers. We predict that the natural increase in serotonin 1A contributes to the female rats' ability to optimize serotonin release in response to rewarding pup-related cues, thus elevating care of the offspring and decreasing maternal depressive and anxiety behaviors.

Investigation of Structural Differences and Storage Capabilities of Skin Glands in Rough-Skinned Newts, (Taricha granulosa)
Hope Dueñas
Category & Time: Integrative Biology, Section 2, 11:30 AM - 12:45 PM
Poster: 57
Mentor: Heather Eisthen, Samantha Westcott

Rough-skinned newts (Taricha granulosa), house a neurotoxin called tetrodotoxin (TTX) that blocks voltage-gated sodium channels in neurons and muscle cells; thus, TTX is lethal to most other animals. Different newt populations possess varying levels of toxicity, with some individuals toxic enough to kill 25 adult humans and some completely non-toxic. We are investigating the structural differences and storage capabilities of rough-skinned newt glands as potential causes for toxicity variation. Many amphibians store toxins in their granular glands, and if rough-skinned newts do the same with TTX, structural differences within the glands may contribute to differences in toxicity across populations. We are testing this idea using histological methods to examine the structure of the newt skin glands. Another factor that may cause variation in toxicity is the ability to transport TTX from its microbial origin to newt tissues. To test this hypothesis, we will incubate toxic and non-toxic newt skin samples in concentrated TTX solutions and measure both rate and total amount of TTX uptake into the skin. This disparity in toxicity levels has long been explained due to an evolutionary arms race between the newts and predatory garter snakes that are evolving resistance to TTX; however, the recent discovery of microbial TTX-producers living on the skin of these newts indicates a more complicated explanation. Our research has the potential to resolve this apparent problem by linking the variation of TTX toxicity levels in newt populations to features of the skin related to storage or transport of the microbial toxin.

Feminized digit ratios in androgen insensitive rats
Victor Dirita
Category & Time: Integrative Biology, Section 3, 11:30 AM - 12:45 PM
Poster: 58
Mentor: S Breedlove

The ratio of the length of the second digit to the fourth digit (2D:4D) is often used as a statistical indicator of prenatal androgen exposure in both human and non-human subjects. The ratio is sexually dimorphic in humans beginning before birth; males - on average - have lower ratios than females. Additionally, masculinized ratios have been identified in both men and women with congenital adrenal hyperplasia (CAH), in self-identified "butch" lesbians, and in male and female rats whose mothers

received testosterone enhancements during gestation. Prior to this study, the 2D:4D had not been investigated in the testicular feminized (Tfm) rat, which expresses a dysfunctional androgen receptor (AR) gene on the X chromosome, giving rise to a female external phenotype in XY rats. Because testosterone plays essentially no role in the development of these animals in utero, they offer a unique model to study the relationship between fetal testosterone and 2D:4D. We hypothesized that male Sprague Dawley Tfm rats would show feminine digit ratios compared to their wildtype (wt) brothers. Examining the hind paws of 21 male Tfm rats and 13 wt male rats at six weeks of age revealed a more feminine (larger) 2D:4D in the Tfm group, with an average ratio of 0.997 (SEM = 0.010) in the right hind paw, compared to male wt rats which showed an average 2D:4D of 0.951 (SEM = 0.014) in the right hind paw ($p = 0.01$, $d' = 0.95$). We did not find a significant difference between the mean digit ratios of wt male and female (N =13) rats, perhaps due to greater variance among females. Nevertheless, the more feminine digit ratio in Tfm males compared to males with a wt AR demonstrates that androgen activity plays a role in the development of masculine digit ratios in rats, as has been shown in mice with limb AR deletions. Our study supports the theory that 2D:4D is inversely related to prenatal androgen stimulation in both human and non-human animals, validating efforts to link statistical trends in human behavior to digit ratios as indications of prenatal hormone influence.

The effect of nocturnal competitors on common marmoset monkey feeding behavior
Lauren Gapp
Category & Time: Integrative Biology, Section 3, 11:30 AM - 12:45 PM
Poster: 59
Mentor: Cynthia Thompson

Marmoset monkeys obtain food by gouging holes in trees to stimulate gum secretion. Although marmosets are among the few mammalian species who consume gum, there is limited evidence that they may face competition from nocturnal foragers such as possums and rodents. We studied wild common marmoset monkeys (Callithrix jacchus) at Tapacurá Field Station in Brazil and used camera traps to monitor animal visits at gum feeding sites. We assessed revisitation rates and latency between feeding visits to identify if marmosets changed their feeding behavior in the presence of nocturnal foragers. Marmosets had higher revisitation rates for feeding sites that were shared with other species compared to sites that were not. Across all feeding sites, marmosets had significantly higher revisitation rates and smaller time spans between feeding visits after a nocturnal forager had visited the night before. These trends remained the same when examining competition at our single feeding site with nocturnal foragers, however were no longer significant. This provides some evidence that marmoset monkeys change their feeding behavior when a nocturnal forager is present by visiting competitive gum sites more frequently within shorter time spans. As such, the degree of competition marmosets face from nocturnal foragers may be sizeable enough to generate behavioral modifications.

Trade-offs between chemical defense and mutualistic mite biotic defense across the genus Vitis
Carolyn Graham
Category & Time: Integrative Biology, Section 3, 11:30 AM - 12:45 PM
Poster: 60

Mentor: Marjorie Weber

Plants employ a diverse set of strategies to defend themselves against herbivory, including direct methods such as thorns, leaf toughness, or toxicity, or indirect methods that may involve mutualistic relationships with microorganisms. Because plant defenses are energetically costly and can sometimes interfere with one another both ecologically and physiologically, plants are predicted to invest in either direct or indirect defenses, but not both. Here, we test this trade-off hypothesis using domatia as a model system. Domatia are leaf structures that allow a plant to sustain populations of predatory mites on their leaves by providing them with shelter. The trait has evolved independently in many distantly related species of plants, and in some cases closely related species differ in the presence or absence of this trait. Here we investigate the potential for a defense-related evolutionary trade-off between mutualistic mite defense and chemical defense of species in the genus Vitis. In order to evaluate chemical defenses in Vitis, we will perform liquid chromatography/mass spectrometry on leaves to quantify the abundance and richness of secondary metabolites present. We will also conduct a bioassay to assess leaf palatability by subjecting leaves from a variety of Vitis species (both with and without domatia) to herbivory from a generalist herbivore and measuring leaf area consumed and survival. We predict that species without domatia will exhibit more secondary metabolites in their leaves than those with domatia, and that their leaves will be less palatable to herbivorous arthropods due to the expected trade-off.

Cardiovascular Effects of Coupled Hyperventilation and Acute Hyperglycemia
Maria Green, Devin Wilhelm
Category & Time: Integrative Biology, Section 3, 11:30 AM - 12:45 PM
Poster: 61
Mentor: Erica Wehrwein

Hyperventilation has significant effects on the cardiovascular system caused by the alteration of blood gas concentrations throughout the body which are sensed by chemoreceptors. Chemoreceptors initiate counterregulations, including elevated heart rates (HR). A similar increase in HR is seen during states of hyperglycemia however no physiological mechanism has been theorized to explain this relationship. This experiment's goal was to determine whether the increase in HR was greater during a combined hyperventilatory and hyperglycemic state versus either of the two states alone. Participants (5M/5F, ages 19-27) fasted for three hours prior to undergoing the experiment. Blood pressure, HR, and pulse amplitude were measured during normal and hyperventilatory breathing rates. The measurements were repeated 30 minutes after the ingestion of an oral glucose tolerance test. The hyperventilation state resulted in a significant increase in HR in both the fasted ($p < 0.05$) and hyperglycemic ($p < 0.05$) states however the increase in HR did not significantly increase during the coupling of hyperglycemia and hyperventilation ($p = 0.21$). There was no significant change in pulse amplitude during either of the two states. Subject demographics were evaluated, showing an inconsistency with participants taking Selective Serotonin Reuptake Inhibitors (SSRIs). SSRI treated subjects exhibited a vasodilatory effect during both fasted and hyperglycemic conditions which was significantly different than non-SSRI treated subjects who exhibited vasoconstrictory effects in both conditions. Further research is suggested to determine the cause and magnitude of this cardiovascular effect to ensure proper treatment of patients

experiencing hyperventilatory symptoms.

Daily rhythm of orexin immunoreacitvity and release in a female diurnal rodent model of seasonal affective disorder
Anna Moody
Category & Time: Integrative Biology, Section 3, 11:30 AM - 12:45 PM
Poster: 62
Mentor: Lili Yan

Orexin/hypocretin is a neuropeptide that has been implicated in many functions including sleep/wakefulness, energy expenditure, reward, mood and cognitive functions. Our previous work using male diurnal Nile grass rats (Arvicanthis niloticus) has shown that there are fewer hypothalamic orexin-immunoreactivity (ir) cells in animals housed in a 12:12 hr light:dark (LD) cycle involving dim daylight intensity (50 lux, dimLD), in comparison to animals housed in bright daylight (1000 lux, brLD). Grass rats housed in dimLD also showed higher depression-like behaviors and spatial memory impairments compared to the animals in brLD, suggesting that the orexin system may serve as a link between daylight intensity and the behavioral changes. It has been reported in humans and nonhuman primates that orexin peptide is high during the day and low at night in brain tissue or cerebrospinal fluid (CSF), suggesting a diurnal rhythm in peptide release. In the present study, we examined day/night fluctuation in the number, soma size, and optical intensity of orexin-ir cells in the hypothalamus of female grass rats housed in dimLD or brLD for four weeks. Female grass rats were perfused at zeitgeber time (ZT, lights on is defined as ZT0) 2 and 14. Brains were processed to examine orexin-ir in the hypothalamus (n = 6-8/condition/time point). The results revealed a significant day/night difference in the soma size and optical density of orexin-ir neurons, with more neurons, bigger soma size and greater density observed at ZT14 in both brLD and dimLD conditions. The higher soma size and density at night is consistent with the high release of peptide during the day in diurnal species. Although a day/night fluctuation was observed in both brLD and dimLD groups, the amplitude was higher in brLD group, suggesting more peptide released during the day in brLD animals than in the dimLD group. Additionally, the results did not show any significance in number of cells in brLD or dimLD. This is contrary to what was observed in male diurnal grass rats in previous studies, which could suggest a sex difference in number of orexin-ir cells. The overall results from this study suggest that in diurnal rodents, orexin peptides accumulate within the cell body at night, before being released during the day and mimics what we have previously seen in our studies with male diurnal grass rats. Daylight intensity modulates the degree of orexin change in the hypothalamus across a day.

Decoding the Mechanisms of Nerve Growth Cones
Candice Rivers
Category & Time: Integrative Biology, Section 4, 11:30 AM - 12:45 PM
Poster: 63
Mentor: Kyle Miller

The growth cone is the large actin-rich extension at the tip of a developing or regenerating axon. When the neuron is extending towards its final target, myosin and actin in the growth cone generate forces

that pull the axon forward. Much like the tires on a front wheel drive car, the growth cone pulls the axon forward and guides it to its destination. The purpose of this project will be to review the mechanical process of neuronal outgrowth, using models that are intuitive for those not in a neurological or STEM field.

Developing curriculum to train Graduate students how to utilize Raspberry Pis to Automate Research Labs
Shelby Santos
Category & Time: Integrative Biology, Section 4, 11:30 AM - 12:45 PM
Poster: 64
Mentor: Dirk Colbry

Raspberry Pis (RPis) are affordable microcomputers (approximately $35) that have the capability to revolutionize the accuracy and efficiency of data collection in basic laboratory environments. Recreationally, RPis can be used as a base for smart televisions, home automation or video games. However, by utilizing basic robotics and circuits in the workplace, microcomputers such as RPis can be programmed to automate data collection (such as temperature measurements or time lapse photography) and output sophisticated plots, create response mechanisms, and other mechanical or electronic tools to automate a research and save significant amounts of researcher time while producing more precise measurements. In this project, we are exploring the capabilities of RPis for graduate laboratories and developing curriculum to teach graduate students how to take advantage of this highly flexible and affordable technology.

Biosynthetic pathway of tetrodotoxin production in skin-associated microbes on Taricha granulosa
Emma Smoll
Category & Time: Integrative Biology, Section 4, 11:30 AM - 12:45 PM
Poster: 65
Mentor: Heather Eisthen, Samantha Westcott

Rough-skinned newts, Taricha granulosa, are highly toxic: some individuals house enough toxin to kill roughly 25 adult humans. This shockingly high amount of toxin has been attributed to an evolutionary arms race wherein predatory garter snakes are evolving resistance to the newt toxin, forcing the newts to produce higher and higher amounts of toxin as the garter snakes become more resistant. Recently, the relationship between newts and garter snakes has been complicated by our lab's discovery that the newt toxin, tetrodotoxin (TTX), is produced by microbes on the newt skin. Although TTX has been synthesized in labs, the biosynthetic pathway of tetrodotoxin remains unclear; arginine is a suspected source of the guanidinium group in TTX that binds to voltage-gated sodium channels, which is the basis of its toxicity. To test the hypothesis that arginine is a TTX precursor, we are culturing toxin-producing bacteria from newt skin in media with varying concentrations of arginine. We will then measure the bacterial TTX production using HILIC-MS/MS. Previous researchers have assumed that in the relationship between newts and garter snakes, natural selection acted on the newts to produce more toxin in order to survive encounters with garter snakes. However, identifying TTX precursors could help us determine whether or not natural selection is acting on the newts to differentially supply their microbes with

precursors, moderating their overall toxicity. Understanding the relationships among garter snakes, newts, and the newt microbes could help us understand how other microbial communities can affect the fitness of their host organisms.

Sodium Chloride Pollution and Deicer Alternatives' Effects on Aquatic Life in Freshwater Environments
Rachel Stander
Category & Time: Integrative Biology, Section 4, 11:30 AM - 12:45 PM
Poster: 66
Mentor: Abigail Cahill

Road salt (NaCl) administration has been an economically affordable and efficient solution to deicing the roads and sidewalks in the northern climate. Unfortunately, it has had increasingly negative impacts on the environment. The elevated, toxic amounts of chloride ions in the saltwater drain into the water systems and have decreased aquatic life populations. Therefore, this research is aimed at analyzing NaCl's effect on freshwater invertebrates as well as testing ice melting alternatives. This research will also examine differing salt concentrations on invertebrates in hopes of finding a solution that deices the roads without harming aquatic life.

Use of fentanyl to investigate regulation of drug reward by VTA SGK1
Ali Stark
Category & Time: Integrative Biology, Section 4, 11:30 AM - 12:45 PM
Poster: 67
Mentor: Michelle Mazei-Robison

According to the National Institute on Drug Abuse, over 130 people per day die of an opioid overdose. Opiate abuse in part results from neuroadaptations in the ventral tegmental area (VTA), and our lab has previously demonstrated that chronic morphine exposure increases catalytic activity and phosphorylation of the protein serum- and glucocorticoid-regulated kinase 1 (SGK1). Furthermore, VTA injection of a catalytically inactive version of SGK1 reduces opioid reward behavior in the morphine two-bottle choice test (TBC). However, the necessary use of quinine as a bitter taste control in the morphine TBC test presents a confounding variable, as quinine on its own is aversive. One strategy to reduce this potentially confounding effect is the use of fentanyl, another opioid 50-100 times stronger than morphine. Much lower concentrations of fentanyl could be used in the TBC test, eliminating bitter taste as a confounding variable. In order to test this, I will run mice through a single fentanyl TBC test with escalating doses in order to establish a dose response curve. In parallel, I will perform Western blots on VTA tissue from mice that have undergone chronic intraperitoneal (IP) fentanyl injections. I predict that chronic fentanyl will induce increases in VTA SGK1 phosphorylation and catalytic activity similar to our established findings in morphine-treated mice. The results of this project will expand our knowledge of SGK1's involvement in opioid reward behaviors and could present SGK1 as a potential therapeutic target for opioid addiction treatments.

Vax1 Heterozyote Mice Have abnormal Circadian Rhythms which Contribute to their Poor Fertility
Tulasi Talluri
Category & Time: Integrative Biology, Section 5, 11:30 AM - 12:45 PM
Poster: 68
Mentor: Hanne Hoffmann

Genetic factors' contribution to infertility remains poorly understood. To develop novel infertility treatments, a better understanding of genes controlling reproduction is necessary. Fertility is regulated by the reproductive axis which encompasses the brain, pituitary gland, and gonads. The primary drivers of the reproductive axis are gonadotropin releasing hormone (GnRH) neurons which release GnRH at the median eminence and drive pituitary release of gonadotropins. Our previous work identified the developmental transcription factor, Vax1 (Ventral anterior homeobox 1) to be crucial for GnRH neuron development. Because Vax1 knock-out (both alleles deleted) is neonatal lethal, fertility was evaluated in Vax1 heterozygote mice. Surprisingly Vax1 heterozygote females were very sub-fertile, a sub-fertility which could not entirely be explained by the reduction of GnRH neurons. Vax1 is highly expressed in the hypothalamic area controlling circadian rhythms called the suprachiasmatic nucleus (SCN). The SCN neuropeptide vasoactive intestinal peptide (VIP) is required for female fertility and normal circadian wheel-running activity. The objective of this study was to determine if Vax1 heterozygosity impacted SCN function and would be a contributing factor to the subfertility of the Vax1 heterozygote females. We hypothesized that Vax1 in the SCN is required for normal SCN function. We placed female Vax1 heterozygote mice in running wheels and found that they had abnormal wheel-running activity in constant darkness, showing impaired SCN function (n=5, Statistical analysis by two-way ANOVA). To determine how the abnormal SCN function arose we performed immunohistochemistry for VIP. Our data show that Vax1 heterozygote mice (n=3) have a reduction in VIP expression, but normal SCN morphology as established using hematoxylin and eosin staining (n=3). We conclude that Vax1 haploinsufficiency cause a reduction in VIP expression leading to an impaired SCN function, both of which are contributing factors to the poor fertility of Vax1 heterozygote females.

Establishing Octopus Bimaculoides Saltwater Environment for Neuronal Engineering Research
Tyler Vanburen
Category & Time: Integrative Biology, Section 5, 11:30 AM - 12:45 PM
Poster: 69
Mentor: Galit Pelled, Gabriela Saldana De Jimenez

Our goal is to develop a method of controlling a network of robotic tools to perform a hand grasping motion. Additionally, this tool could be used in next generation prosthetics, robotic surgeries, or even by service personnel to improve their effectiveness in the field. The challenging aspect in conducting this research with humans includes decoding the complex mechanisms involved in controlling hand movement and coordination as well as rendering automatic and deliberate response upon external stimuli. To overcome these adversities, a model organism with a complex neurological system and is more advantageous for recreating the mechanisms for a grasping motion is needed, therefore our lab has chosen the octopus as the best model for this research. The initial objective for this project is to set up an octopus environment. The initial introduction of the octopus to the aquarium caused environmental parameters, including ammonia, nitrate, and nitrite, to fluctuate to dangerous

concentrations. We hypothesize the introduction of snails, specialized sand, bacteria, algae, and routine water replacement will stabilize the environment through the absorption of nitrite. As predicted, levels of ammonia, nitrate, and nitrite stabilized due to the implemented changes made. Next steps in the research are to begin recording the octopus's behavior and physiology to understand its complex central nervous system.

Understanding the Transmission of Antibiotic Resistance in Microbial Communities
Charles Whitehead-Tillery
Category & Time: Integrative Biology, Section 5, 11:30 AM - 12:45 PM
Poster: 70
Mentor: Linda Mansfield, Azam Sher

Since the mid-20th century, antibiotics have been the main therapeutic for curing pathogenic bacterial diseases, however the genetic capabilities of the gut microbiome has allowed these bacteria to harbor genes making some of them resistant to antibiotics. The gut microbiome contains millions of bacteria which are beneficial for the health of the host. But microbiomes can also be responsible for driving antibiotic resistance where it may be harmful because of close interaction between microbial communities and the host. We hypothesize that bacteria containing an F-plasmid with antibiotic resistant genes are donors in the process of conjugation. Furthermore, those recipients obtaining those antibiotic resistant genes from previous donors also act as donors. The aim of this study was to examine the process of conjugation between Escherichia coli (E. coli) and other bacteria in the microbiota by finding donors and recipients that contain antibiotic-resistant genes that are not already present in the mouse gut. Coliforms were extracted from fecal samples of three mouse groups with different microbiotas: Adult Humanized, Infant A, and Conventional mouse microbiota or wild type. MacConkey Agar media was prepared with and without antibiotics to culture bacteria at different dilutions to identify the amount of colonization on the plates. The antibiotic chosen for this study was Cefotaxime because it's a third generation cephalosporin, so it's the most effective in killing microorganisms and a commonly used drug in clinical settings. Colonies were chosen to determine which coliforms were E. coli using Chromocult Coliform Agar media. Any E. coli present on the media turned purple and was stored for future use. A screening of bacteria will be done to examine our F-plasmid to start to test the conjugation process between E. coli and other bacteria. For our results no growth was present on the Adult Humanized mice as well as any of the antibiotic plates. In addition, there was growth on the Conventional & Infant A mice at both dilutions without antibiotic. The dilution at 10^{-1} contained more colonies than 10^{-2} due to higher concentration.

Do pearl bodies in grape plants (Vitis sp.) attract and feed beneficial mites?
Thomas Zambiasi
Category & Time: Integrative Biology, Section 5, 11:30 AM - 12:45 PM
Poster: 71
Mentor: Marjorie Weber

Without a "flight" response, plants must get creative with their "fight" response in order to avoid damage from herbivory. Defensive strategies produced by this "fight" response are often categorized as

direct – such as thorns or toxic compounds – or indirect, including extrafloral nectaries. Another example of an indirect strategy in grape plants (Vitis sp.) are tufts of leaf hairs in vein axils, known as domatia, that house beneficial mites to prey on fungi and herbivorous mites. However, all Vitis species also have an obscure feature found on petioles and abaxial leaf surfaces: pearl bodies. Pearl bodies are small orbs of proteins, fats, and sugars, and have been hypothesized to feed and attract mutualists in tropical plants, yet their ecological function in temperate plants (such as Vitis) is unknown. To determine the function of pearl bodies in temperate plants, I will conduct observational experiments to examine how mites interact with pearl bodies on Vitis riparia and Vitis labrusca; mites are known to be mutualists of plants across the Vitis genus. These observations will determine the interactions mites have with pearl bodies, if pearl bodies correlate with mite abundance, and if pearl bodies are inducible in Vitis. The results of these experiments will be compared to one another to establish an ecological relationship between mites as mutualists and pearl bodies on grapes. The presented data could potentially expand our knowledge about defensive mechanisms in Vitis and improve strategies for cultivating this agriculturally important crop.

Assessing Cardiopulmonary Synchrony Between Romantic Couples
Rozzie Bloch
Category & Time: Integrative Biology, Section 5, 11:30 AM - 12:45 PM
Poster: 72
Mentor: Erica Wehrwein

Along with many other animals, humans are no exception when it comes to synchrony. Within humans there are proposed sensory feedback mechanisms that allow couples to walk in synchrony and autonomic coupling that occurs in touching romantic couples. Our project attempted to replicate certain data from a previous study on inter-partner physiological coupling while also testing new conditions. The study recognized that touching heterosexual romantic partners have autonomic coupling that endures through a pain stimulus induced in the female partner. The purpose of our study was to provide further evidence that romantic couples display synchronous cardiac and pulmonary rates when holding hands and then determine if this synchrony was used to transfer the effects of a systemic response, using the cold-pressor test (CPT), a known inducer of a sympathetic response. Using a simple correlation, our project was unable to replicate this paper's recognition of autonomic coupling in heart rate (HR) and respiratory rate (RR) during touch conditions. In addition, an assessment on their empathy, physical, and emotional connectedness had no statistically significant impact on their HR and RR. However, it is possible that touching heterosexual romantic couples may decrease the recognized increase sympathetic response, but future studies should assess baseline CPT measurements in heterosexual romantic couples and compare them to CPT measurements in the touch condition.

Scaffolding a Traditional Organic Chemistry Lab Experiment to Include Scientific Practices and Emphasize Green Chemistry
Rozzie Bloch
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 73

Mentor: Elizabeth Day, Melanie Cooper

In the field of chemistry education, "sense-making" is recognized as an important part of what scientists do and therefore should be a focus of science learners in the classroom. The National Research Council defines a set of scaffolding tools called the "science practices" in A Framework for K-12 Science Education that are essential for students to make sense of phenomena. Many organic chemists would argue that teaching laboratories are crucial for students' success in organic chemistry. However, traditional organic chemistry labs may focus on technical skills and reiteration of lecture material, with little evidence that these labs engage students in "sense-making." Within the past couple decades, transformed teaching laboratory curricula are moving away from traditional "cookbook"-style experiments to guided-inquiry or problem-based collaborative experiments. While this may be an improvement from traditional labs, we hope to more explicitly align the laboratory curricula with "sense-making" by incorporating some "science practices." In addition, our laboratory curriculum aims to emphasize green chemistry by creating exploratory questions for students that engage students in the consideration of efficiency and reusability. In this project, we analyzed a traditionally taught Michigan State University organic chemistry experiment and redesigned it to emphasize green chemistry and to incorporate the following "science practices": 1) planning and carrying out investigations, 2) developing and using models, and 3) engaging in argument from evidence. With these changes we hope to develop a more environmentally conscious experiment that helps students develop the skills necessary to make sense of the phenomenon.

Resurrecting the Transformative Vindicationist Pedagogy and Achievements of Jane Dabney Shackelford
Gloria Ashaolu
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 74
Mentor: Pero Dagbovie

During the era of Jim Crow Segregation when Carter G. Woodson was active, the execution of Black history within k-12 curriculum in the United States aligned with the goals of white supremacy. This allowed for justification for the deprivation of fundamental civil and human rights for African Americans. In an effort to counter this, Woodson dedicated nearly forty decades, advocating for the legitimate recognition of Black History. As he often acknowledged, Woodson did not bring the early Black history movement by himself. Woodson worked with numerous women, especially teachers, who were part and parcel of his various projects. With that said, there is not much scholarship that focuses on the work of Black female teachers and their collaborative effort in the formal and informal assertion for legitimacy in Black History. In an effort to highlight the contributions of Black female teachers, I seek to analyze how Jane Dabney Shackelford, a Black female teacher, developed counternarratives through her publications and community involvement during the Woodson Era and sought to engage in race vindication to uproot and shift the dominant and dismissive narrative about Black History. My approach entails a brief biography of her, the work of Black teachers and the manifestation of the Race Vindicationist Tradition, Shackelford's community-oriented services, and an in-dept analysis of her two books, Child Story of the Negro, and Oh Happy Days. In order to best address these topics, this research

centers archival work produced by or about Shackelford.

Role of adolescent-formed, drug-associated environmental stimuli in relapse: behavioral sub analysis in Sprague-Dawley rats
Nataleigh Austin
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 75
Mentor: Amy Arguello

Drug-associated environments can trigger relapse, a critical problem in cocaine-use disorders. Adolescence is a vulnerable developmental time period in which drug use is first initiated. Using a rodent model of relapse, the mechanisms by which contextual stimuli precipitate relapse in adulthood has been well studied. However, the ability of context-drug-associations formed during adolescence to precipitate relapse has not been researched extensively in this vulnerable population. Our lab has abbreviated the standard self-administration-reinstatement paradigm to allow for tests of drug relapse to occur during adolescence. Adolescent male Sprague-Dawley rodents underwent jugular catheterization surgery, followed by a recovery period. Rats received self-administration training in a distinctive context where they learned to press a lever for cocaine infusions. Next, rats underwent extinction training in a separate distinct context in which lever presses resulted in no infusions. After extinction, rats were placed back into the cocaine-paired context for a drug-relapse test in which drug-seeking behavior was measured (i.e. increased active lever responses). We predict that adolescent rodents with a history of cocaine use will display increased contextual drug-seeking behavior. In addition, we aim to explore time-dependent behavioral patterns of adolescent rodents during all phases of the training and test sessions. To conduct these sub-analyses, we will transfer data sets from Med-PC to R studio software. We will focus behavioral sub-analyses on the relationships between lever responses, infusions during initial vs stabilized self-administration training and subsequent drug-seeking tests. Results from these analyses will provide insight on how adolescents respond to drug-associated environmental stimuli.

Association Racial/Ethnic Peer-Victimization and Academic Performance: Sleep as a Moderator
Faizun Bakth
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 76
Mentor: Yijie Wang

Victimization has pernicious effects on adolescent academic performance. Therefore, it is important to identify the protectives factors for adolescents against severe negative experiences. Recent research has identified sleep as a crucial bio-behavioral factor that can alleviate social risks such as stress and discrimination (El-Sheikh et al., 2015). El-Sheikh et al., examined sleep as a moderator between peer discrimination and youth internal and external symptoms and found that sleep indeed can be a protective factor as adolescents who slept longer and experienced low perceived racial discrimination reported low internalizing symptoms. However, no research so far examined sleep as a moderating

factor between racial/ethnic peer-victimization (a more severe type of adverse experiences) and academic performance, another critical domain of development. Therefore, the purpose of this study is to examine sleep as a protective factor by assessing if having longer and better sleep could ameliorate the association between racial/ethnic peer victimization and adolescents' overall GPA. The study consisted of 178 9th and 10th-grade participants who wore actigraphy watch and took nightly surveys to record the sleep and wake time. Additionally, participants also received a pre and post survey that included questions regarding peer-discrimination and academic performance. By identifying sleep as a protective factor, this study could highlight innovative interventional strategies such as improving sleep quality and duration that may help adolescents' adjustment to social challenges.

Sense of Control
Quintasha Beamon
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 77

This experiment was previously conducted to examine if choice is rewarding and if older individuals have a difference in preference for control. After, research it was concluded that both older and younger people have around the same sense of perception for reward. However, will we receive the same results with Parkinson's patients. During this experiment we will run three surveys to test the questions listed above? Both the control(elderly) and Parkinson's patients will take a choice based game. The Parkinson's patients will then take an attention based line test. While the control group will be taking a mental survey. After the Parkinson's patients are done they will also complete a short mental survey. Lastly, the Parkinson's patients will return a week after their first meeting and retake the same surveys. However, this time they will be off their daily medications. This will allow us to see if being on or off their medication will change or alter their motivation for reward.

Communication Dynamics and Team Productivity in Project Teams: An AEC Case Study
Jackeline Benitez
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 78
Mentor: Sinem Mollaoglu

Team productivity is defined as the collaboration of a group of individuals to meet superior results while focusing on performance excellence to promote work life satisfaction. Existing literature in the Architectural, Engineering, and Construction (AEC) industry focuses on approaches in decision-making, integrated communication, and timing of decisions as important factors in improving project costs among interorganizational team members. There is a knowledge gap concerning the importance of team communication as a vital factor in maintaining an effective project status and team productivity. This study examined the relations between communication dynamics and team productivity on an AEC project case study focusing on one of its early action-transition episodes: schematic design phase. This phase included 180 total team members from 20 different organizations. Communication dynamics data were collected longitudinally by periodically retrieving email data among project team members and by

observing face-to-face meetings to determine the frequency each individual gave/asked information. Data were descriptively analyzed to determine communication frequencies and their changes over time associated with individual's expertise, role, and tier of the project team. Team productivity data were extracted using project team weekly meeting minutes. The data were analyzed qualitatively to determine how long issues take to resolve. Based on these analyses, preliminary results answered questions regarding the longevity of issues that are brought about in AEC industries and determined trends on communication dynamics that may potentially make or break team productivity.

"This Insolent and Inhuman Race": White Union Soldiers' Thoughts about White Southerners during the Civil War Era
Lauren Bergeron
Category & Time: Social Sciences, Section 1, 11:30 AM - 12:45 PM
Poster: 79
Mentor: Marcy Sacks

The Civil War was the United States' bloodiest and deadliest war, with intense battles interspersed between long periods of boredom. In order to preserve the spirit and combat boredom, Union soldiers frequently wrote letters to home and kept personal diaries. For many ordinary white Union soldiers, it was their first time in the South, and their first time interacting with Southerners, both white and black. From reading scores of letters and diaries from white Union soldiers, I have found that everyday white Northern soldiers were fascinated by white Southerners, enough that they commented on their perceived character and behaviors in their diaries and letters home. While there was often disdain, there also was frequent sympathy for poor white Southerners with the assumption that they had been duped into supporting secession by rich, slave-owning white Southerners. My project analyzes comments made by white Union soldiers about white Southerners in order to better understand how white Union soldiers' perceptions of white Southerners contributed to their overall understanding of the war. Additionally, this analysis helps reveal the depth of the division between the North and the South, revealing that it extended far deeper than politics or commitment to a cause. Rather, white Northerners and Southerners in many ways viewed themselves as fundamentally culturally incompatible.

High School Transition Experience: Preventative Measures in Exposure to Violence
Natalie Berrios
Category & Time: Social Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 80
Mentor: Christopher Melde

Previous research suggests that adolescent victimization experiences occur either in school or street settings, but less often examines how individuals experience victimization across these contexts. Polyvictimization focuses on the types of victimization adolescents experience and whether or not there are similarities and differences across these contexts. This research has established how polyvictimization can negatively affect an adolescent's mental health, academic performance, and social life. For example, 75% of adolescents are impacted by polyvictimization and they have experienced at least one other form of victimization that affects their mental health (Finkelhor et al., 2006). Research in

this area needs to focus on how adolescents cope with victimization across context, including how they express different responses to victimization risks and the preventative measures they take to mitigate these risks, what has come to be known as "street efficacy." Drawing from the "Safe School Transitions: Part of the Comprehensive School Safety Initiative" survey data and in-depth interviews collected from elementary school students transitioning to high school. The current study will examine the prevalence of polyvictimization in this local context, how confident students are in their ability to avoid dangerous situations, as well as how adolescents cope with the threat of victimization in both their neighborhoods and school environments. By using an independent sample t-test, this will determine how significant school efficacy and street efficacy are by comparing concepts. Results will provide a greater understanding of the link between school and street efficacy, and the techniques adolescents use to avoid victimization.

Estrus Cycle Influences Perception of Interval Timing
John Bogucki
Category & Time: Social Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 81
Mentor: Alexander Johnson

Sex differences in behavioral processes are well established in both rodent and human models. One possible underlying mechanism of sex differences relates to gonadal steroid hormones exercising influences over behavior, which has been documented in both laboratory and real-world settings. In the current study we made use of a Peak Interval task to examine whether interval timing differed based on the stage of estrous cycle. Interval timing is a critically important biological mechanism that guides learning and decision-making. In our study, female rats first learned to respond on a lever for sucrose reward following the passage of a 20 second criterion duration. Next, intermixed probe trials were introduced during which the lever extended but no sucrose was provided. Probe trials allowed measurement of maximum lever responding across a trial, and enabled assessment of the rat's interval timing function. Responding on the lever during these trials revealed a normal distribution that peaked near the 20 s criterion duration indicating intact temporal performance. However, when we compared the performance of female rats based on their stage of estrous cycle; diestrus females showed a leftward shift in the timing function, suggesting that their perception of the criterion duration was shorter compared to proestrus/estrus stages. Given that progesterone and estrogen are lower during diestrus, these findings suggest that androgens have the capacity to influence this critical facet of timing behavior in females, which may have a wide-range of implications for learning and decision-making.

Missing/Murdered Indigenous Women in News Media
Kelli Bowers
Category & Time: Social Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 82
Mentor: Jennifer Stewart

Little research is being done on the inflated rate of violence against and the many missing and murdered indigenous women (MMIW) in the United States, especially in urban areas. There is also little news

coverage given to the women who are victims of this violence. The lack of research being done on this topic, combined with the lack of news coverage leads to a lack of understanding by the general topic on the issue as a whole. The goal of my project is to do a content analysis of three online news papers in the three cities with the most MMIW- Seattle, Anchorage, and Albuquerque. I will analyze the number of stories done on MMIW and the language used within them. For example, Abigail Echo-Hawk and Annita Lucchesi (2018) found that many of the articles on MMIW they analyzed had reference to the victim's use of drugs and alcohol or referenced the victim's criminal history. One of my goals is to find a ratio of the number of represented MMIW compared to white women in these newspapers to see if they are consistently represented. In the past, the language used to describe MMIW newspapers has been degrading and violent. I will code the language used in each online newspaper article to see if there are patterns or distinctions from the language used to describe white women in similar situations.

Multilingual Children's Language use Settings and Literacy Activities
Madison Brodoski, Eric Farhadi
Category & Time: Social Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 83
Mentor: Lori Skibbe, Sarah Goodwin

Phonological awareness (PA), or sensitivity to the underlying sound structure of oral language, is a skill that benefits young children's reading development (McDowell et al., 2007). The measurement of the English PA knowledge of dual language learners (DLLs), children who are acquiring English and other languages, is critical because DLLs' other language systems may impact their ability to acquire English word structure (Hammer et al., 2014). Although younger DLLs (ages 3-5) may at first have more limited oral language, they often improve when starting school (McLeod et al., 2016); moreover, home literacy materials can also benefit children (Foster et al., 2016; Froyen et al., 2013). We hypothesized that children who use their languages across more settings (e.g., home, school, or other communication sites), and whose homes have more literacy activity (e.g., "How often do you read to your child?"), would have stronger PA skills. Parents of DLL children aged 3 to 7 (n=60) completed a questionnaire about their child's home literacy environment. Questionnaire items included children's language acquisition and ages of use, including settings in which languages were used. Children took the Peabody Picture Vocabulary Test-4, letter name/sound knowledge batteries, and a new tablet-delivered assessment (Access to Literacy Assessment System- Phonological Awareness, measuring the ability to rhyme, blend, and segment sounds and words). Results indicated that children used their languages across diverse settings and that family literacy behaviors spanned a wide range. Implications for early childhood education and literacy acquisition will be discussed.

Trans & Gender Diverse Suggestions for Improving Health Care
Corinne Brown, Rowan Giffel
Category & Time: Social Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 84
Mentor: Jae Puckett

Transgender persons are marginalized in our society and often are not connected to necessary mental

health and medical care resources due to stigma and many providers' lack of basic understanding of this population and their health needs. Transgender populations often report poor healthcare experiences; though the content of these reports is familiar within the community, there is a need for research documenting in what ways these poor experiences manifest in order to organize a concerted effort to improve them. In prior research, participants were asked about barriers they experienced to receiving gender-affirming medical care. In order to elaborate on the understanding of this experience, participants were asked to describe any recommendations they might have for medical and mental health providers or staff to improve experiences of trans individuals within healthcare or mental health settings. Participants included [insert participant info/demographics] who were screened and then selected to respond to an online survey. Thematic coding of these responses revealed five basic categories of suggestion: trans accessibility, forms, papers, and preferences; training, basic respect and decency, and professional suggestions. These results provide better understanding of transgender experiences in healthcare and a most useful, comprehensive compendium of the ways in which transgender individuals suggest their healthcare be improved, aiding development of professional healthcare practices for a historically stigmatized and underserved population.

Women of Color at Predominantly White Universities
Taneya Chavis
Category & Time: Social Sciences, Section 2, 11:30 AM - 12:45 PM
Poster: 86
Mentor: Terah Venzant Chambers

In this paper I hope to examine the general challenges that high achieving women of color face at predominantly white college institutions. Among many problems lies, with high achieving women of color are who often get overlooked by professors and advisors due to the lack of awareness around the constant obstacles these students endure on campus. I hypothesize that my research will show women of color coming across hypervisibility or invisibility, uneasy adjustment to campus, and lack of supportive resources on campus. I will conduct a two-month long qualitative investigation of the obstacles that three high achieving women of color have encountered at their predominantly white institutions. These interviews will be conducted in the same location, and under the same conditions. My findings will be based off of analyzed interview data of the three participants and build on existing literature. From my research, I hope to find commonalities amongst the stories of the participants, and to narrow down the main challenge's women of color deal with at these institutions. These commonalities allowed me to draw conclusions based upon the experiences of my interviewees.

Perceived Invasiveness of Psychiatric Electroceutical Interventions as Treatment for Clinical Depression
Marissa Cortright, Emily Castillo
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 87
Mentor: Laura Cabrera Trujillo, Robyn Bluhm, Aaron McCright, Eric Achtyes

A number of therapies that use electrical or magnetic stimulation of the brain are in use or development

to treat treatment resistant depression. These psychiatric electroceutical interventions (PEIs) include: electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), deep brain stimulation (DBS), and adaptive brain implants (ABI). Psychiatrists' views on the use of these interventions are influenced by various ethical beliefs, values, and concerns. To better understand psychiatrists' viewpoints on these various PEIs, we conducted semi-structured interviews with 16 Michigan-based psychiatrists, who were directly recruited via recommendation by a member of the team. We used qualitative content analysis to identify major themes across the group. In this abstract we focus on results from one particular view: invasiveness, where invasiveness refers mainly to physical invasiveness. A key distinction in the medical literature is between invasive and non-invasive interventions, with technologies like DBS characterized as invasive and TMS as minimally invasive. DBS was considered to be the most physically invasive PEI, however, the majority of psychiatrists (11/16) also believe that ECT is physically invasive. Just over half of psychiatrists (9/16) believe that TMS is less invasive than ECT, or not invasive at all. In comparison to psychotherapy, ECT is seen as more invasive, or invasive in a different way. In comparison to pharmaceuticals, ECT is mostly seen as invasive in a different way. Our results suggest that while physical features are key for assessments of invasiveness, psychological, emotional, and lifestyle effects also play an important role.

Rates of Eating Disorders and their Symptoms in Women with Mood and Anxiety Disorders: Comorbidity and Implications for Treatment
Susana Cruz Garcia
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 88
Mentor: Kelly Klump

Individuals with eating disorders (EDs) have increased rates of major depressive disorder (MDD) and anxiety disorders. Yet, very few studies have investigated rates of EDs and their symptoms in individuals with MDD and anxiety disorders. The purpose of this study is to examine the prevalence of (1) MDD and anxiety disorders in individuals with a lifetime diagnosis of an ED, and (2) EDs and their symptoms in individuals with a lifetime diagnosis of MDD or an anxiety disorder. We will analyze archival data collected from adult female twins (n = 594) from the Michigan State University Twin Registry (MSUTR). Diagnoses were assessed using the Structured Clinical Interview for DSM-IV (SCID), and disordered eating symptoms were measured using the Minnesota Eating Behavior Survey (MEBS). We will use chi-square tests to examine whether rates of EDs are significantly higher among people with MDD/anxiety disorders, and perform t-tests to compare dimensional disordered eating symptoms in individuals with and without MDD or an anxiety disorder. Preliminary results show that among participants with lifetime MDD or an anxiety disorder, ~13% also have a lifetime ED, compared to ~3% of participants with no lifetime MDD/anxiety disorders. Clinical and epidemiological studies have consistently shown high comorbidity of MDD/anxiety disorders in ED samples. However, this study examines ED diagnoses and symptoms in people with MDD/anxiety disorders. Filling this gap in the literature could help improve treatment for patients with MDD/anxiety disorders who have disordered eating symptoms that could otherwise go overlooked.

Is There Evidence of a "Ferguson Effect" on Crime in the United States?
Pero Dagbovie
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 89
Mentor: Joseph Cesario

Following the killing of Michael Brown in Ferguson, Missouri and the ensuing chaos, social commentators introduced the idea of the "Ferguson Effect." This effect claimed that the increased public scrutiny of police officers following police shootings results in higher crime rates. Although some past work has attempted to study this effect, past efforts have been limited to one or two cities and have had problems with measurement of crime rates. The current research tests for evidence of one model for the Ferguson Effect: that the increased scrutiny of police officers' dealings with black communities causes officers to disengage from discretionary policing methods and, as a result, crime rate increases. I will test whether changes in national discretionary policing data have corresponded to changes in national crime rates. The two major strengths of this work are (1) the use of over-time data across a large number of U.S. cities, and (2) a measure of crime that is independent of policing data (death by assault data from the CDC).

SAD Orexigenic Projection to the Dorsal Raphe in Regulating Affective Behaviors
Samhar Daoud
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 90
Mentor: Lili Yan

Seasonal Affective Disorder (SAD) is one of the most common disorders in humans, it occurs in the fall and winter seasons when the days are shorter and there is less sunlight to understand the underlying neuropathology, our group has developed an animal model of SAD using diurnal Nile grass rats (arvacanthis noliticus). Previous research from our lab has shown that grass rats housed in dim winter like lighting conditions have shown increased depression and anxiety-like behaviors compared to those in summer-like lighting conditions (Leach et al, 2013). Interestingly in rats, depression and anxiety-like behaviors are accompanied by decreased hypothalamic peptide orexin, which has been implicated in regulating sleep to wakefulness, rewards, and regulation of the mood. The objective of this study is to follow up on the tested hypothesis that the pathway of orexin -1 receptors to the dorsal raphe regulates the anxiety and depression-like behaviors in the animal models of the SAD. The animals were treated with a viral vector (AAV) expressing OX1-R-shRNA that resulted in sustained knockdown of OX1-R mRNA. Following the surgery, animals were housed in summer like lighting conditions for 4 weeks prior to behavioral testing. The testing included forced swim test (FST) to test for depressive-like behaviors and open field test (OFT) tested for anxiety-like behaviors. There are experimenters who are blinded with treatment condition conducted video scoring of the behaviors of the rats. There was a high consistency between the results. This study will give us a better understanding of the implication of lighting conditions and the role orexin plays in the brain.

Associations Between Age and Life Satisfaction: Does Meaning in Social Interactions Change As We Age?
Alan De La Cruz
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 91
Mentor: Richard Lucas

Even though emotional trajectories fluctuate throughout the lifespan, well-being tends to remain relatively stable. This effect prevails even when older adults begin to experience declines in physical ability and executive functioning. A possible explanation lies within the context of Socioemotional Selectivity Theory, which states that older adults are more likely to prioritize emotionally meaningful partners compared to younger adults who seek novelty interactions. The purpose of the present study is to explore whether meaning in social interactions and activities is a mediator of the association between age and life satisfaction. Participants were 2,303 men (48%) and women (52%), aged 17-95 years (M = 51.8, SD = 18) recruited in 2012 from the German Socioeconomic Panel Innovation Sample (GSOEP-IS). The Day Reconstruction Method was used to assess outlying emotional variations in daily life events and social interactions. Different factors such as the frequency, quality, meaning, and mood of these interactions were recorded. First, we aim to examine the average meaning across all different activities and social interactions. We will then examine correlations between the time spent in each of these interactions and age. Furthermore, we plan to analyze how fluctuations from social to non-social interactions and their respective meaning changes as age progresses. A multilevel modeling analysis will be used to explore possible differences in meaning across age. Findings from the present study will aid in explaining the role of Socioemotional Selectivity Theory and help us better understand how age and meaningful interactions can impact life satisfaction.

The Effects of Stereotype Threat, Belonging, and Psychological Cost on Science Career Intentions of Underrepresented Minority Students
Chino Ekwueme
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 92
Mentor: Lisa Linnenbrink-Garcia

Of students who reported intending to pursue a science, technology, engineering, and math (STEM) major their freshman year, the number who persist and graduate with this major is fewer than 40%. This high attrition phenomena is even more striking for underrepresented minority (URM) students. Previous literature has observed an indirect negative relation between stereotype threat and science motivation in women, specifically for science career choice intentions. A relation between stereotype threat and increased stress arousal has also been observed. Additionally, Walton and Cohen found that belonging uncertainty hindered the academic performance and potential of negatively stereotyped groups. The current study aims to examine the relation between the experience of stereotype threat in URM university students and science persistence. The potential role of feelings of belonging and psychological costs due to excess stress in mediating this relation is also analyzed. Preliminary analyses, using a sample of underrepresented minority students (N= 225) enrolled in a chemistry course obtained from a larger longitudinal study, found that ethnic stereotype threat was associated with a decrease in

belonging among peers and an increase in psychological cost. Significant associations between psychological cost and stereotype threat and psychological cost and STEM career intention were also observed. However, psychological cost did not mediate the stereotype threat-STEM career intentions relation as there was no direct effect.

Effects of Perceived Gender on Attitudes Towards Criminal Sentencing
Alivia Foster, Kayla Behm
Category & Time: Social Sciences, Section 3, 11:30 AM - 12:45 PM
Poster: 93
Mentor: Jenna Van Fossen Vanfossen

Even though research has found that the rate of incarcerated women is increasing in the United States, the prison population remains male. This study aimed to evaluate whether perceived gender alone causes a change in attitudes towards criminal sentencing, and more specifically, whether people believe males deserve to be punished more severely thus sentencing males to longer sanctions. Each of the 403 participants were randomly assigned to one of three conditions (male, female, gender-neutral) in a hypothetical crime scenario and were asked how long the person depicted should be sentenced based on the robbery described. There was no statistically significant difference in sentencing between the three conditions. However, there was a negative correlation between the male condition and whether the participant personally knew someone who had been a victim of robbery. This combination of being presented with a male offender and being a potential juror who knows a victim of the same crime committed by the offender causes the potential juror to become apart of a specific subgroup that is dangerous for the outcome of the offender because it has a direct effect on his/her/their sentence, and thus their life. This is why it is critical for lawyers to have the power of dismissal of a potential juror during pretrial to eliminate potential biases. Even though there may be other factors that explain why more men are still overrepresented in prison populations, perceived gender can have a direct effect on an offender's perceived length of sentence.

Interviewer Gender Effects in the Afrobarometer Survey
Carla Garcia
Category & Time: Social Sciences, Section 4, 11:30 AM - 12:45 PM
Poster: 94
Mentor: Ana Bodea

The number of political science publications utilizing surveys conducted in developing countries has more than doubled in the past decade. However, there is a limited understanding of the unique methodological challenges faced by survey researchers in the developing world. US-based research suggests that characteristics of the interviewer influence survey responses (the "interviewer effect"), though this theory has not been widely tested in the developing world. To work towards bridging this gap, this study investigates the research question, how does interviewer gender influence responses to the Afrobarometer survey? The Afrobarometer is a public opinion survey of democracy and governance in Africa, the results of which are used widely in academic research. We use Round 6 of the survey, which was administered in 2014-2015 to over 53,000 respondents across 36 countries. Using logistic

regression models, we analyze how interviewer gender affects responses to a question regarding women's political participation. We compare these results with a model analyzing the effect of interviewer gender on questions unrelated to gender issues. We find that respondents of both genders are more likely to report support for women in politics when interviewed by a woman, consistent with social desirability theory. We also expect to find that women interviewers elicit higher non-response rates, as predicted by social power theory. We expect the effects to be small overall, but vary in magnitude across countries and regions. We anticipate that this study will have valuable implications for the future collection of accurate, unbiased survey data in the developing world.

Who Is a Mexican? Afro-Mexicans Reclaim their Place in the Nation State
Kendra García
Category & Time: Social Sciences, Section 4, 11:30 AM - 12:45 PM
Poster: 95
Mentor: David Stark

The research examines the field of Afro-Mexican history, in particular how the field has evolved, how Afro-Mexicans have been marginalized and reclaimed their place within the nation. Three questions guide my analysis: one, how and why were Afro-Mexicans rendered invisible in the historiography; two, what prompted renewed interest in Afro-Mexicans and three, what have they done to raise awareness or fight for inclusion? My central argument is around how the concept of mestizaje was used to marginalize Afro-Mexicans. As such, the gap in the research is due to the erasure of Afro-Mexicans from national identity, and general emphasis on mestizaje in the period after the Revolution. Resurgence in the field began as a result of a growing interest in comparative history, the era of post-emancipation, and a small segment of the Afro-Mexican population becoming involved in politics beginning in the 1980s which led to this renewed interest in the lives of contemporary Afro-Mexicans.

Codename Storm: A Socio-historical on one of Marvel's First Black Female Superheroine
Dinah George
Category & Time: Social Sciences, Section 4, 11:30 AM - 12:45 PM
Poster: 96
Mentor: Jualynne Dodson

The Marvel superheroine Storm stands as one of the most powerful members of the mutant-superhero team of the X-Men. Her power to manipulate the weather, alongside her skills as a master thief and team leader, make her a phenomenal character in the comics. Storm's introduction in the 1975 Giant Size X-Men #1 was not coincidental, but rather a portion of a targeted campaign to introduce a more "diverse" line-up for the existing X-Men comic series. This qualitative research project seeks to understand the socio- historical context in which the Black superheroine Storm was created. This project will look at the social movements surrounding her introduction into the Marvel Universe, while also taking into account the racial and gender dynamics of Marvel characters at the time of Storm's introduction in 1975. Both of these aspects will create a better understanding of the context that created one of Marvel's first Black Female Superheroine. This project will review varying comics in the Michigan State University comic book archive collection, along focusing on particular social movements

and societal influences that created the context to create the superheroine Storm. This scholarship is significant because it uses aspects of the arts and popular culture to analyze the societal humanities (comic characters) as a means of scientific exploration of the societal popular culture figures found in society.

Connecting Ideas across Courses: Relating Energy, Bonds, and How ATP Hydrolysis Can Power a Molecular Motor
Abby Green
Category & Time: Social Sciences, Section 4, 11:30 AM - 12:45 PM
Poster: 97
Mentor: Becky Matz

Core chemistry ideas are often useful tools for explaining biological phenomena. For example, to explain the denaturation of DNA at the molecular level, it is critical to understand intermolecular forces and forces of attraction. Unfortunately, students often have difficulty understanding these core general chemistry ideas. This issue stems in part from a lack of explicit opportunities in introductory courses for students to practice connecting ideas. Our goal is to provide a set of opportunities for students to connect their knowledge across introductory chemistry and biology courses. The central research questions is: In what ways do students use their knowledge of core chemistry ideas to explain biological phenomena? We are developing activities that examine students' abilities to connect a chemistry idea with a biological phenomenon. Here, we describe one particular example highlighted by faculty that focuses on concepts about energy and ATP coupling. Our team iteratively developed a written activity that first asks students about their knowledge of the role of energy during the breaking and forming of covalent bonds, then asked a series of questions about their knowledge of ATP and why ATP interactions are important to help power a molecular motor. Preliminary results show that students used the concept of energy in various ways when discussing interactions between ATP and the motor; this range of responses is being used to iteratively develop a coding scheme that relates students ideas about bond breaking and forming to the role of ATP in powering a molecular motor.

Sex Differences in CRF2 Receptor Regulation of Depressive-Like Behavior During Protracted Ethanol Withdrawal
Lavar Green-Jackson
Category & Time: Social Sciences, Section 4, 11:30 AM - 12:45 PM
Poster: 98
Mentor: Glenn Valdez

Alcoholism is the third leading preventable cause of death in the United States. While there are certain medications to help treat alcoholism, there are none that pacify depressive symptoms experienced following long-term withdrawal. This study seeks to understand why individuals experience depression during alcohol withdrawal, which often leads to relapse. In our experiment, we examined the ability of the CRF2receptor to alleviate depressive-like behaviors following long-term withdrawal from alcohol by investigating the ability of Urocortin 3 (Ucn 3), a neuropeptide that selectively activates CRF2 receptors, to reverse immobility in the forced swim test, an animal model of depression. We found that animals

injected with the Ucn 3 showed a trend towards immobility compared to rats that are injected with the control solution. Currently we are examining potential sex differences in Ucn 3's actions during forced swim test. After analyzing our results, we hope to find a treatment for humans experiencing depression following long-term alcohol withdrawal.

Method Notes on Data Reporting and Meta-Analyses in Sexual Assault Research
Mackenzie Hetfield, Rachael Goodman-Williams
Category & Time: Social Sciences, Section 4, 11:30 AM - 12:45 PM
Poster: 99
Mentor: Rebecca Campbell

A recent meta-analysis on rates of sexual victimization found that many relevant articles could not be included in the analysis due to a lack of information on how sexual assault was measured. In addition, certain research questions couldn't be analyzed due to missing information on study-level variables (e.g. participant race, perpetrator gender, data collection method). Without access to contextual study details, we aren't reaping the benefits of using published work in the fullest way possible. To identify trends of incomplete reporting, we used the database of 5,289 articles from the previous meta-analysis and studied the 160 publications that measured sexual victimization but could not be included due to insufficient information on key constructs, as well as notations made in the full database regarding the variables that could not be tested due to lack of consistent reporting. We identified three main areas where incomplete or absent information restricted interpretation or reanalysis of the presented data. Specifically, authors frequently did not include: (1) How sexual victimization was operationalized in the study, (2) Victimization rates for each operational definition used in the study, and (3) Relevant participant or contextual variables. This poster will present detailed examples of data from each of these categories, and will also include recommendations for publishing researchers on how to present their data in a more complete way so it can be used to the absolute fullest potential.

Do We Get Along?: Understanding Race Relations and Racial Climate at a Predominately White University (PWI)
Bri Johnson, Antanae Love-Humble, Casey Pearson
Category & Time: Social Sciences, Section 5, 11:30 AM - 12:45 PM
Poster: 100
Mentor: Terry Flennaugh, Vaughn Watson

As a part of a youth-led undergraduate research project, students examined how their classmates at a large mid-West research university understood the relationship between different racial groups on campus. Over 200 students responded to an online survey to gather information on sources of information about racial climate on campus, stereotypes about different racial groups, and individual attitudes about socializing with students from different racial groups. Survey results highlight the complexity of racial understandings and social practices at racially diverse college campuses. Study findings have implications for higher education researchers and university staff and students interested in bettering the racial climate on college campuses.

A Cross-Cultural Comparison of Narrative Responses to Instrumental Music
Gabby Kindig, Anusha Mamidipaka
Category & Time: Social Sciences, Section 5, 11:30 AM - 12:45 PM
Poster: 101
Mentor: J McAuley

Humans have a natural tendency to narrativize abstract visual stimuli in the form of short animations of moving shapes. In the domain of music, recent studies have similarly found that people have a robust tendency to imagine stories when listening to instrumental music; moreover, the narratives that people generate are remarkably consistent and often contain common underlying themes. The present study considers the relationship between the culture of the musical excerpt (classical Western or Chinese) and the narrative responses subjects have to instrumental music. Participants from the University of Arkansas and Dimen, China listened to eight one-minute long instrumental Western and Chinese musical excerpts. For each excerpt, they described any story they imagined, and completed a survey in which participants rated musical enjoyment, familiarity, and their level of narrative engagement. Results reveal a cross-cultural difference in the types of stories that people generated; Western participants mostly generated original narratives. In contrast, though participants from China also primarily generated original narratives, they had a greater tendency than Western participants to generate autobiographical narratives and reference pop culture. On-going analyses examine the relationship between levels of self reported narrative engagement and the content of the stories they generate such as the number of events and characters in the story. We will also look at levels of narrative convergence across participants within and between cultures. The present study is part of larger cross-cultural project examining processes involved with narrative listening in music.

Family Factors, Attachment and the Impact on Mental Health
Taylor Kovach
Category & Time: Social Sciences, Section 5, 11:30 AM - 12:45 PM
Poster: 102
Mentor: Clifford Broman

This research investigates family factors and their importance to mental health. Family factors refer to such issues as family structure, interparental conflict, and attachment. A specific focus will be on attachment. Research is supportive of the importance of attachment. Research shows that attachment has an important influence on mental health, and seems to contribute to depression, anxiety and other mental health concerns. The family setting is discussed as an important issue in this set of outcomes. This paper will present the evidence on family roles, relationships and problems as they affect mental health. I then discuss the critical role of attachment and attachment disorders in the relationship to mental health outcomes.

The Effects of Racial Biases on Latinx Candidates in State Legislative Elections
Raymundo Lopez
Category & Time: Social Sciences, Section 5, 11:30 AM - 12:45 PM
Poster: 103

Mentor: Eric Juenke

Elections serve as an effective means for a citizenry to hold elected officials accountable,

influence the policy-making process, and advance a party's political interests. Although Latinx representation in state legislative elections continues to yield subpar rates compared to other ethnic groups, past literature has suggested that LatinX candidates get elected as often as minority and non-minority candidates. Our study seeks to identify whether a voter's preference on a Latinx state legislative candidate is altered when visual or written cues for a candidate's race are presented. In a randomized survey conducted through Amazon Mechanical Turk, we survey a sample of 300 respondents, where we split our sample into 3 groups, one control group (100 people) and two experimental groups (100 people respectively). In the survey, some participants were asked to select a candidate with only a name to reference, while the latter groups received visual and partisan information. We aggregate demographic information from our sample in order to conduct t-test models of our results to determine whether voter decisions were influenced by racial or ideological biases. We expect to find that voter bias against Latinx-named candidates is mitigated by party and other candidate information, as previous literature has suggested.

Measuring Parent Engagement in a Parent-Mediated Intervention for Social Communication Skills in Children with Autism Spectrum Disorder
Grace MacDonald
Category & Time: Social Sciences, Section 5, 11:30 AM - 12:45 PM
Poster: 104
Mentor: Brooke Ingersoll

Parent-mediated intervention (PMI) is an evidence-based practice in which parents are taught to use intervention techniques to help their child develop skills or manage their behavior. There has been recent interest in delivering PMIs via telehealth to expand access to the intervention. Studies have found that expectations and acceptability of the intervention, and sociodemographic variables have predicted parent engagement in PMIs more generally and fluency with technology is related to engagement in telehealth-based interventions. This research explores predictors of parent engagement in Project ImPACT, a PMI for young children with ASD, delivered via telehealth. Participants include 38 caregivers of children with ASD (78.9% female), who have enrolled in a full scale RCT of Project ImPACT Online. They were randomly assigned to either complete the program at a self-directed pace or with the support of a coach. The dependent variable, parent engagement, will be measured by the amount of online activities parents complete, and the number of logins and total time spent on the intervention website. We predict that parent-reported computer fluency, intervention acceptability, and expectations for treatment will significantly and positively relate to parent engagement. We also expect that parent education level will significantly relate to parent engagement. Results from this study could improve support services for parents of children with ASD.

Personality Predictors of Overconfidence: A Facet-Level Analysis
Caroline Manning
Category & Time: Social Sciences, Section 5, 11:30 AM - 12:45 PM

Poster: 105
Mentor: Andrew Christopher

Overconfidence is the tendency to overestimate one's abilities and can occur in a multitude of contexts such as school, the workplace, and in stock market investing. Previous research has found that personality factors can predict overconfidence. More specifically, previous studies have found that traits such as extraversion, conscientiousness, and narcissism are all positively related to overconfidence. The purpose of the present study was to conduct a more in-depth examination of these relationships by using the different facets of extraversion (e.g., assertiveness), conscientiousness (e.g., deliberation), and narcissism (e.g., superiority) to glean a more-detailed understanding of the traits and facets that may predict this judgment bias. A total of 312 participants recruited through Amazon Mechanical Turk completed the study (196 male, Mage= 35.07). Participants were presented with 15 general knowledge questions, each of which was followed by a question asking participants to rate their confidence level with their answer. Participants then completed a series of personality inventories measuring extraversion, conscientiousness, and narcissism. Consistent with previous literature and our hypotheses, a Pearson's correlation revealed a positive relation between both factor-level extraversion and narcissism and overconfidence. No relation, however, was found between conscientiousness and overconfidence. A linear regression model including the 19 collective facets from the 3 personality factors revealed that only the superiority facet of narcissism and the competence facet of conscientiousness were significant predictors of overconfidence (positive and negative, respectively). Additional analyses and implications of these findings will be further discussed during the presentation.

I Belong Here: Instrumentality and Exclusion Predict a Sense of Belonging for Underrepresented Students in Research Teams
Gabriella Mendoza
Category & Time: Social Sciences, Section 6, 11:30 AM - 12:45 PM
Poster: 106
Mentor: Gwen Wittenbaum

Why are female students and students of color more likely to leave STEM fields? Some research suggests the answer is in the group dynamics within project teams. Female engineering students are more likely to be assigned roles that are not instrumental to group task completion (Seron, et al., 2016). Taking our lead from this idea, we proposed that playing an instrumental role in a task group promotes a sense of belonging to the group. To test this idea, we surveyed 59 undergraduate and graduate students from underrepresented groups working in research teams in social science and STEM fields at a large Midwestern university. Those who felt that their contributions to the research team were instrumental (e.g., important and essential for the team's productivity and performance) reported a higher sense of belonging to the team. Also, experiencing exclusion behaviors from other research team members predicted a lower sense of belonging to the team. These relationships held while controlling for work interdependence/independence and team composition (gender and race). Predicting a sense of belonging is important because it is a foundational psychological need that promotes well being and a feeling that life is meaningful. It may be the key to understanding why students from underrepresented groups choose to stay or leave their research teams and fields of study.

Barriers to Health Care MSM of Color Living with HIV Experience
Koi Mitchell
Category & Time: Social Sciences, Section 6, 11:30 AM - 12:45 PM
Poster: 107
Mentor: Kaston Anderson-Carpenter

HIV is a virus that affects over one million people in the United States of America. Men who has sex with men (MSM) are more likely to be diagnosed with HIV. 70 percent of those diagnosed with HIV are MSM of color (CDC, 2019). Prior research indicates that men who has sex with men who are diagnosed with HIV face a number of barriers that include but are not limited to stigma and lack of trust for health care providers (Eaton, 2015; Stojisavljevic, 2016). Barriers to health care and social support could lead to the spread of HIV and those diagnosed could go untreated. Many studies use quantitative methods on such as surveys in order to research the barriers men who has sex with men they face in regard to receiving health care and social support. With the help of those quantitative studies we have a broad idea of the barriers MSM face when using healthcare. Using a qualitative methodology, we hope to gain an in depth understanding about the broad barriers we learned from the previous studies. This qualitative phenomenological study aims to answer the following question: (1) What are the barriers MSM of color living with HIV face when accessing or using health care? We conducted four interviews and focus groups on MSM of color living with HIV in rural areas in the Midwest of the United States. Responses were analyzed from N=13 MSM of color living with HIV using a 6-phase thematic analysis (Brum, 2016). We anticipate that there are multiple barriers minority men who has sex with men face when accessing or receiving health care due to stigma based on their race/ethnicity, sexual behavior, and HIV-positive status. Our results will lay the foundation for eliminating barriers that may prevent health care or social support engagement.

Community Organizing and Education Reform
Abigail Mosley
Category & Time: Social Sciences, Section 6, 11:30 AM - 12:45 PM
Poster: 108
Mentor: Sarah Reckhow, Chris Torres

Across the country, community stakeholders have begun building and utilizing collective power to address issues within their school systems that are typically ignored. This study investigates the impact of community organizing on urban education reform. Specifically, we seek to find the most perceivably effective strategies utilized by community organizers to achieve sustainable change within the education systems they serve. We will lead semi-structured interviews with members and leaders of community organizations in the Detroit area. The focus organization is Detroit's 482Forward. Interviewees will be asked a variety of questions relating to their organizing strategies. Potential questions ask interviewees to describe to their arrival into leadership or membership at their respective organization, their organization's educational mission, how they navigate relationships with other community members, and what they perceive to be the most effective strategies to achieve change in the schools they partner with. After collecting and processing the data through Rev Transcription Services, we will conduct a qualitative analysis of the interviewees' responses. Our discussion will highlight themes within the interviewees' responses and explain the reasoning behind each strategy presented. We hope to develop

a comprehensive list of strategies that community organization leaders deem to be the most effective. This investigation and its findings will provide a blueprint for community organizations working within education reform.

Governing the Unknown: Mobility Policies over Autonomous Vehicles (Avs) in USA, Germany, and China
Luca Muench
Category & Time: Social Sciences, Section 6, 11:30 AM - 12:45 PM
Poster: 109
Mentor: Eva Kassens Noor

Right now, robotic cars drive themselves and their occupants on roads and highways across the globe. These may only be engineers from some of the biggest car and tech companies in the world, but within the next few years drivers will have the option to sit behind the wheel of a fully autonomous vehicle. Governments across the world now have the responsibility to test, implement, and regulate the future of vehicular travel. Taking a look at the three biggest players in the future of autonomous vehicles (China, Germany, and The United States), our research goal is to explore how these countries are responding to these changes, and how they will decide to govern a completely new technology. Using interviews from professionals and government officials in the autonomous vehicle field, across these three countries, we have established five key points of implementation: Who initially sets policy, how vehicles are being tested, initial autonomous vehicle testing, the use of human drivers, and the approach of car makers to implementation. Our findings hope to establish how autonomous vehicles are being implemented, and the similarities/differences between the processes of the different countries.

Public School Funding: Racial and Socioeconomic Disparities
Marquis Murry
Category & Time: Social Sciences, Section 6, 11:30 AM - 12:45 PM
Poster: 110
Mentor: Todd Elder

Public schools across the nation have been facing funding issues for a great deal of time. I will use the National Center for Education Statistics(NCES) annual Condition of Education report and their Early Childhood Longitudinal Study(ECLS-K:2010:2011) volunteer survey to look at schools located in underfunded, low-income, primarily Black and Latinx communities and the relationship between outcomes from students that attend these schools and outcomes of students that come from more affluent neighborhoods with stronger tax-bases that attend schools located in these neighborhoods. There is a wide range of literature that highlight the stark disparities that the structure of the funding of these public schools create, but most of the literature fail to highlight just how much more additional funding is needed to educate students in low-income communities and they fail to discuss a solution. I will pinpoint the disparities of how most of the low-income schools that are found in racially segregated communities have higher local property taxes that fund their school districts compared to those school districts in wealthier neighborhoods. I will also highlight how the entire structure of funding for public

schools perpetuate racial and socioeconomic disparities that have been plaguing our nation for decades.

The Impact of Individualized Meaningful Activities for Older Adults with Dementia Living in Nursing Homes
Tracy Nguyen
Category & Time: Social Sciences, Section 6, 11:30 AM - 12:45 PM
Poster: 111
Mentor: Linda Keilman

The majority of activity programs created at nursing homes lack individualized meaningful activities (IMA) for older adults with dementia. Older adults with dementia are in great need of IMAs to spark interest in actively engaging in socialization and activities. Studies have shown that by engaging in IMAs, older adults with dementia are able to stimulate brain activity that can improve cognition and functional status. Many studies have suggested types of non-pharmacological interventions (NPIs) and IMAs that may improve cognitive function for older adults with dementia and behavior issues. While results differ from study to study, the common theme is that meaningful activities depend on the individual's interest, hobbies, and values. The objective aim of this study was to find meaningful activities for older adults with dementia and create IMAs for each individual at a five-star community nursing home. In-person interviews were conducted using open-ended personal questions to determine the person's unique story. Asking questions about childhood, adolescence, memorable events, fads and trends in the person's lifestyle, marriage/parental life, and what life advice they would give to younger adults sparked deep-seeded memories and allowed reminiscence. Interviews were transcribed and will be run through NVivo. Field notes will be evaluated in order to find common themes. Preferences and life choices will be categorized regarding information shared by participants. Based on what was recorded during the interview, and the common themes resulting from the NVivo analysis, an individualized activity calendar will be created for each participant – creating memories.

Experiences of Natural Science Majors Transferring from Two-Year Colleges to Four-Year Universities
D'Mario Northington
Category & Time: Social Sciences, Section 7, 11:30 AM - 12:45 PM
Poster: 112
Mentor: Vashti Sawtelle, Angela Little

Transfering from a two-year college to a four-year university is becoming more relevant each year because more students are beginning at two-year institutions. Our research focuses on transfer students within the College of Natural Sciences at universities and their transitional process from their two-year college. Our research aims to understand how to best support these students. Using semi-structured interviews with students during their first year after transferring to a 4-year university, we coded for transfer experiences and those students' self-efficacy post-transfer. Initial results from these interviews include both positive and negative experiences during the transfer process. Places where students expressed the need for more support include: lack of inclusion, limited academic advising, difficulties with the transition, and underdeveloped study habits. In this poster we will present a novel coding

scheme that captures critical elements of transfer student experience.

The Voices and Values of Good Food Policy
Zaire Parrotte
Category & Time: Social Sciences, Section 7, 11:30 AM - 12:45 PM
Poster: 113
Mentor: Lindsey Scalera

According to the CDC's 2016 National Center for Health Statistics report, diet-related diseases and health conditions are killing more Americans annually than other diseases. Heart disease, cancer and stroke claims almost 1.4 million lives alone. These same diseases are the top three causes of death among African Americans. There is much literature about how historical and contemporary policies create unhealthy and inequitable impacts in our current food systems, such as childhood obesity, diabetes, and health disparities among racial/ethnic populations and along class lines. However, there is a small yet significant sector of literature that sheds light on what principles and values food policy councils have and what policy-makers should have when addressing food policy itself. Therefore, this study will explore the challenges and opportunities statewide food and farm networks see as the most critical for developing a "good food" system in Michigan. According to the Center for Regional Food Systems in Michigan State University, "Good Food is food that is healthy, green, fair, and affordable." The methodology employed for this research is grounded theory. It will include surveys and interviews of 5-10 members of different statewide food and farm networks. This study will gather and analyze their responses, and examine common themes and patterns. Displaying underlying motives and goals in food policy has the potential of improving health outcomes and reducing inequities within the food system. This research is supported by the Center for Regional Food Systems and the Department of Community Sustainability from Michigan StateUniversity.

I Wonder How She Feels? How Two Wordless Books Elicit Different Mental State Language from Toddler Teachers
Ella Patrona
Category & Time: Social Sciences, Section 7, 11:30 AM - 12:45 PM
Poster: 114
Mentor: Claire Vallotton

Exposure to mental state language (MSL; i.e., language labeling the thoughts, feelings, perceptions and intentions of others) in early childhood is associated with children's prosocial behaviors and social-emotional understanding (Drummond, Paul, Waugh, Hammond, & Brownell, 2014). In early childhood classrooms, booksharing is a rich context for MSL, generally eliciting greater MSL than free play contexts (Farkas, 2018). Little work has examined what types of books may provide the most robust exposure to MSL. Thus, the purpose of this study was to examine the frequency of MSL in two books for toddlers: Fly Little Bird (a wordless book depicting numerous emotions) and Goodnight Gorilla (a book depicting limited emotions). The sample included 35 infant/toddler teachers in Early Head Start; teachers were filmed in their classrooms, prompted to share the two books. Videotaped bookshares were transcribed and coded for categories of MSL including cognitive states, desires/goals, emotions, perceptions, and

physiological states. Also, teachers' more advanced mental state comments were coded reflecting teachers' statements of their own or the characters' mental states and invitations for the children to wonder about the mental states of characters. Preliminary results indicate that teachers used significantly more MSL when sharing Fly Little Bird (M = 35.18, SD = 18.41) compared to Goodnight Gorilla (M = 24.27, SD = 16.27); in addition, they used more advanced forms of MSL. Given that exposure to MSL through booksharing can build young children's emotional competencies, preliminary results suggest that teachers should expose toddlers to emotionally-rich books.

Strategies Utilized in Efforts to Aid GoPro in the Recovery Phase
MonaLisa Paulk
Category & Time: Social Sciences, Section 7, 11:30 AM - 12:45 PM
Poster: 115
Mentor: Qingqing Cao

In this study we will establish a set of strategies to aid GoPro (GPRO) in their recovery stage. We will simulate the three strategies using the data abstracted from sec.gov on GPRO sales, through SPSS. The goal is to find a statistically significant strategy that will aid the GPRO in the recovery stage. The research questions that we will be addressing is as follows: What variables need to be considered in the recession stage of GoPro to set a basis to go off of in efforts to propel GoPro into a recovery stage? What strategies can GoPro utilize to increase their revenue after expenditures? The variables are determined by examining the reported sales of GoPro data from sec.gov. If we can find aggregated data of the GoPro camera sales and GoPro drone sells and see a trend in the sale, we will work towards answering the question from the standpoint of the comparison of the two products and argue that focusing on camera sales and eliminating the drones sales will increase overall revenue. If we cannot access such data we will address our question from a timeline standpoint. At which moment did the company's downfall start? What was going on at that time that was different from the incline or peak? With our findings it is best for us to run regressions with our variables to see if there is a relationship between the variables, in efforts to support our arguments.

College Students' Other-Contingent Extraversion and School Satisfaction
Julie Pineda
Category & Time: Social Sciences, Section 7, 11:30 AM - 12:45 PM
Poster: 116
Mentor: Jason Huang

Although personality traits have received abundance of research investigations, psychologists have only recently started to assess contingent units of personality. Unlike personality traits, which describe individuals' average behavioral tendencies across a wide variety of situations, contingent units of personality (Fleeson, 2007; Minbashian, Wood, Beckmann, 2010) capture how individuals tend to behave differently under certain situational cues. Extending research that demonstrated an association between interaction partner's friendliness and an individual's state extraversion (i.e., how extraverted one behaves at a given moment), our study focuses on the notion of other-contingent extraversion as a unit of personality that is associated with college students' satisfaction with school and life. Using an

experience sampling design, college students reported their state extraversion and friendliness of others around them two times a day for a period of 3 weeks. After the 3 weeks, participants reported their overall life and school satisfaction. We anticipate that a positive correlation between friendliness of others and respondents' state extraversion. More importantly, we expect such an association to differ across individuals. Such individual difference, defined as other-contingent extraversion, should be related to school and life satisfaction. Our results will lay the foundation for trying to understand whether or not people would respond positively to the environment they are in and understand under what conditions that may happen.

The Correlation between Parent's Substance Use and their Offspring's Misconduct
Ravon Pittman
Category & Time: Social Sciences, Section 7, 11:30 AM - 12:45 PM
Poster: 117
Mentor: Catherine Durbin

This study focuses on familial history and etiologies of SUD in order to examine the parallel behaviors and neurobiology of parents and their offspring. The aim is to determine if there is a correlation between parents who have a substance use disorder and their offspring's conduct problems. By using the data provided through the Michigan Longitudinal Study conducted at Michigan State University, we will determine the appropriate measurement of frequent substance usage and the behaviors that qualify as misconduct. While this study examines the hereditary imprint of SUD's, the goal of this study is to further the present MLS discourse by understanding the relationship between the family's substance disorder history and possible inherited misconduct in order to determine effective treatments for individuals with substance use disorders.

Dissimilarities Between Fatal and Nonfatal School Shootings
Kaelyn Sanders
Category & Time: Social Sciences, Section 8, 11:30 AM - 12:45 PM
Poster: 118
Mentor: Steven Chermak

School shootings are a phenomenon that has been going on for many years now, but in the past couple decades, people as well as the media are paying increasing attention to them. The Columbine High School shooting in April 1999 was the catalyst for the rise in conversation because of the severity and surprise of the attack. Now, society is trying to figure out the causes and how we can identify threats early on since the amount of attacks appear to be rising in frequency. Even though there are many debates on how to define school shootings and their causes, the body of research on shooters and cases studies of the events is growing, but the data is still lacking. Current research completely ignores nonfatal shootings and the school's role, which is essential to fully understand why shootings occur and identify preventive measures. This is why we must examine how the school's environment influences the shooter and amount of death alongside the shooter's characteristics. Through SPSS, this study will conduct a secondary analysis of 377 coded cases from the United States School Shooting Database (SSDB) to see what perpetrator and school characteristics differ between nonfatal and fatal school

shootings in hopes to identify potential areas of prevention and intervention.

Exploration of the Horror Genre
Marlo Scholten
Category & Time: Social Sciences, Section 8, 11:30 AM - 12:45 PM
Poster: 119
Mentor: Allison Harnish

It is my hope that, by studying the top grossing horror films from each decade (1930s-2010s), I can ascertain a "horror movie formula" that will help me write the horror story of the 2020s that is historically grounded and empirically informed. This summer, I intend to collect the necessary data about the construction and execution of the most popular horror films, in order to determine the ways in which the socio-economic and geopolitical climate of each decade influences the monstrous fiction that Americans produce and consume. I will also study current events and political trends of the last decade so as to develop a monster and a monstrous setting that is informed, on the one hand, by the evolution of horror over the last century and, on the other, by events and anxieties that are unique to Gen-Z (people born between '96 and '01). I plan to supplement this research with surveys this fall about the demographic known as Gen-Z, and I hope to continue this research this fall at the Newberry Library in Chicago.

Head Start on Life Science: Assessing Early Childhood Science Education
Laurin Schultz
Category & Time: Social Sciences, Section 8, 11:30 AM - 12:45 PM
Poster: 120
Mentor: Hope Gerde, Arianna Pikus

Science learning interactions and experiences are important in early childhood education. High-quality science education can promote the development of early science reasoning and knowledge of science concepts. Currently, most children receive low-quality science education. The current study utilizes a newly published curriculum to measure teacher understanding of science and science education. 1) Which teaching practices do teachers use when they implement self-prepared and curriculum supported science lessons in preschool classrooms? And 2) Do teachers provide higher-quality teacher-child interactions during implementation of a self-prepared lesson vs. a lesson supported by the HSOLS curriculum? Pre-service teachers through Michigan State University participated in the study. Teachers were video recorded implementing a science lesson they prepared and for a lesson they chose from the curriculum. The lessons were coded for the type of language and science concepts the teachers used. Results include descriptive analyses and ANOVA depicting teachers teaching strategies and an examination of high-quality teacher-child interactions. The discussion will identify recommendations for teacher practice and education will be included.

Developing a Transfer Experience Codebook Using Transfer Students Self-Efficacy Interviews
Stephanie Taylor
Category & Time: Social Sciences, Section 8, 11:30 AM - 12:45 PM

Poster: 122
Mentor: Vashti Sawtelle, Angela Little

Self-efficacy measures one's confidence in their abilities and is used to predict academic persistence. This study focuses on how self-efficacy affects students who have transferred from a two-year college to a four-year university. In this poster, a study focused on coding interviews will be presented to help understand the intersection of self-efficacy with transfer experiences. Semi-structured interviews were conducted during students' first semester of being at a four-year university. The questions asked during the interview were focused on their confidence in their abilities at the four-year university. The interviews were coded using a tagging system that focused on the student's experiences and how those experiences effect their self-efficacy. Through this data analysis we were able to develop a transfer experience code book that consists of four major codes. This research can be utilized by anyone who is interested in how transitioning from a two-year college to a four-year university affects student success, as well as what four-year universities can do to better serve transfer students.

The Perfect Dictatorship: The Effects of Organized Crime on Democratic Backsliding in Mexico
Lesley Tenorio Malagón
Category & Time: Social Sciences, Section 8, 11:30 AM - 12:45 PM
Poster: 123
Mentor: Benjamin Appel

Organized crime in Mexico has been increasing over the years despite the country's and the United States' attempts to reduce the rate of violence. Mexico has slowly been shown to be backsliding democratically especially through the 2007 political reform. Allegations of organized crime colluding with the government have also led to economic collapse within the country and increased rates of violent crime which hurts the constituency. The objective of the research is to demonstrate that Mexico is a country that has been affected by democratic backsliding. The hypothesis to be analyzed is if one of the reasons for Mexico's democratic backsliding is the presence of organized crime within the country. The second hypothesis to be analyzed is if Mexico as a whole has actually been subject to democratic backsliding or of it is simply a change in political reform in the country. A mixed methods approach will be used in order to analyze the data. For the qualitative methods, a case study will be conducted observing the history of political reform in Mexico beginning in 1929 when one of the major political parties in Mexico was established.

Democracy in Crisis: Domestic Factors in 21st Century Democratic Backsliding
Langston Thomas
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM
Poster: 124
Mentor: Benjamin Appel

Today, researchers in the field of political science are focusing on the 21st century surge of democratic backsliding. Democratic institutions around the world, especially in the West, are weakening, contributing to what the Varieties of Democracy Institute (V-Dem) calls the third wave of

autocratization. Among the new literature being produced on the subject are reactions towards the weakened state of democracy internationally and postulations regarding how and why authoritarian leaders are coming to power. While it is common for researchers in the field to look at global and regional factors that contribute the trend, such as the rise of nationalism or the role of Russia in threatening democratic stability in Eastern Europe, few have discussed the potential role of domestic factors in the devolution of democracy. The purpose of this investigation is to explore the relationship between a democratic country's deep-rooted racial, ethnic, or religious tension, the rise to polarization, and democratic backsliding in the 21st century. This perspective contributes to the current discourse by considering that the new wave of autocratization can, in part, be attributed to sociohistorical domestic factors. Through analyzing data from the V-Dem annual democracy reports, revisiting literature on the detrimental effects of political polarization, and comparing the history of backsliding in the cases of Venezuela, the United States, Poland, and Ecuador, this paper will reveal that the countries with deep-rooted racial, ethnic, or religious tensions are more likely to experience backsliding in the 21st century.

Selective Annexation: Evidence from a Spatial Typology of Municipal Boundary Changes
Jada Tillison-Love
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM
Poster: 125
Mentor: Noah Durst

Municipal annexation is the most common means by which local governments in the United States redraw their jurisdictional borders, with cities conducting more than 100,000 annexations totaling more than 5,000 square miles of territory since 2000. Prior quantitative research suggests that as municipalities annex territory along their jurisdictional fringe they often sidestep African American neighborhoods, a practice that appears to be exacerbated by state annexation laws and the recent invalidation of Section 4 of the Voting Rights Act by the Supreme Court (Durst, 2018; Durst, forthcoming). This process of racially selective annexation constitutes a form of local government gerrymandering with important implications for local democracy, voting rights, and access to local government services (Anderson, 2010). Quantitative research on selective annexation is limited. The limited research that does exist on the topic is largely aspatial and thus fails to explicitly incorporate space as a means of measuring or explaining patterns of selective annexation. This research project will contribute to scientific knowledge regarding selective annexation by developing spatial measures to capture the various types of annexation and to examine the economic and political factors that drive them.

Efficiency of Consult Mechanisms on Environmental Public Policy Commenting Periods
Taylar Tramil
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM
Poster: 126
Mentor: Julie Libarkin

The quality of environmental policy commenting, public perspective opportunities during the decision-making of a process, in the state of Michigan is a significant matter for local communities. Within a

democratic society, it is important to analyze the positivity of civic engagement in ones' community and how well the state can appropriately allow it to provide a sustainable community. The research question that is being asked is, how effective are consult mechanisms, a process of active communication from public input on situations that affect them, for collecting public perspectives on environmental public policy in Michigan? To conduct this research, the goals are to look at the means in which the public is made aware of consult opportunities, where and when the public is allowed access, and how mechanisms such as emails, phone calls, and public hearings, provide consult. The hypothesis is that there is no strong form of effective awareness to receive the most public participation in commenting, Our data will be derived from permit and policy announcements, and comment period reports from last year, using the Department of Environmental Quality (DEQ) for the state of Michigan and the Michigan Department of Environment, Great Lakes, and Energy (EGLE). A thematic content analysis will be run after coding to find the commonalities that are present in the invitation process of public commenting. The purpose of this research is to evaluate the efficiency of consult mechanisms to further understand the relationship between the public and the incorporation of public comments in policy decision-making.

The Effects of Milk Folate (FOLR1) on Child Morbidity Patterns in Northern Kenya
Tin Tran
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM
Poster: 127
Mentor: Masako Fujita

Folate is important for the development and maintenance of health, especially during early life-history stages (prenatal, infancy, early childhood), because of its major role in DNA, RNA, and protein synthesis. Maternal folate intake pre-pregnancy and during pregnancy can reduce the risk of neural tube defects in offspring. Mothers' milk provides folate for offspring, but few studies have been conducted to determine the health implications of folate intake during infancy and early childhood. In this study, we evaluated the impacts of milk folate (binding protein; FOLR1) on child morbidity patterns, using archived data from Ariaal communities of northern Kenya (n=79). We hypothesize that levels of milk folate will protect against child morbidity. Specifically, we examined 10-day morbidity recalls of fever, cough, and diarrhea. To evaluate our hypotheses, we constructed logistic regression models to calculate the odds of each symptom associated with milk folate. Adjusting for infant age, maternal factors, and SES, milk FOLR1 was associated with higher fever symptoms in offspring (odds ratio 1.207 [95% CI: 1.049-1.388]). From this result, milk FOLR1 was a risk factor for fever. However, no significant associations between milk FOLR1 and cough or diarrhea were found. For all symptoms, child morbidity increased with an increase in milk FOLR1, indicating a more complicated role of folate in early child health development. Due to our small sample size, future research is needed to investigate the associations between milk FOLR1 and child morbidity patterns. Our results may potentially contribute to public health strategies to decrease infant morbidity and mortality.

Dialogue, Discourse, & Dragons
Richard Vegh
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM

Poster: 128
Mentor: Daniel Brown

Role-playing games (RPGs) have received attention as activities and cultural products that are rich sites of meaning for players, although the degree of player identification with their characters/avatars in these games has been shown to be complex and not automatic. In recent years, popular RPGs, such as Pathfinder and Dungeons & Dragons (D&D), have shifted in terms of both their rule systems and in terms of the demographics of who plays them (e.g., D&D's current 5th Edition ruleset asserts that characters may have any gender or be agender, and that gender has no bearing on game mechanics). This study investigates player involvement with RPGs through a combination of conversation analysis, critical discourse analysis, and frame analysis, drawing on dialogism and intertextuality. Four groups of gamers were recorded over several weekly gaming sessions, and the data was coded for references to gender, racial, and class identity, political views, as well as instances of intertextual references and shifts in tone or "key." Individual, semi-structured stimulated recall interviews with players followed, focusing on participants' conscious use of the games to express political and moral viewpoints, with particular attention to how gender, sexuality, and representation in RPGs is viewed and negotiated by players with a range of gender identities. This study explores how gender intersects with player identities in practice and through conversation in and around gaming.

Risk Behavior Stigma and Substance Abuse in Latino MSM
Amiracle Williams-Anderson
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM
Poster: 129
Mentor: Kaston Anderson-Carpenter

Risky behaviors are behaviors in which an individual consciously or unconsciously does something that puts them in harm's way. This includes unsafe sex practices and substance abuse. There is an increased need to reduce stigma related to sexual behaviors and substance abuse in gay men and other men who have sex with men (MSM). However, most studies do not take into account how race and the culture that comes with ones race affects the stigma as well. The objective of these analyses is to determine the association between experienced and perceived stigma and alcohol use. Also to determine to what extent does social support effects of experienced and perceived stigma and alcohol use. A 479 item questionnaire was given to 643 Latino MSM in Chicago by the Inter-University Consortium for Political and Social Research (ICPSR) in 2004. The second hand data will be used to conduct a multiple logistic regression and mediation.

Assessing the Effective Strategies in Achieving Accommodations for People with Hidden Disabilities
Keenan Case
Category & Time: Social Sciences, Section 9, 11:30 AM - 12:45 PM
Poster: 130
Mentor: Stacy Hickox

Employees or applicants with hidden disabilities may require accommodations to effectively preform job

duties. Due to the lessened visibility of hidden disabilities, the employee or applicant is faced with the unique and difficult situation of having to reveal her disability. This process is burdensome due to stigma and stereotypes surrounding psychiatric and other hidden disabilities. A medical facilitator has been proposed as a method to reduce these hardships by filtering stigmatized information from reaching an employer while also offering effective solutions. This research will aim to analyze the effectiveness of adding a medical facilitator or other third party to the accommodation process. This will be done by collecting qualitative data via interviews and surveys with students, faculty, and physicians that use the VISA system at MSU, an accommodation system with a medical facilitator.

Perfluorinated Alkyl Substance (PFAS) Bioaccumulation in Great Lakes Benthic Species: A Molecular Level Study
Baris Aydintug
Category & Time: Biochemistry & Molecular Biology, Section 1, 1:00 PM - 2:15 PM
Poster: 133
Mentor: Angela Wilson

Perfluorinated alkyl substances (PFAS) are synthetic organic molecules with straight or branched carbon chains bonded to fluorine atoms. Recent studies have shown various adverse health effects (cancer, birth defects, estrogen inhibition) via exposure to PFAS, e.g. drinking water from the Great Lakes, despite its extensive usage in firefighting foams, non-stick cookware, and pesticides. The Great Lakes Ecosystem is a home to a wide variety of unique fish species and it is unknown how they are being affected by these substances. A molecular level study offers an approach to identify how various PFAS molecules are binding to proteins that belong to Great Lakes benthic species in an efficient manner. In this study, the Molecular Operating Environment (MOE) software package has been used to find potential PFAS binding sites for protein receptors. These binding sites were then examined with a large database of PFAS molecules through docking, molecular dynamic simulations, and binding free energy calculations using end state approaches. The calculated binding free energies provide insight towards understanding the binding behavior of PFAS to proteins as well as its effect on the Great Lakes ecosystem.

Multiplex qPCR for Four Plasmodium Species in Malawi
Nikki Bhangu
Category & Time: Biochemistry & Molecular Biology, Section 1, 1:00 PM - 2:15 PM
Poster: 134
Mentor: Elahe Crockett-Torabi, Karl Seydel

Introduction: Malaria infects approximately 300 - 500 million individuals annually, with the majority of deaths being young children in sub-Saharan Africa. Malaria is caused by an infection by any of the five human Plasmodium species. The most lethal Plasmodium species is P. falciparum and is the main cause of death. As a result, the prevalence of the other four Plasmodium species has been studied in less detail. Hypothesis: There is a high prevalence of non-P. falciparum in Malawi that has not previously been appreciated due to the lack of symptoms from these species. Methods/Results: A qPCR TaqMan assay was optimized to test the blood in a multiplex format. The assay specifically amplifies the 18s

rRNA gene in each of the Plasmodium species. In order to simultaneously test for two species in the same tube, the P. falciparum and P. malariae probes were labeled with the fluorophore FAM, while P. ovale and P. vivax probes where labeled with the fluorophore VIC. Purification and amplification of the blood spots is underway. The prevalence of the non-P. falciparum species in Malawi will be reported at the time of the poster presentation. Conclusion: If the data support our hypothesis this diagnostic tool can be used for identification of specific Plasmodium species involved which that will assist in assigning proper treatment and care for the infected patients. Support: N.B. is a REPID scholar, supported by NIH-5—R25-HL108864 award to Elahé Crocket, and NIH grant 2U19AI089683-8 award to Karl Seydel.

Understanding the Influence of Alternative Transcription Start Site Selection on Translation Initiation and Protein Diversity
Melina Brunelli
Category & Time: Biochemistry & Molecular Biology, Section 1, 1:00 PM - 2:15 PM
Poster: 135
Mentor: Herve Begue, Erich Grotewold

Maize (Zea mays) is an economically important crop, central to both local communities and the global food system. Understanding how genes involved in agronomic traits are regulated by gene regulatory networks (GRNs) is a major challenge. Among the GRN components, transcription factors (TFs) are proteins able to bind to gene promoters and help recruit the RNA polymerase complex, which initiates the transcription of mRNAs at transcription start sites (TSSs). For any given gene, multiple TSSs are found, and utilization of alternative TSSs could have multiple consequences at different gene product levels. At the transcript level, alternative TSS selection can impact the stability and/or the translation efficiency of mRNAs. At the protein level, alternative TSS might force the translation machinery to select an alternative translation start codon, leading to the synthesis of new protein isoforms. Here, we selected genes from the maize B73 inbred line that express long and short transcripts due to alternative TSS selection. Long and short proteins from those transcripts are predicted to display different features, including protein-protein interaction (PPI) domains and signal peptides that target them to different subcellular compartments. My research is to confirm that long forms containing localization signal peptides will localize to different subcellular compartments compared to the respective shorter protein isoforms. We also predict that long protein isoforms containing putative PPI domains will be involved in distinct, and likely more, PPIs, compared to the corresponding short forms. Results from these analyses will provide important information regarding the biological impact of alternative TSS selection.

The Synthesis of Novel Antitubercular Compounds
Piper Burghduf
Category & Time: Biochemistry & Molecular Biology, Section 1, 1:00 PM - 2:15 PM
Poster: 136
Mentor: Matthew Hart

According to the World Health Organization, tuberculosis (TB) is one of the leading causes of death worldwide. TB is caused by a bacterium called Mycobacterium tuberculosis that typically infects the lungs. Unfortunately, the rise of antibiotic resistance has rendered many of the current drug treatments

ineffective against Mycobacterium tuberculosis; therefore, the need for novel antibiotics is imperative to saving millions of lives. Within the past few years, our lab has discovered that a family of diphenyl ureas exhibits antibiotic properties towards Mycobacterium. The goal for this project is to synthesize similar compounds in hopes of creating novel antibiotics that can effectively inhibit Mycobacterium. Herein, we report the synthesis of a variety of diphenyl ureas with varying ester chain lengths and aromatic substituents from the corresponding esters and isocyanates. Biological testing involving kill zone assays will be conducted to determine the efficiency of these synthesized compounds.

Proximity Labeling Interactors of Tic22, an Intermembrane Space Protein Import Component of the Chloroplast
Sara Campbell
Category & Time: Biochemistry & Molecular Biology, Section 1, 1:00 PM - 2:15 PM
Poster: 137
Mentor: Lynn Richardson

Chloroplasts are green, photosynthetic organelles in plant cells. Many proteins necessary for chloroplast function are nuclear-encoded and must be post-translationally imported into the chloroplast. Chloroplasts have an outer and inner membrane, with an intermembrane space between the two, and each membrane has a protein import complex, called the Translocon at the Outer Membrane of Chloroplasts (TOC) and Translocon at the Inner Membrane of Chloroplasts (TIC), respectively, that recognize an N-terminal targeting signal on incoming precursors called the transit peptide. Tic22 is a protein located within the intermembrane space, which is thought to connect TOC and TIC translocons and play a role in nuclear-encoded protein import. However, the function of Tic22 is not well understood. To identify proteins that are physically associated with Tic22, fusions of BioID2, a promiscuous biotin ligase, and Tic22 homologs Tic22-III and Tic22-IV, as well as the transit peptide of Tic22-III, were expressed in Arabidopsis. Streptavidin immunoblots of total protein extracts from transgenic plants showed biotinylated forms of putative interactors of Tic22 via proximity labeling. Chloroplast isolation followed by fractionation of chloroplast membranes and soluble proteins showed successful import of the Tic22-IV fusion protein, and biotinylation of novel target protein interactors within the chloroplast membrane and stroma. Protein mass spectrometry was used to identify several interactors of Tic22-IV. Further work is currently being carried out to determine the functional relevance of these interactions.

Characterization of CgX Tautomerase and Mutants with Acetylenecarboxylic Acid
Daniel Chi
Category & Time: Biochemistry & Molecular Biology, Section 1, 1:00 PM - 2:15 PM
Poster: 138
Mentor: Karen Draths, Amaya Mathes Hewage

In the production of commodity chemicals through microbial syntheses, the use of renewable sugars as a raw material is increasingly common. However, this generates competition between its use in the chemical industry and the food industry. Therefore, developing alternative biosynthetic pathways involving other renewable feedstocks to replace starch-derived feedstocks is crucial. CgX, a tautomerase

native to Corynebacterium glutamicum, catalyzes the hydration and subsequent decarboxylation of acetylenecarboxylic acid (ACA), a compound that can be produced from methane gas and carbon dioxide, both abundant greenhouse gases. The products formed from CgX (wild-type)-catalyzed reaction of ACA results in a mixture of malonic semialdehyde and acetaldehyde. Six amino acids have been identified as the catalytic residues. The research project involves monitoring the formation of products and building product profiles, in addition to kinetic characterization, of various mutants of CgX. In addition to the six critical amino acids, Q5 site-directed mutagenesis will be used to generate other mutants of CgX. In this presentation, the synthesis methodology and the products formed, as determined by NMR, will be discussed. In addition, results from kinetic studies using coupled enzyme assay will be presented.

Understanding the Roles of Genes that are Translationally Up-Regulated by ABA-Treatment
Drina Cooper
Category & Time: Biochemistry & Molecular Biology, Section 2, 1:00 PM - 2:15 PM
Poster: 139
Mentor: Polly Hsu

mRNA translation can be affected by a wide range of abiotic environmental stresses, such as drought, high temperatures, and UV light. This study aimed to understand the role of genes that are translationally upregulated by ABA treatment. ABA, also known as abscisic acid, is a plant hormone that promotes leaf detachment, stomata closure and inhibits seed germination. In order to understand the roles of these genes, we studied mutants of selected genes that were translationally upregulated after ABA treatment, called t-DNA mutants. By phenotyping root emergence and green cotyledon, the results suggested that some genes were required for ABA response. In summary, the results revealed how sensitive the t-DNA mutant plants were to ABA treatment, and also revealed that some of these mutants weren't affected by ABA treatment. Furthermore, by understanding the roles of these genes that are translationally upregulated after ABA treatment, it is a possible goal that crop performances could improve and possibly minimize agricultural lost in the future.

Identifying the Molecular Determinants Involved in cyclic-GMP-AMP Activation of the Phospholipase CapV
Alyssa Corpus
Category & Time: Biochemistry & Molecular Biology, Section 2, 1:00 PM - 2:15 PM
Poster: 140
Mentor: Christopher Waters, Geoffrey Severin

The pathogen Vibrio cholerae is the causative agent of the diarrheal disease cholera. The current pandemic (7th) is perpetuated exclusively by the El Tor V. cholerae biotype, which maintains the unique 15kb genomic island, VSP-1. While most genes in VSP-1 remain unexplored, a second messenger signaling network encoded in VSP-1 was recently characterized, composed of the genes dncV and capV. The enzyme DncV synthesizes the cyclic dinucleotide (cdN) c-GMP-AMP (cGAMP), which binds to and directly activates the phospholipase activity of the enzyme CapV. While activation of CapV results in rapid degradation of El Tor's membrane, leading to cell death, the molecular mechanism by which

cGAMP activates CapV has yet to be elucidated. Guided by a computationally-derived model of CapV and sequence comparison to other bacterial phospholipases, we are investigating this cGAMP-dependent activation of CapV. Analysis has revealed two unique residue loops that appear to lie outside of the enzyme active site, are found only in CapV orthologs associated with DncV-like enzymes and encode numerous arginine residues- which commonly mediate protein binding to cdNs. We are targeting these suspicious residues using site-directed mutagenesis and by making loopless CapV variants and testing their cGAMP-dependent activity in vivo. We are also performing a non-biased screen for constitutively-active CapV variants, using error-prone PCR, to reveal other molecular determinants involved in activation. Understanding how CapV is regulated by cGAMP will not only have implications for identifying cGAMP-dependent enzymes in other bacterium, but also help elucidate the physiological role of this signaling network in V. cholerae.

Characterizing RBL10: A Rhomboid Protease in Arabidopsis Thaliana
Cameron De La Mora
Category & Time: Biochemistry & Molecular Biology, Section 2, 1:00 PM - 2:15 PM
Poster: 141
Mentor: Christoph Benning, Anastasiya Lavell

Plant cells rely on the chloroplast for light energy capture among other numerous biological functions. Incentive for studying these other functions include: the merit of scientific discovery, contributions to stress tolerance, and the potential to increase plant productivity for food and fuel. The protein examined in this study is called Rhomboid like protein-10 (RBL10). This protein is a 6-pass transmembrane protease at the inner envelope of the chloroplast. Current evidence suggests RBL10 is involved in lipid trafficking. To narrow which part of the lipid biosynthetic pathway RBL10 participates in, the rbl10 mutation was introduced to existing lines with mutations in two different genes encoding lipid biosynthetic enzymes (rbl10 x tgd1 and rbl10 x ats1). A mutation in the TGD1 gene decreases the efficiency of lipid import from the endoplasmic reticulum pathway, while the ats1 mutants are impaired in the acylation of phosphatidic acid and consequently in the downstream chloroplast pathway.
The rbl10 mutation should further impact one of the two major lipid pathways. Identified double homozygous mutants analyzed by thin layer and gas chromatography, when compared to the lipid profiles of tgd1 and ats1, will provide insight to which pathway RBL10 belongs to. There is preliminary evidence that RBL10 is autocatalytic. Creating mutations in residues that are the predicted active serine histidine dyad, which are conserved in catalytic domains of other rhomboids, should inhibit the protein's proteolytic activity. The wild type and mutant RBL10 constructs will be expressed in bacteria and protein fusion analyzed via western blot.

Do the Neurotensin and FGF21 Signaling Systems Interact to Suppress Caloric Intake?
Harim Delgado-Seo
Category & Time: Biochemistry & Molecular Biology, Section 2, 1:00 PM - 2:15 PM
Poster: 142
Mentor: Gina Leinninger, Anna Makela

Obesity is highly prevalent and increases the risk of developing chronic diseases that reduce life span.

Since obesity is caused by overconsumption of calorie-dense food, treatments to restrain feeding would be useful to support weight loss and improve health. However, the design of such treatments has been hindered by the incomplete understanding of how feeding is controlled. Here we investigate whether two separately reported anorexic signaling systems may, in fact, interact to mediate weight loss. The neuropeptide neurotensin (Nts) acts via the neurotensin receptor 1 (NtsR1) in the brain to suppress appetite and promote water intake, dual behaviors that promote weight loss. Intriguingly, the hepatokine fibroblast growth factor 21 (FGF21) also diminishes sugar intake while promoting water intake that leads to weight loss. Given that endocrine FGF-21 and central Nts-NtsR1 invoke similar ingestive behaviors, we hypothesize that peripheral FGF21 might engage the central Nts-NtsR1 system to suppress caloric intake and promote water intake. If our hypothesis is accurate, then we would expect FGF21-mediated effects to be blunted in mice lacking NtsR1 (called NtsR1-KO mice). To examine this hypothesis, we will treat wild type control mice and NtsR1-KO mice with FGF21 and assess their body weight and intake of sucrose and water. These data will determine if the FGF-21 and Nts-NtsR1 pathways interact to modulate ingestive behaviors, and could reveal a common physiological mechanism that could be targeted to support weight loss.

How Bacterial Shape Affects Motility Behavior of Vibrio cholerae
Blaine Derbigny
Category & Time: Biochemistry & Molecular Biology, Section 2, 1:00 PM - 2:15 PM
Poster: 143
Mentor: Yann Dufour

Mucus serves as one of the body's most important natural defense mechanisms against pathogens by confining and restricting pathogen motility in a hydrogel matrix. Although mucus limits movement, pathogens are able to penetrate through mucus via chemotaxis and flagellar rotation. Vibrio cholerae, is crescent shaped and penetrates the mucosal lining of the small intestines as part of its infection cycle, which can result in cholera disease. Wild-type V. cholerae was compared against rod-shaped, mutant strain, ΔcrvA, to determine if cell shape impacts mucosal navigation. The motility and growth of both strains were compared by utilizing swim plates, growth curve analysis, and single-cell tracking microscopy. The spreading phenotype observed on swim plates is a composite of growth and chemotaxis. Growth curve analysis was used to investigate the role of cell shape on growth rate. In single-cell tracking microscopy, cell motility is tracked and quantified in reference to speed, change in direction, percent motile versus non-motile, and diffusion. Wild type V. cholerae spread more on swim plates than the rod-shaped mutant ΔcrvA. However, the growth rate exhibited no differences between the growth of both strains and microscopy results indicate similar motility behavior. Investigating V. cholerae's shape and its effects on cell motility plays a vital role in understanding mucus' response to penetrating pathogens, as well as the pathogenesis of cholera disease.

Examining TLR2 Mediated Changes in Neuronal Models of Alzheimer's Disease
Megan Dykstra
Category & Time: Biochemistry & Molecular Biology, Section 2, 1:00 PM - 2:15 PM
Poster: 144
Mentor: Anne Slavin

Alzheimer's disease is the most common form of dementia, a progressive neurodegenerative disorder characterized by various pathological markers, including neuroinflammation. The resident immune cell of the brain, Microglia, become chronically activated during the aging process. Toll like receptors on these cells are activated, and account for much of the inflammation observed in this condition. In this study we wished to assess the effects of the TLR2 agonist, lipoteichoic acid (LTA) on three cell types, one that represented cells from a healthy brain, and two that mimicked neurons with an Alzheimer's disease-like phenotype. Current treatments for AD are variable in their effectiveness among the population, and at best can alleviate some of the symptoms. Therefore, we examined the therapeutic potential of cannabidiol (CBD), which has been widely reported to exert anti inflammatory properties. Results suggest that cellular expression of Aβ42 regulates the proliferation and differentiation of neuronal cells. We concluded that LTA induces inflammatory effects in neurons which appear more profound in cells expressing the AD phenotype. Additionally, CBD alleviated the LTA-induced increase in nitrite release in the AD-model cells.

Characterization of Rice Granule-Bound Starch Synthase
Raoul Fulgos
Category & Time: Biochemistry & Molecular Biology, Section 3, 1:00 PM - 2:15 PM
Poster: 145
Mentor: James Geiger, Hadi Nayebi gavgani

To further explore the differences between this family of GBSSI and other starch (glycogen) synthases, crystalization of the rice GBSSI-ligand complex has been refined. The structure with the ligands present will give a better idea of how the catalytic activity of adding glucose to a glycogen chain occurs. This information will be key in developing an appropriate kenitic assay to further understand the enzyme.

Disentangling the Role of PntAB, a Pyridine Nucleotide Transhydrogenase, in the Regulation of Photosynthetic Function of Flavodiiron Proteins in Synechococcus elongatus PCC 7942
Eric Gonzales
Category & Time: Biochemistry & Molecular Biology, Section 3, 1:00 PM - 2:15 PM
Poster: 146
Mentor: Daniel Ducat, Maria Del Carmen Santos Merino

Maximizing the photosynthetic efficiency of cyanobacteria is an important objective that would improve their potential utility for a variety of biotechnological applications. While photoprotective processes help cyanobacteria dissipate excess absorbed light energy, these mechanisms also inherently reduce photosynthetic efficiency. Flavodiiron proteins are an important photoprotective mechanism found in cyanobacteria to safeguard photosystems against oxidative damage, since they deliver excess high energy electrons generated by photosynthesis to O2 without the concomitant formation of reactive oxygen species. Our cyanobacterial model species, Synechococcus elongatus PCC 7942, has two flavodiiron proteins, Flv3 and Flv1, that have been shown to protect cells under fluctuating light conditions by acting as an electron sink downstream of Photosystem I. The regulation of Flv3/1 is currently unknown, but is hypothesized to be influenced by the levels of NADH and/or NADPH in the

cell, since both electron carriers can be used as Flv3/1 substrates. We hypothesize that a balance of the ratio of NADH:NADPH is critical to control the activity of Flv3/1, allowing the dissipation of excess energy under stress conditions, but reducing the loss of energy under steady-state light conditions. Pyridine nucleotide transhydrogenase (PntAB) is a key factor involved in balancing NADH:NADPH levels, as it catalyzes the reversible transformation of NADPH into NADH. To explore the hypothesis that PntAB may be involved in regulating Flv3/1, we have constructed a mutant lacking PntAB and/or Flv3/1 proteins, and are evaluating differences in photosynthetic performance under different light intensities using a custom built fluorimeter-spectrophotometer. A more detailed understanding of the regulation of Flv3/1 activity may ultimately be useful for reducing the proportion of captured solar energy that is lost to photoprotective mechanisms.

Comparison of Two Diagnostic Methods for Hrp2 Concentration Measurement in Malaria Positive Individuals

Ahmad Hammad

Category & Time: Biochemistry & Molecular Biology, Section 3, 1:00 PM - 2:15 PM
Poster: 147
Mentor: Karl Seydel, Elahe Crockett-Torabi

Histidine Rich Protein-2 (HRP2) is a protein produced by the malaria parasite, Plasmodium falciparum. Previous work from this laboratory demonstrated a correlation between plasma concentrations of HRP2 and progression to cerebral malaria. There are two methods to measure HRP2 – the Enzyme-Linked Immunosorbent Assay (ELISA), which measures plasma concentration, and a Rapid Diagnostic Testing, a point-of-care monitor which uses whole blood. The aim of this study is to improve whole blood ELISA accuracy to the level of the point-of-care method. Preliminary data shows lower concentrations in whole blood. A secondary point of interest is determining the nature of this inhibition in whole blood. Whole blood has inhibitory factors that impact the readings of HRP2 concentration in ELISA, resulting in lower readings when compared to Rapid-Diagnostic Testing (point-of-care.) Children, ages one through twelve, who test as malaria positive were recruited from Blantyre, Malawi. HRP2 concentration was measured in their blood and plasma using ELISA and rapid diagnostic test. To determine the source of inhibition of whole blood readings, processes such as filtration, purification, hydration and denaturation will be used. ELISA whole blood HRP2 concentration readings were lower than HRP2 rapid test readings. Lower HRP2 concentration in whole blood than those of plasma levels. The nature of inhibition in whole blood is yet to be explored. Support: A.H. is a REPID scholar, supported by NIH-5—R25-HL108864 award to Elahé Crocket and NIH grant 2U19AI089683-8 award to Karl Seydel.

Utilization of Methylobacterium Extorquens AM1 for Recovery of Rare Earth Elements from Electronic Waste

Emily Hawker

Category & Time: Biochemistry & Molecular Biology, Section 3, 1:00 PM - 2:15 PM
Poster: 148
Mentor: Nathan Good, Norma Martinez Gomez

Rare earth elements (REE) are critical components of modern technology and industry. Demand for REE

continues to increase while supply remains restricted due to limited sourcing, environmentally destructive mining and hazardous processing practices. Recent discoveries have shown that methylotrophic bacteria, which can metabolize inexpensive and readily abundant feedstocks such as methane and methanol, can utilize REE as enzymatic cofactors, acquire them from the environment, and store them as biominerals. The active metabolic utilization and storage of REE by methylotrophs presents unexploited potential for biometallurgy - technology using microbiology to acquire metals from complex sources. In this study, we are investigating the capacity of the model methylotroph Methylobacterium extorquens AM1 to utilize electronic waste as a source of REE. Using genetically modified strains that rely on REE for growth with methanol, we show that M. extorquens AM1 grows robustly with neodymium magnet as the sole REE source. Growth with the solid magnet is not statistically different from growth with soluble neodymium chloride, indicating that an efficient REE solubilization and acquisition system is employed by the microbe when required. While REE are effectively acquired from electronic waste by M. extorquens AM1, iron, an additional metal constituent of neodymium magnets, does not leach into the growth medium. This suggests that in M. extorquens AM1 either iron is acquired along with REE, or acquisition of REE is highly selective and inhibits iron leaching. Together, these results show the potential of methylotrophs, and M. extorquens AM1 specifically, for development into a sustainable biometallurgy platform.

Identifying the Transcription Activator for Amylovoran Synthesis in Erwinia amylovora
Jacob Hieber
Category & Time: Biochemistry & Molecular Biology, Section 3, 1:00 PM - 2:15 PM
Poster: 149
Mentor: Christopher Waters, Brian Hsueh

The Gram-negative plant pathogen Erwinia amylovora is the causative agent of the disease fire blight, which primarily affects apple and pear trees. This disease causes vast economic loss worldwide. E. amylovora disease progression is marked by a transition from a chronic biofilm state to systemic acute plant infection. The ubiquitous second messenger cyclic-di-GMP (c-di-GMP), which regulates a wide variety of cellular behaviors in many bacterial species, partially governs this transition by increasing biofilm formation and decreasing motility and virulence. It has been shown that secretion of the exopolysaccharide (EPS) amylovoran is required for biofilm formation in E. amylovora, and expression of the genes necessary for amylovoran synthesis is also dependent on c-di-GMP. Furthermore, previous research in our lab has indicated that c-di-GMP interacts with transcription factors, specifically enhancer-binding proteins (EBPs), in other bacteria to regulate downstream pathways, including biofilm formation and motility. However, the mechanism by which c-di-GMP regulates amylovoran production is less understood. We therefore hypothesize that c-di-GMP is activating a transcription factor that controls amylovoran production, and thus biofilm formation. Using random transposon mutagenesis, a technique that interrupts the functions of genes within the genome, we will identify genes that are responsible for the regulation of amylovoran production in E. amylovora. Understanding the mechanisms by which E. amylovora colonizes hosts may initiate further advancements in controlling fire blight.

The Effects of Inorganic Nanomaterials in Cancer Photodynamic Therapy
Silver Homa
Category & Time: Biochemistry & Molecular Biology, Section 3, 1:00 PM - 2:15 PM
Poster: 150
Mentor: Taeho Kim, Md Nafiujjaman

It is estimated that over 1.7 million cases of cancer are currently diagnosed in the U.S. according to the National Cancer Institute. There are various cancer treatment options available (chemotherapy, surgery, radiation therapy, immunotherapy, etc.) but they are inefficient in potency and patient safety. Photodynamic therapy (PDT) has been extensively explored as a minimally invasive treatment strategy for treating malignant cancers. It works by irradiating a photosensitizer in cancer tissue with near-infrared light to produce potent toxins (1O2) and induce cell-death. However, the tumor microenvironment overexpresses reactive oxygen species (ROS) such as H2O2 due to the rapid metabolic activity in cancer cells. Insufficient oxygenation (hypoxia) leads to low production of singlet oxygen (1O2) during phototherapy. In this study, we developed a hybrid nanoparticle composed of manganese silicate (Mn-Si) and a photosensitizer that can generate significant amounts of O2 to potentially overcome tumor hypoxia and enhance the therapeutic efficacy of PDT. We hypothesized that our nanoparticle can have an amplified impact in its ROS scavenging abilities and increase the level of oxygen in the cells by dismutation of oxygen radicals. Our Mn-Si nanoparticle showed high superoxide dismutase (SOD) activity, catalase activity, significant ROS scavenging, and exhibited low cytotoxicity. It also demonstrated high potency in PDT when applied to 4T1 mammalian breast cancer cells. These results confirm our hypothesis and demonstrate that Mn-Si hybrid nanoparticle will find wide applications for image-guided photodynamic cancer therapy.

Sweet Defenses: Identifying Acylsugar Diversity in Nicotiana
MacKenzie Jacobs
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 151
Mentor: Craig Schenck

In addition to primary metabolites, plants synthesize structurally diverse specialized metabolites, which allow them to tolerate various biotic and abiotic stresses. Acylsugars are a class of specialized metabolites with defensive roles that are biosynthesized in the trichomes by species throughout the Solanaceae family. Typically, they consist of a disaccharide sugar core like sucrose, but some species have monosaccharides cores like glucose with varying numbers of esterified acyl chains. Given the variability of sugar cores, acyl chain types, and acylation positions, there is tremendous acylsugar diversity throughout the Solanaceae. Acylsugar profiles have been characterized in agronomically important Solanaceae species, but less is known about other species within the Nicotiana genus. To determine the acylsugar diversity within Nicotiana, acylsugar profiles from leaf dips were screened via liquid chromatography coupled with mass spectrometry. So far, nine of ~70 Nicotiana species have been screened. Some plants, including Nicotiana linearis, produce both acylsucroses and acylglucoses, while others produce only acylsucroses or acylglucoses. Acyl chain lengths of two, five, and six carbons have been observed in all species, whereas acyl chains of five carbons with a double bond and seven carbons were only found in samples of N. glutinosa, N. paucliflora, N. tomentosiformis, and N. linearis. Further, in acylsucroses, only 2 carbon acyl chains have been found esterified to the glucose subunit. Preliminary results suggest that diverse acylsugar biosynthetic mechanisms are present within Nicotiana. Ongoing

screening will determine the full breadth of acylsugar structures and determine the taxonomic distribution of unique acylsugar features within Nicotiana.

Respiration Arresting Growth Conditions Enhance β-lactam Resistance in Methicillin Resistant Staphylococcus aureus
Matthew Kegerreis
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 152
Mentor: Neal Hammer

Antibiotic resistant Staphylococcus aureus is a considerable threat to our current healthcare system. Cell wall inhibiting β–lactam antibiotics such as methicillin, and its analogue oxacillin, are limited for treating S. aureus infections due the prevalence of methicillin resistant S. aureus (MRSA). MRSA strains express MecA, a penicillin-binding protein that facilitates synthesis of the cell wall in the presence of β–lactams. I have found that resistance to oxacillin significantly increases when S. aureus is cultured in numerous respiration arresting conditions that promote fermentative metabolism. Previous reports postulated that this enhanced resistance is due to slower growth rates associated with fermentation and the fact that β–lactams are more effective against actively dividing cells; however, I demonstrate that genetic inactivation of mecA ablates anaerobic oxacillin resistance. This result is consistent with the conclusion that MecA and not growth rate is the mechanism by which fermentative β–lactam resistance in enhanced. mecA expression is controlled by mecR1 and it has been reported that there are at least two mecR1 alleles – full length and truncated. I found that strains harboring the truncated mecR1 allele demonstrate enhanced anaerobic oxacillin resistance. Together, these facts support the hypothesis that mecA expression is increased when S. aureus ferments. To test this hypothesis, mecA transcripts in aerobically and anaerobically cultured S. aureus will be compared. In total, this work demonstrates that metabolism is an important driver for antibiotic resistance and has the potential to facilitate new strategies for treating MRSA infection.

Exploring Antimicrobial Bialaphos Activity in Staphylococcus aureus
Abigail Kuplicki
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 153
Mentor: Neal Hammer

The Gram-positive, opportunistic pathogen, Staphylococcus aureus is a leading cause of nosocomial infections and rapidly develops antibiotic resistance, necessitating development of alternative therapies. An approach to developing new therapeutic strategies is repurposing natural products that demonstrate toxicity in other organisms. Bialaphos, a tripeptide herbicide composed of two alanine residues and a glufosinate residue, is produced by some species of Streptomyces. Antibacterial activity of bialaphos has been demonstrated against other bacterial pathogens, however, to our knowledge, its capacity to inhibit S. aureus growth has not been elucidated. In other pathogens, bialaphos toxicity has been exploited to define substrates for peptide transporters. Consistent with this, we hypothesize that bialaphos will demonstrate inhibitory activity against S. aureus and that this activity depends on peptide transporters.

S. aureus encodes four peptide transporters; substrates for two have been determined. To test my hypothesis, I performed Kirby Bauer disk diffusion assays using 10 µM bialaphos and S. aureus strains lacking varying peptide transporters. I found that bialaphos inhibits S. aureus growth in chemically defined medium supplemented with distinct sulfur sources. Additionally, bialaphos toxicity is mitigated in a SAUSA300_0712::Tn peptide transporter mutant. Three other peptide transporter mutants demonstrate WT-like bialaphos sensitivity. Taken together, these results support the hypothesis that SAUSA300_0712::Tn imports bialaphos and likely other nontoxic tripeptides. This is the first demonstration that bialaphos inhibits S. aureus proliferation. Thus, determining the mechanism by which bialaphos impedes S. aureus growth could reveal a new therapeutic strategy for treating staphylococcal infection.

Investigating Metabolic Augmentation of Antibiotic Resistance in Staphylococcus aureus Isolates from Patients with Cystic Fibrosis
Jessica Liu
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 154
Mentor: Neal Hammer, John Shook

The Gram-positive, opportunistic bacterial pathogen Staphylococcus aureus causes a multitude of infections ranging from skin and soft tissue to bacterial endocarditis. S. aureus infections affect thousands of Americans annually, many of them children. In addition to the numerous infection sites, S. aureus readily resists antibiotics. Consistent with this, Methicillin-Resistant S. aureus (MRSA) is the leading cause of morbidity and mortality due to antibiotic-resistant bacterial infections. With the ability to spread from the bloodstream to the heart, bones, joints, and lungs, S. aureus is commonly found in patients with Cystic Fibrosis (CF). CF is characterized by a mutation in the cftR gene which consequently leads to thick, sticky mucus and heterogeneous micro-environments limited for oxygen. Interestingly, antibiotic-resistant, respiration-arrested S. aureus mutants can be isolated from CF patients' lungs due to multiple rounds of antibiotic treatment. We previously discovered that laboratory-derived MRSA strains demonstrate significantly increased resistance to the methicillin analog oxacillin in respiration arresting conditions. To determine whether clinical MRSA strains display a similar phenotype, I tested the oxacillin resistant profiles of MRSA strains isolated from CF patients in aerobic and anaerobic growth conditions. To perform this analysis, I used Kirby-Bauer disk diffusion assays to find that a majority of the MRSA CF isolates demonstrate increased resistance oxacillin in anaerobic conditions. These findings suggest that the metabolic status of the cell has the potential to augment antibiotic resistance, increasing the difficulty of treating MRSA infections.

Caffeine Intake May Affect Diabetics and Endurance Athletes
Max Macgregor, Ryan Hunt
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 155
Mentor: Erica Wehrwein

There is some evidence that caffeine can act as an inhibitor of the GLUT 1 transporter. This glucose

transporter is located in almost all tissues of the body though its level of expression is not consistent throughout these tissues. Its expression is highest in red blood cells and in certain endothelial tissues. This inhibition combined with the consumption of caffeine by a significant fraction of our population raised questions as to whether caffeine could have a significant effect on the blood glucose levels of individuals consuming caffeine. To examine this, a study consisting of 10 male and female participants of similar age was created. The study examined all ten participants in two separate trials. The first being a control trial where a subject would undergo a standard OGTT, and a second trial where a subject would undergo the same OGTT and take a caffeine pill concurrently. Blood glucose levels would then be measured at specific time points for a period of one hour following the OGTT. The one-hour time point showed a significant difference in blood glucose levels between the OGTT control and the OGTT plus caffeine group. It was reasoned that uncompetitive inhibition of the GLUT 1 transporter by both the caffeine and the ATP resulting from the metabolism of the glucose from the OGTT caused blood glucose levels in the caffeine group to be maintained at a higher level relative to the control group. With further study, these findings could be significant for diabetic individuals who consume large amounts of caffeine as they may have greater than normal difficulty managing their blood glucose levels.

Reduction of Greenhouse Gases via Genetic Modification of Methanotrophic Bacteria
Danielle Matz, Taryn Hanses, Sophia Swiecki, Evan Harrison
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 156
Mentor: Michaela TerAvest

Our biological approach aims to genetically modify a methanotrophic bacteria, Methylomicrobium alcaliphilum, to work under anoxic conditions. This particular strain has a pre existing engineered pathway that allows for the intake of methane and the output of 2,3-butanediol, a precursor for biofuels. A byproduct of methane metabolism is formate, which can build up in collection tubes to create an acidic environment, harmful to the cells. To prevent this, we will engineer a formate biosensor that will make the cells fluoresce when formate concentrations are high. This can increase efficiency and safety for the implementation of this methanotrophic bacteria. The spread of our inserted genes could cause unknown consequences, so we will introduce a toxin-antitoxin system to help minimize horizontal gene transfer.

Detecting TF-DNA Interactions that Participate in the Transcriptional Control of Genes Involved in Maize Flavonoid Metabolic Pathway
Makayla Mitchell
Category & Time: Biochemistry & Molecular Biology, Section 4, 1:00 PM - 2:15 PM
Poster: 157
Mentor: Yi-Hsuan Chu, Erich Grotewold

Over the last decades, plant biotechnology has been used to enhance nutritional content of crops for medical benefits, and human health. It has been shown that consuming flavonoid-rich diet is highly correlated with reduced risk in cancer and chronic diseases. Therefore, understanding the molecular mechanisms underlying flavonoid regulatory pathway in maize provides us an opportunity in improving

crop nutrient value to benefit human health. However, it is still unclear how transcription factors (TFs) working together in controlling gene expression of the flavonoid regulatory pathways in maize. In this study, our goal is to identify interactions between TF- and flavonoid pathway genes and how these interactions contributing to gene regulation in the network. In order to identify the TF-gene interactions we conducted the genome-wide binding profiles of 45 transcription factors, which shows t the most interactions with gene promoter involving flavonoid pathway. The ChIP (Chromatin Immunoprecipitation) experiment, an in vivo technique, was done by a collection of maize tissues from the tassel and leaf from a Mu Insertion f. An evaluation of the effects of the TFs on metabolites accumulation in maize tissues will be conducted. Additionally, DAP (DNA Affinity Purification) experiment, an in vitro technique, and an easier alternative to ChIP, was also performed to identify TF-DNA binding. As a result, these analyses can help to unravel the gene regulatory network of maize flavonoid pathway to further improve the nutrient status in food consumption.

Plant-Based Chemicals Exhibit Significant Antimicrobial Activity against Pathogenic Salmonella typhimurium
Cody Neeb
Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM
Poster: 158
Mentor: Michael Bachmann, Angela Detomaso

One of the major causes of foodborne illnesses are various species of Salmonella bacteria. Moreover, many Salmonella strains - both typhoidal and non-typhoidal strains - have developed resistance to antibiotics. Antibiotic resistance is outpacing the discovery of antimicrobial agents and poses an urgent public health problem. To address both of these issues, we are investigating the antimicrobial activity of plant-based chemicals in complex mixtures of essential oils (EOs). EOs are phytochemicals extracted by steam distillation, many of which have been shown to possess antimicrobial activity. The rationale behind our research is that in complex formulations, resistance is less likely to occur compared to treatments with just one antimicrobial substance. Our initial studies showed that the EOs of clove, oregano, and thyme dissolved at 0.1% in carrier oil could kill bioluminescently labeled Salmonella typhimurium within 6 hours. To improve on this, we emulsified numerous EOs with lecithin and tested them in vitro against S. typhimurium using an In Vivo Imaging System (IVIS) to measure the antimicrobial efficacy. We found that the emulsified EO of Oregano (Origanum vulgare) was the most effective at killing S. typhimurium at 0.07%. Finally, we will perform in vivo testing of the emulsified EOs using a mouse model of S. typhimurium infection to confirm the antimicrobial activity of phytochemical mixtures and to demonstrate efficacy in a preclinical model.

Crosstalk Between the Aryl Hydrocarbon Receptor (AhR) and the Translocator Protein (TSPO), and its Role in Regulating Mitochondrial Function
Sophia Ono-Korkowski
Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM
Poster: 159
Mentor: John LaPres

The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor that binds to a variety of environmental toxicants, such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The AhR mediates most, if not all, of the toxic effects caused by these ligands. Most of the cellular pool of AhR exists in the cytosol; however, evidence suggests that a portion of a cell's AhR is found in the intermembrane space of its mitochondria. We predict that crosstalk between translocator protein 18 kDa (TSPO), which is in the outer mitochondrial membrane, and mitochondria-associated AhR modulates electron transport chain efficiency. Additionally, we hypothesize that this crosstalk is responsible for some of the negative effects caused by AhR activation. To test this hypothesis, we used three different strains of the mouse hepatoma cells, Hepa1c1c7: wild type, and AhR and TSPO knockout cells. Oxygen consumption rates were measured in each cell strain following exposure to TCDD and/or PK11195, a ligand for TSPO, using the XF24 Seahorse Assay. Gene expression in the three different cell types was also characterized by treating the cells with TCDD and/or PK11195, extracting RNA and performing Quantitative Reverse Transcription Polymerase Chain Reaction (qRT PCR). Our data suggest that TCDD decreases ETC efficiency in an AHR-dependent manner, and that TSPO is capable of modulating this activity. Characterizing the relationship between TSPO, the AhR, mitochondrial dysfunction and TCDD-induced toxicity is important for understanding how exposure to ligands, such as TCDD, can cause human disease.

Structural Analysis of TcPink1 Protein
Nnamdi Onyene
Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM
Poster: 160
Mentor: Xiangshu Jin

When amino acids form bonds they become capable of forming a polypeptide also known as a protein. These proteins have different levels of structures also known as the primary, secondary, tertiary, and quaternary structures. Our research focuses on examining the functions of the different structures of proteins that are found within various strains of Escherichia coli, also known as E. coli. These proteins are examined in order to view the amino acid residue. Amino acid residue is the amino acid chain left after the polypeptide chain is formed from the dehydration reaction. This chain of amino acids makes up the primary structure of the protein and by taking a look at both the primary and quaternary structures we will be able to further understand the function of the protein through its amino acid sequence as well as the way it interacts with other proteins.

A Novel Method to Generate Vectors for Exosome Therapeutics
Nathaniel Pascual
Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM
Poster: 161
Mentor: Masako Harada

Assembling recombinant DNA in vitro - molecular cloning - is an essential tool used in molecular biology. Traditional molecular cloning methods involve time and resource demanding processes that may include

treatments of insert and backbone DNA with various enzymes, require specific restriction sites, and leave unwanted sequences. In the Harada Lab, we utilize the next generation of molecular cloning method: Seamless Ligation Cloning Extract (SLiCE) cloning. This new technique utilizes the recombinant activity of lysates from common laboratory Escherichia coli strains to clone vectors in a simple one-pot incubation. We describe a novel method to generate vectors for exosome therapeutics using SLiCE cloning whereby therapeutic vectors are significantly reduced in length: (1) necessary vector components are PCR amplified from a parental vector, (2) the vector is circularized by SLiCE reaction, (3) linear DNA fragments are digested by Exonuclease V, and (4) remaining primers and dNTPS are removed with a PCR clean-up kit. By bypassing bacterial transformation to generate the vector, we are able to remove bacterial DNA sequences such as antibiotic resistance markers, the bacterial origin of replication and unnecessary promoter sequences from conventional mammalian expression vectors. We hypothesized that therapeutic vectors produced in this method would result in improved transfection and protein expression due to reduced vector size and improved stability due to the lack of bacterial sequences. We tested this hypothesis by comparing the expression of fluorescent molecules eGFP and mCherry in HEK-293T cell cultures transfected in the traditional cloning method and the new method outlined above.

Physiological and Metabolic Features Associated with Divergence in Chilling Tolerance between Upland and Lowland Switchgrass Cultivars

Quang Hieu Pham

Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM

Poster: 162

Mentor: Anne-Sophie Bohrer

Switchgrass (Panicum virgatum), a perennial prairie grass native of North America, is a lignocellulosic bioenergy crop of interest for the sustainable production of biofuels and bioproducts. Upland cultivars of switchgrass are adapted to survive cold winters in the northern U.S. but have low biomass yield due to the early onset of flowering. Lowland cultivars accumulate more biomass, are more tolerant to drought and heat, but are sensitive to cold environments. To understand the divergence in cold tolerance between switchgrass cultivars, we analyzed the physiological and metabolic responses to a 24-hour chilling event of two parental cultivars, VS16 (upland) and WBC3 (lowland), and their F1 hybrid (VS16xWBC3). The physiological responses to chilling for each cultivar were assessed by measuring photosynthetic parameters before, during, and after the chilling event. Leaf samples were collected at each time point and the metabolic differences between cultivars were analyzed by LC-MS. Our results indicate that the cold-tolerant VS16 closes its stomata upon chilling yet maintains a high carbon assimilation rate. Additionally, levels of proline and betaine, metabolites known to accumulate in response to cold and enhance cold tolerance, are inherently higher in VS16 compared to WBC3. The cold-sensitive WBC3 accumulates oxidized glutathione, which correlates with observed lasting damages to the photosynthetic electron transport chain upon chilling. Additionally, we analyzed another set of parental cultivars DAC6 (upland) and AP13 (lowland), and their F1 hybrid (DAC6xAP13). The metabolic and photosynthetic features of cold tolerance identified from two independent sets of cultivars will be discussed in this presentation.

Characterization of a New Family of Water Soluble Carotenoid Binding Proteins
Claire Radtke
Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM
Poster: 163
Mentor: Sigal Lechno-Yossef

Evolved to function as a critical step to avoid light and oxidative damage that occur as a result of photosynthesis, the Orange Carotenoid Protein (OCP) is used for a non-photochemical quenching in cyanobacteria to dissipate excess energy not used in photosynthesis. OCP's two structural and functional domains: the C- and N- terminal domains, have respective homologous structures in genomes of many cyanobacteria. The homologous gene product of the C-terminal domain is named C-Terminal Domain Homolog (CTDH). Through cloning in expression vectors for E.coli, expressing the proteins in a strain that produces the carotenoid canthaxanthin , purifying the protein, and crystallization this project looks to determine the structure of CTDH from diverse groups of cyanobacteria. The structure of CTDH will allow a closer look at CTDH function, allowing for a fuller understanding of photosynthesis and its complementary processes to ultimately look into utilizing cyanobacteria in biotechnology.

Identifying Medicinal Defense Metabolite Genes in Mimulus guttattus
Hannah Ramcharan
Category & Time: Biochemistry & Molecular Biology, Section 5, 1:00 PM - 2:15 PM
Poster: 164
Mentor: Rachel Kerwin

Caffeoyl phenylethanoid glycosides (CPGs) form a class of specialized metabolites that is produced by the flowering plant, Mimulus guttatus as defense against herbivores. CPGs possess invaluable anti-inflammatory, anti-oxidant, antibacterial, and antiviral qualities that may be applied to effectively treat human diseases. CPG accumulation in plant tissues is just 1-5% of total biomass and the purification process is expensive, limiting the range of commercial applications. The CPG biosynthetic pathway is currently unresolved, though many upstream components are known. Identifying the genes involved in CPG production can enable the use of synthetic biology to improve methods to manufacture this potentially valuable natural product. The first committed step in the CPG pathway produces a compound called hydroxytyrosol glycoside through a reaction likely catalyzed by a UDP-dependent glycosyltransferase (UGT) enzyme. Therefore, the goal of this project was to identify UGT candidate genes and test their role in CPG biosynthesis in Mimulus guttatus. To identify candidate UGTs, a sequence similarity search was performed by querying the conserved UGT domain against the Mimulus guttatus proteome, which yielded 147 genes. To narrow this gene list for downstream functional analysis, a combined phylogenetics and transcriptomic approach was used, which produced a list of 17 high-priority candidates. To rapidly test the function of these candidate genes in CPG biosynthesis in planta, a transient assay based on virus-induced gene silencing (VIGS) was developed and utilized in Mimulus guttatus.

Impact on Flagellar Formation in Burkholderia thailandensis through Targeted Mutagenesis to Eliminate the Production of FliI and FliH

Michael Rose, Zoe Buszka
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM
Poster: 165
Mentor: Poorna Viswanathan

Burkholderia thailandensis is a close relative of Burkholderia pseudomallei, the pathogen responsible for the infectious disease known as melioidosis. It is much less virulent than its pathogenic relative, yet they share many features. Thus, B. thailandensis may be studied as an analog of B. pseudomallei while posing minimal safety challenges in a laboratory setting. One shared feature is the ability to form flagella, which is a virulence factor in B. pseudomallei. During the formation of flagella, flagellar proteins are exported to the surface of the cell through a membrane-imbedded protein complex that functions as a protein-proton antiporter. A non-soluble protein complex, composed of proteins FliH, FliI, and FliJ, delivers flagellar proteins to the membrane-imbedded protein antiporter complex. In the present research, the function of this non-soluble protein complex is examined through the exploitation of the natural competency of B. thailandensis (E264) for transformation. Targeted mutagenesis was used to create two knockout mutants; one lacking the gene necessary to produce FliI and the other lacking the genes necessary to produce of both FliI and FliH. The ability to produce flagella in the knockout mutants was analyzed by staining (simple silver stain) the cells to visualize via microscopy. Swarm assays were utilized to quantify the motility of each mutant.

Activation of VTA NtsR1 Neurons to Suppress Feeding and Promote Weight Loss
Krystal Santiago
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM
Poster: 166
Mentor: Patricia Perez-Bonilla, Gina Leinninger

Behaviors that impact energy balance, like the motivation to eat and locomotor activity, are mediated by dopaminergic neurons of the ventral tegmental area (VTA). Yet, dopamine neurons are molecularly heterogeneous and project to different brain sites, and it remains unclear which specific VTA neurons exert behaviors to support weight loss. Neurotensin (Nts) released to the VTA promotes weight-loss behaviors in mice, which is dependent on neurotensin receptor-1 (NtsR1). Interestingly, only a subset of VTA neurons express NtsR1, and these "VTA NtsR1 neurons" only project to the nucleus accumbens (NAc) but not to the other main output of the VTA, the prefrontal cortex (PFC). Therefore, we hypothesize that selective activation of VTA NtsR1 neurons increases activation of downstream NAc neurons and suppresses feeding to support weight loss. To investigate this, we are using Cre-dependent Designer Receptors Activated by Designer Drugs (DREADDs) to selectively activate VTA NtsR1 neurons of diet-induced obese NtsR1Cre mice. We will activate VTA NtsR1 neurons and assess cFos immunoreactivity (a marker of depolarized neurons) in the NAc vs. PFC to determine if VTA NtsR1 neurons indeed act via a specific neural circuit. We will also determine if activating VTA NtsR1 neurons restrains feeding even when motivation to eat is high (after overnight fasting), and if it specifically blunts preference and/or motivation for sucrose to reduce weight. Together, these data will reveal how the VTA NtsR1 subset of dopamine neurons contributes to energy balance, and if it might be leveraged to support weight loss to treat obesity.

The Role of Lactic Acid in Mrgprx2 Receptor-Induced Mast Cell Activation
Nathan Seamans
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM
Poster: 167
Mentor: Hariharan Subramanian, Elahe Crockett-Torabi, Ananth Kumar Kammala

Mast cells are immune cells that are critical mediators of human allergic responses. Recently, a novel G protein-coupled receptor, MRGPRX2 has been identified on mast cells and this receptor has been implicated in causing pseudoallergic reactions to antibiotics such as ciprofloxacin, bradykinin B2 receptor antagonist icatibant and several other FDA-approved drugs. Specifically, when activated via MRGPRX2, mast cells rapidly release inflammatory mediators such as histamine and cytokines which cause symptoms of allergy. Thus identifying and developing inhibitors that target the MRGPRX2 pathway is clinically significant because these pharmacologic agents can then be used to treat patients that show clinical manifestations of pseudoallergy. Previous studies have demonstrated that lactic acid inhibits mast cell responses and prevents anaphylaxis in mouse models to allergens. Objective: to determine the role of lactic acid in MRGPRX2 induced mast cell activation. Specifically, we will test whether lactic acid inhibits the release of histamine and inflammatory cytokines following activation of human mast cells with the known MRGPRX2 ligands: compound 48/80, substance P, ciprofloxacin and icatibant. Use human mast cell line (LAD2) and assess mast cell activation by performing assays such as degranulation, intracellular Ca2+mobilization and cytokine release, following exposure to various concentrations of MRGPRX2 agonists, in the presence or absence of lactic acid. Data obtained using this in vitro system will form the foundation for future studies that will use primary tissue-derived human/mouse mast cells. Support: Nathan Seamans is a REPID-scholar, supported by NIH-5-R25-HL108864 award to E.C., NIH-R00HL121073 Award to H.S.

Neuron Restrictive Silencer Factor and Hypoxia in Neuropathic Pain
Breanna Sellers, Harrison Lawson, Ryan Thompson
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM
Poster: 168
Mentor: Christina Chan

Neuropathic Pain is pain caused by damage of the somatosensory system. Neuropathic pain treatments treat the symptoms not the cause of the pain. This creates a need for a way to target the cause. Neuron Restrictive Silencer Factor (NRSF) is important in the growth and development of the nervous system. NRSF recruits' corepressors which allow for gene silencing. This is important because in neuropathic pain NRSF is upregulated which is responsible for the downregulation of ion channels and analgesic promoting genes. Hypoxia causes a reduction in the levels of Na+/K+ ATPase ion transporters which likely contribute to hyperexcitability of the injured nerve. Hypoxia-inducible factor alpha (HIF-1α) is degraded under normal oxygen environment but after nerve injury HIF-1α stays present. Our hypothesis is that hypoxia causes up regulation of NRSF which results in downregulation of analgesic promoting genes which causes neuropathic pain. We made plasmids from E. Coli and then transfected PC 12 cells with the plasmid DNA. We then lysed the cells and extracted the proteins to perform western blotting using PAGE. We are going to use RT-PCR to find out what the NRSF levels are when HIF-1α is present and when it is not. HIF-1α should be present in the western blots. We are expecting the results of RT-PCR to

have a higher expression of NRSF in the cells that have HIF-1α present. (This work was supported by NIH R25ES025060)

Synthesis of Antimicrobial Agents
Anna Skrip
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM
Poster: 169
Mentor: Matthew Hart

Tuberculosis is a harmful disease that affects millions of people worldwide every year. Drug resistant Mycobacterium Tuberculosis is one of the top ten causes of death across the globe and is only becoming more resistant to existing antibiotics. In recent studies from our lab, it has been determined that diphenyl ureas exhibit antibiotic properties against Staphylococcus and E. coli and show a promising outlook against Mycobacterium. This study synthesizes phenyl ureas with differing aromatic substituents and differing side chains off the urea. These structures show similarities to antibiotics known to treat Mycobacterium tuberculosis. The structures will be tested using carbon and proton NMR and then biologically tested using kill zone assays on Staphylococcus, E. coli. and Mycobacterium. It is hoped that these new compounds will provide insight into treating Mycobacterium infections.

Utilizing Optical Tweezers and Fluorescence to Examine Folding Patterns in G-Quadraplex
Joseph Slivka, Lauren Jernstadt
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM
Poster: 170
Mentor: Matthew Comstock

There are some instances in which DNA does not conform to the canonical base-pairing rules (A-T, C-G). One instance of this is when four guanine nucleotides hydrogen bond with each other in stacks of three, forming G-Quadraplex (GQ). This structure plays an important role in cell division by interacting with telomerase. Telomerase is an important protein that creates the repeated GQ sequence at the ends of telomeres to protect the important sequences of DNA during replication in eukaryotic chromosomes. Thus, it is important to understand how these structures fold and unfold. One way to observe the dynamics of a protein is to use high-resolution, single-molecule optical trapping using high-intensity lasers. Utilizing optical trapping in conditions that telomerase is active, the GQ is attached between two beads whose extension is manipulated by the laser. Real time observation of the dynamic GQ shows it folds and unfolds at the 10 second timescale. Current data suggests that the GQ exhibits normal patterns of folding, but also with some anomalous configurations (states) that don't align with current models of GQ. Further experimentation using both optical trapping and fluorescence energy transfer measurements simultaneously will provide more information in targeting the mechanism that causes this anomalous state.

Controlling Quorum Sensing Bacteria with Light-Sensitive Molecules
Shelby Stajdl
Category & Time: Biochemistry & Molecular Biology, Section 6, 1:00 PM - 2:15 PM

Poster: 171
Mentor: Craig Streu

Quorum sensing is the means by which bacteria communicate with each other using signaling molecules. In response to a high population density of signaling molecules gene transcription is initiated generating a beneficial response such as biofilm formation. If the natural process of quorum sensing could be controlled or co-opted, then the biotechnical applications could be limitless. Photoswitchable molecules, like azo stilbenes, have the ability to respond to a light stimulus. Azo stilbenes isomerize from trans to cis confirmation upon irradiation with the appropriate wavelength of light. This photoisomerization has the ability to activate or inactivate the molecule in response to light if just one of the conformations is bioactive. The power of light responsive chemical signaling systems comes from their ability to achieve exquisite spatial and temporal control, which is of tremendous utility for numerous bioindustrial applications. Applications include targeted treatment of industrial pharmaceuticals, and control of bacterial growth. To this end, we have designed a series of photo switchable molecules based upon the N-acyl homoserine lactones (AHLs), which are signaling molecules used by Gram negative bacteria. We herein outline the synthesis and biological evaluation of these compounds using a Vibrio fischeri modelsystem.

Advantages in the Motility of Peritrichous Bacteria in Mucus-Like Environments
Leah Terrian
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM
Poster: 172
Mentor: Yann Dufour

A bacterium's main goal is to divide and grow the colony. With this colony growth comes a need for the bacteria to find additional resources that are necessary for cell division. Most bacteria find resources by swimming with the rotation of one or more helical filaments called flagella. Making flagella requires energy, energy that could instead be spent dividing the cell. From previous research, it is known that having more than one flagellum does not increase a cell's swimming speed in liquid. Perhaps, having multiple flagella allows for motility that would be advantageous in a different environment. In porous and viscous environments, bacterial motility such as greater torque to untangle itself, or an increased ability to change direction would be more desirable. However, it is unknown whether more flagella produce this result. This project aims to test if a greater number of flagella corresponds to greater bacterial motility in a porous, viscous, environment by controlling the number of flagella produced by a modified strain of Salmonella Enterica LT2 injected into soft agar (mucus-like) swim plates. The number of flagella that are formed is controlled by growing the bacteria in the presence of an inducer. As the inducer concentration increases, the number of flagella produced increases as well. Therefore, if multiple flagella are advantageous for bacterial motility in a porous, viscous, environment, the plates with higher inducer concentrations will exhibit greater colony radii.

Engineering Shewanella oneidensis MR-1 for Diterpenoid Production
Jaclyn Thompson
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM

Poster: 173
Mentor: Bjoern Hamberger, Britta Hamberger

Diterpenoids are a diverse class of natural plant products with useful applications in the pharmaceutical, cosmetic, and bioenergy industries. Despite high demand for these molecules, their production is complicated by the difficulty of accessing diterpenoid-producing plants and the difficulty of chemically synthesizing diterpenoids. Transplanting the biosynthetic pathways responsible for diterpenoid production from plants into organisms easily grown on industrial scales, such as E. coli or S. cerevisiae, has been shown to be a viable means of increasing yields. The pathway responsible for diterpenoid production is the methylerythrophosphate (MEP) pathway. This pathway requires not only carbon inputs in the form of pyruvate and glyceraldehyde-3-phosphate (G3P), but also input of reducing equivalents, such as NADH. This project aims to engineer Shewanella oneidensis strain MR-1 for diterpene production due to its unique ability to conduct extracellular electron transfer (EET). The Mtr pathway, responsible for EET in S. oneidensis, can be reversed, allowing the input of electrons into the cell. By increasing the reducing power available in the cell, it is hypothesized that diterpenoid production will be increased. In order to simplify the engineered diterpene synthesis pathway in S. oneidensis, the gene encoding geranylgeranyl disphosphate (GGPP) synthase will be integrated into the host's genome using mini-Tn7 vectors. GGPP synthase is the enzyme responsible for combining 5C precursors, produced by the MEP pathway, into the 20C GGPP, the starting point for the synthesis of all diterpenoids. The mini-Tn7 vectors utilize the bacterial Tn7 transposon which inserts itself downstream of the highly conserved glms gene, allowing the insertion of GGPP synthase with great site-specificity.

Exploring if a Cytidine deaminase is a Cyclic GMP-AMP Receptor in Vibrio cholerae
Megan Toler
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM
Poster: 174
Mentor: Christopher Waters

El Tor V. cholerae is responsible for the 7th cholerae pandemic impacting the world. A trait acquired by El Tor, encoded on a genomic island, VSP-1, is a signaling system that utilizes the cyclic di-nucleotide, cyclic GMP-AMP (cGAMP). Previous research in the Waters laboratory identified the first protein receptor of cGAMP as a phospholipase also encoded on VSP-1. I am searching for additional protein receptors of cGAMP in V. cholerae. Co-occurrence analysis of bacterial genomes determined that the V. cholerae gene VC0175, a cytidine deaminase enzyme located on VSP-1, is found in genomes that may utilize cGAMP signaling. We hypothesize that VC0175 is a receptor for cGAMP activity. To test this hypothesis, I expressed VC0175 in the presence and absence of cGAMP and measured growth. I determined that in E. coli the growth rate of cells is significantly inhibited when VC0175 and cGAMP are present. Because VC0175 is predicted to convert cytosine to uracil, I speculate that cGAMP and VC0175 cause increased mutation rates inhibiting growth in E. coli cells, which is tested by quantifying mutation rates. Future plans are to introduce VC0175 and cGAMP synthase into V. cholerae cells and conduct replicate experiments. Similar results would suggest that VC0175 is a receptor for cGAMP, which could be further characterized by purifying VC0175 and directly measuring binding of cGAMP in vitro. The results of these studies might identify a new target of cGAMP in bacteria, leading to a better

understanding of chemical signaling in V. cholerae and other bacterial species.

Arbuscular Mycorrhizal Fungi Identification
Ethan Woodruff
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM
Poster: 175
Mentor: Pedro Beschoren da Costa

A microbiome is an array of microorganisms that share an environment. These microbiomes can form symbiotic relationships that positively impact plant growth and health. Having an agricultural management practice in which the microbiome supports plant growth is a key goal for GLBRC to sustainably increase switchgrass productivity, thus these microbes can be applied for cellulose production. Arbuscular mycorrhizal fungi (AMF), which are located within the roots of plants, cannot be cultured in standard media but have key roles in plant health and development as part of the microbiome of plants. Specialized methods must be applied to explore this group of microorganisms which will be applied in this project, filling a knowledge gap and providing high-quality research materials for future studies. AMF spores will be collected through wet sieving, then suspended in a sucrose solution, centrifuged, and separated into individual spore types according to sizes and colors. The isolated spore types are then identified by PCR and Sanger Sequencing. Finally, identified spore types will be re-introduced to sterilized seedlings and kept in gnotobiotic conditions. Plant growth will be recorded, and spores will be reisolated from grown plants to validate the methodology of multiplication and storing AMF species.

Converting Artificial Substrates with Bacterial Terpene Synthases
Vang Yang
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM
Poster: 176
Mentor: Bjoern Hamberger

Terpenes have been used throughout history for many different purposes ranging from cosmetics, foods, and medicines. Diterpenes are a subset of these metabolites and are made up of a 20-carbon backbone from the substrate geranylgeranyl pyrophosphate (GGPP). Among diterpene molecules, there is a wide array of diverse chemical structures, leading to their use in numerous applications. Naturally occurring terpenes are not produced in significant quantity for massive commercial use and chemically synthesized diterpenes are expensive to manufacture. For the purpose of this research we are testing four bacterial diterpene synthases with an artificially modified GGPP substrate. Four terpene synthases (TPS) of interest were cloned into E. coli, then proteins were expressed and purified. These TPS have been seen to convert GGPP substrate into various diterpene molecules. Since the artificially modified substrate have similar carbon configuration to GGPP, this study could create completely novel diterpenes with the potential to improve pharmaceutical development, antimicrobial application and bettering the flavor/fragrance industry.

Dose-Dependent Effects of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) on Acetyl-CoA Metabolism
Nic Zacharewski
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM
Poster: 177
Mentor: Kelly Fader, Rance Nault

Acetyl-CoA is a two-carbon metabolite that plays a central role in carbohydrate, lipid, and protein metabolism. Its primary function is to deliver an acetyl group into the Krebs cycle leading to further oxidation and production of adenosine triphosphate (ATP). 2, 3, 7, 8- Tetrachlorodibenzo-p-dioxin (TCDD), a persistent environmental contaminant, has been shown to cause the development and progression of steatosis to steatohepatitis in mice resembling human non-alcoholic fatty liver disease (NAFLD). TCDD activates the aryl hydrocarbon receptor (AHR), a transcription factor responsible for regulating gene expression. TCDD has been reported to cause central carbon metabolism reprogramming in mice, however the effects on acetyl-CoA metabolism have not been fully investigated. In this study, C57BL/6 male mice were orally gavaged every 4 days for 28 days with sesame oil vehicle control or 0.01, 0.03, 0.1, 0.3, 1, 3, 10, and 30 mg/kg TCDD. Hepatic acetyl-CoA levels and gene expression were examined using untargeted liquid chromatography tandem mass spectrometry and RNA-Seq analysis, respectively. At 3, 10, and 30 mg/kg TCDD, hepatic acetyl-CoA levels decreased 1.9-, 28.5-, and 6.4-fold, respectively. TCDD also repressed Acacb(2.3-fold), Acly(4.29-fold), and Acss2(8.8-fold) at 30mg/kg. Decreased protein levels of ACACα/β, ACLY and ACSS2 were confirmed using the WES ProteinSimple System, suggesting sources (e.g. citrate and acetate) and utilization (e.g. fatty acid biosynthesis) of acetyl-CoA were repressed. Further studies will examine the significance of acetyl-CoA depletion in the progression of steatosis to steatohepatitis.

Separating human blood plasma constituents through the Coffee Ring Effect: A dilutions-based method
Najya Zaman
Category & Time: Biochemistry & Molecular Biology, Section 7, 1:00 PM - 2:15 PM
Poster: 178
Mentor: Rebecca Lahr

Despite the prevalence of colorectal cancer (CRC), it being the third most common cancer among men and second among women, clinical CRC detection procedures have not been optimized to reduce patient mortality (WHO). The gold standard of CRC detection is colonoscopy, combined with stool-based tests. However, these tests are either highly invasive (colonoscopy) or suffer from cumbersome procedures patients neglect following (fecal occult blood testing). Blood plasma holds diagnostic promise in CRC detection for its accessibility and ability to reveal cancerous biochemical markers. In this work, we are harnessing the phenomenon called the coffee-ring effect to separate the constituents of blood plasma as a diagnostic tool for cancer. A lab technique called drop-coat deposition Raman (DCDR) is then implemented to identify blood plasma components. However, human blood plasma has roughly a total solute concentration eleven times higher and a total protein concentration nineteen times higher than other biofluids previously studied with DCDR. High solute concentrations prevent the formation of distinct, concentric rings of separated solutes as observed in human tear and knee joint fluid studies. Therefore, experiments are underway to determine if dilutions of human blood plasma before DCDR

improve the nanochromatographic separation of plasma components. Specifically, dilutions at one-half to one-nineteenth the concentration of the original plasma have been analyzed using DCDR. The goals of this work are to identify the ideal solute concentration range for which the coffee-ring effect provides nanochromatographic separation of biomolecules, and identify how plasma dilutions can be optimized for clinical use.

Bulk Segregant Analysis of Quantitative Trait Loci Pertaining to Seed Coat Color in Eragrostis tef
Joseph Baczkowski
Category & Time: Cell Biology, Genetics & Genomics, Section 1, 1:00 PM - 2:15 PM
Poster: 182
Mentor: Robert VanBuren, Ching Man Wai

Teff is an annual cereal akin to wheat, that is native to Africa, and is a staple crop in Ethiopia. Due to the rising demand for gluten-free foods, research on teff has become increasingly important. Teff plants can produce seeds of various colors ranging from white to deep red and brown. We used a bulk segregant analysis to identify quantitative trait loci (QTL) controlling seed color in teff. Three different teff cultivars with segregation of white and brown seeds were used in this study. For each line, we sequenced DNA collected separately from bulks of teff plants germinated from white and brown seeds, returning at least 40X genome coverage. Based on the QTL analysis, we identified two main peaks controlling seed color in teff corresponding to two genes related to the production of chalcone synthase. In arabidopsis, chalcone synthase is involved in the upstream pathway of anthocyanin biosynthesis, which in turn produces pigment compounds. The inclusion of these pigments in teff suggest a reasoning behind the range of colors expressed by the species. Subsequent seed color segregation of the teff will be observed in planta to validate the role of these two candidate genes on controlling teff seed coat color. Using the information collected, markers can be developed to increase specificity in breeding traits, such as seed color, in more desirable lines of teff.

Functional analysis of endothelin ligand genes in the zebrafish neural crest cell population
Cameron Bennett
Category & Time: Cell Biology, Genetics & Genomics, Section 1, 1:00 PM - 2:15 PM
Poster: 183
Mentor: Ingo Braasch

Neural crest cells (NCC) are an embryonic cell population that differentiates into many derivatives including heart, vascular, pigment, neuronal, and craniofacial bone structures. Unique to vertebrate animals like fish and humans, the neural crest forms along the dorsal neural tube before migrating throughout the body. The endothelin (Edn) signaling system is a key molecular regulator in cell fate determination, migration, and differentiation into the different NCC derivatives. Endothelin ligands and their respective receptors make up the core of the endothelin system. Vertebrate genomes contain multiple Edn ligand and receptor genes as results of multiple rounds of whole genome duplication. Our objective is to better understand the function of several Edn ligands, focusing here on the Edn4 ligand, within the endothelin system of the zebrafish, Danio rerio. We are using zebrafish because they are established biomedical model organisms with transparent embryos that allow visualization of gene

expression and function during development. The CRISPR-Cas9 genome editing system will be used to knock out edn2a and edn2b genes in established edn4 mutant zebrafish to create triple mutants. We compare endothelin ligand mutant fish to wildtype individuals and expect major phenotypic differences between wildtype zebrafish and fish with multiple endothelin ligand knockouts. The findings of this study will enhance our understanding of the functions of the endothelin ligand gene family and provide insight into cases of duplicate gene function evolution after genome duplication.

AVE 0991, A NON-PEPTIDE ANALOGUE OF ANGIOTENSIN-1-7, STIMULATES ENTEROCYTE MIGRATION
Wesley Bird
Category & Time: Cell Biology, Genetics & Genomics, Section 1, 1:00 PM - 2:15 PM
Poster: 184
Mentor: Mark Kadrofske, Elizabeth Moore, Elahe Crockett-Torabi

Introduction: Damage to the intestinal mucosa is followed by enterocyte migration, which helps with repair to the mucosa and restoring gut barrier integrity. The Angiotensin1-(1-7)/MAS branch of the renin-angiotensin system (RAS) has anti-inflammatory properties, which may promote mucosal growth and healing in the intestine. Data from our laboratory provides evidence that Ang-(1-7) stimulates repair in mouse models of intestinal injury. AVE 0991 is a non-peptide analogue of Ang-(1-7), that is specific to the MAS receptor. We speculate that AVE 0991 will have similar effects to Ang 1-7 on intestinal wound healing. Hypothesis: AVE 0991 stimulates enterocyte migration that is mediated through the MAS receptor. Methods/Results: CaCo-2 cells (enterocyte like cells, derived from human colorectal adenocarcinoma) were used. The CaCo-2 cells were passaged and cultured under standard conditions (Complete Growth Medium (CGM) = 10% Fetal Bovine Serum, 90% Eagle's Minimum Essential Medium, 5% CO2, 37°C). Once the cells reach confluence, the CGM is replaced with Serum-Free Medium (SFM) for 24 hours. Cells were treated with various concentrations of AVE 0991 (1fM-1uM). Images were obtained using a phase contrast microscope and NIH Image J software was used for measurements and statistical analysis. Conclusion: We anticipate that AVE 0991 treatment will increase enterocyte migration in the intestinal mucosa layer, which could provide a therapeutic means for the repair of gut mucosa. Support: W.B. is a REPID scholar, supported by NIH-5—R25-HL108864 award to Elahé Crocket.

Genomic Prediction of Traits Using Convolutional Neural Networks
Emily Bolger
Category & Time: Cell Biology, Genetics & Genomics, Section 1, 1:00 PM - 2:15 PM
Poster: 185
Mentor: Shinhan Shiu

Genomic Prediction (GP) is the process of using genetic markers to predict complex traits. This process can accelerate the breeding cycle of crops and animals and if we interpret these models we can identify markers important for each trait. Many models have been used for GP; including linear models like ridge regression Best Linear Unbiased Prediction (rrBLUP) and various Bayesian models as well as nonlinear models such as decision tree based algorithms and Artificial Neural Networks (ANNs). The nonlinear models more accurately capture effects like epistasis and dominance which are important for predicting complex traits. With recent improvements in the field of deep learning, there has been interest in using

these methods for GP. In this project, we use a deep learning method called Convolutional Neural Networks (CNNs) to predict the trait values of 18 different traits across 6 different species. CNNs are typically used for image classification due to their ability to identify complex spatial patterns. When used for GP, we hypothesize CNNs will identify complex genetic signatures associated with traits. To test this hypothesis we will compare the performance of our CNN models to the performance of other established methods such as rrBLUP and ANNs.

Telomerase Assembly, RNA, and Protein
Semika Burnette
Category & Time: Cell Biology, Genetics & Genomics, Section 1, 1:00 PM - 2:15 PM
Poster: 186
Mentor: Jens Schmidt

Telomerase activity is crucial for tumor survival. Telomerase is a ribonucleoprotein enzyme, containing the protein TERT and the RNA TR, which synthesize telomeric DNA and are responsible for length maintenance of telomeres. In 90% of cancers, telomere is active, and this allows cells to replicate indefinitely, leading to tumor formation. Despite the impacts of telomerase activity on human health, little is known about how telomerase is assembled, and specifically, where and how the TR binds to TERT at the time of telomere assembly. To address this gap in knowledge and closely monitor the assembly of telomerase to facilitate telomere synthesis, we will use CRISPR-cas9 mediated genome editing and super-resolution Microscopy. Findings from this research will contribute to the growing body of work aimed at developing telomerase-based diagnostic tools and anticancer therapies.

Examining the role of NHERF-2 in iNKT cell development and function
Melissa Bush
Category & Time: Cell Biology, Genetics & Genomics, Section 1, 1:00 PM - 2:15 PM
Poster: 187
Mentor: Rupali Das, Anant Kamala

Introduction: NHERF (Na+/H+ Exchanger Regulatory Factor) 1 and 2 belong to the PDZ protein family with important roles in immune cell functions and cancer progression. Although it is known that chemokine receptors regulate the development, tissue distribution and functions of invariant natural killer T cells [(iNKTs), innate T lymphocytes that recognize glycolipid antigens (aGC)], the mechanisms remain undefined. Our recent studies using Nherf1−/− mice demonstrate that NHERF-1 is a negative regulator of iNKT cell functions. However, the role NHERF-2 in INKT cell development and function remains unknown. Hypothesis: Given NHERF2 regulates the functions of chemokine receptors and is abundantly expressed in the livers (organ with high iNKT cell incidence), we hypothesized that NHERF2 regulates iNKT cell development and functions. Methods: Using CRISPR technology, we have recently generated a Nherf2−/− mice. To examine the role of NHERF2 in iNKT cell development, thymus, spleen and livers of wildtype C57BL/6 (B6) and Nherf2−/− mice will be harvested and analyzed iNKT cell incidence and absolute numbers by flow cytometry. Additionally, we will flow-sort purify iNKT cells from the livers of B6 and Nherf2−/− mice and examine their cytokine production in vitro by ELISA. Results and Conclusion: We confirmed the gene deletion of Nherf2 by polymerase chain reaction (PCR) and gel

electrophoresis. Studies are underway to gain mechanistic insights into how NHERF1 functions can be modulated to enhance iNKT cell anti-tumor responses. Support: Melissa Bush is a REPID-scholar, supported by NIH-5-R25-HL108864 award to Elahe Crockett, and NIH-K22-5K22CA18814902 Award to Rupali Das.

A computational approach to identify unique pathogenic miRNA signatures in domestic and wild hosts
Philip Calhoun
Category & Time: Cell Biology, Genetics & Genomics, Section 2, 1:00 PM - 2:15 PM
Poster: 188
Mentor: Janani Ravi

Early diagnosis of many agriculturally relevant zoonotic diseases has always been problematic since the hosts often remain asymptomatic (not displaying clinical symptoms) until it's too late, resulting in late diagnoses post-slaughter. The second main problem has been with achieving an accurate and sensitive diagnosis confounded by closely-related and environmental bacteria. We, therefore, focus on developing a computational workflow to identify biomarker targets unique to the pathogen of interest, that can be detected in a wide range of host species. microRNA (miRNA) is a class of non-coding RNA that is critical for gene regulation in immunological and developmental contexts in many organisms. When a pathogen infects a host, changes occur in miRNA expression and it becomes possible to detect bacterial miRNA alongside host noncoding RNA in the host sera. Although intra- and extra-cellular miRNA have been used extensively in cancer detection, very few studies have addressed miRNA as a diagnostic target for the detection of pathogens in the host. Here, we propose to use computational approaches to detect pathogenic miRNA in host samples. We will use the miRNA databases and literature surveys to cross-reference the genomes and help us discern uniquely bacterial miRNA isolated from infected host samples. Additionally, we will use de novo approaches to predict miRNA unique to the pathogen of interest. Taken together, our approach will help us identify miRNA signatures unique to pathogens and help with bacteremia in host species.

Characterization of Morphine-Regulated Neuropeptides in the Ventral Tegmental Area
Nicole Marie Camacho Fontánez
Category & Time: Cell Biology, Genetics & Genomics, Section 2, 1:00 PM - 2:15 PM
Poster: 189
Mentor: Michelle Mazei-Robison

Morphine is an opiate drug commonly administered as treatment for chronic pain despite its addictive properties. Chronic morphine exposure induces synaptic, genetic and structural neuroadaptations in the ventral tegmental area (VTA) mesocorticolimbic reward circuit, where dysregulation of dopaminergic (DA) neurons may contribute to drug-related behavior. Gene expression analysis following morphine administration using translating ribosome affinity purification found increased expression of neuromedin S (NMS) and glucagon (GCG) in VTA DA neurons. These neuropeptides were initially characterized in the suprachiasmatic nucleus and the lower brainstem, respectively, where NMS is involved in regulation of the circadian rhythm and GCG regulates glucose homeostasis. Increased expression of these neuropeptides by VTA DA neurons following drug exposure implies a novel

physiological significance. The goal of this project is to determine the subset of VTA DA neurons that express NMS and GCG in order to understand how activation of these novel DA neuron populations affect drug behavior. The number of GCG and NMS expressing DA neurons will be quantified using immunohistochemistry for EYFP and tyrosine hydroxylase (TH) following injection of a Cre-dependent viral vector into the VTA of NMS- and GCG-Cre mice. Immunohistochemistry for EGFP and TH will also allow identification of GCG and NMS terminal expression in VTA projection areas, providing insight on the subset of VTA DA neurons that express each neuropeptide. Additionally, NMS-Cre and GCG-Cre mice will be crossed with Rosa26-L10-EGFP to label all cells that express NMS or GCG in the brain with EGFP, allowing verification of neuropeptide expression in previously described areas.

ADAP controls iNKT cell peripheral maintenance by regulating proliferation and apoptosis.
Kenya Daniels
Category & Time: Cell Biology, Genetics & Genomics, Section 2, 1:00 PM - 2:15 PM
Poster: 190
Mentor: Rupali Das, Devika Bahal, Elahe Crockett-Torabi

Introduction: Invariant natural-killer T (iNKT) cells are innate T-lymphocytes that play pivotal role in modulating immune response in cancer, infection and inflammation. However, the mechanisms that regulate iNKT-cell development and functions aren't fully known. Our previous studies established a critical role for SAP (SLAM-associated protein) and tyrosine kinase Fyn in iNKT-cell development. Hypothesis: ADAP (adhesion and degranulation promoting adaptor protein) is a known binding partner of Fyn, we hypothesized ADAP regulates iNKT-cell development. However, we found that ADAP is dispensable for iNKT-cell development but required for homeostatic maintenance of iNKT-cells in peripheral organs such as the liver. Methods: To investigate the role of ADAP in peripheral maintenance, we used C57BL/6 (B6) and ADAP-deficient (Adap−/−) mice. Using flow cytometry, we examined the expression of surface receptors (CXCR6, CD122, and CD127) as well as intracellular proteins (BcL-2 and BcL-xL) that are known to promote iNKT-cell homing to the periphery and/or promote survival. We also examined for iNKT cell proliferation and apoptosis in vivo by incorporation of BrDU and annexin staining respectively. Results and Conclusion: We observed both B6- and Adap−/−mice express comparable levels of CXCR6, CD127, CD122, Bcl-2 and Bcl-xL. Strikingly, iNKT cells from the livers of Adap−/−mice exhibit significantly reduced BrDU incorporation but increased annexin staining in comparison to those from B6mice. Conclusion: Collectively, these results suggest ADAP regulates iNKT-cell peripheral maintenance by modulating their proliferation and apoptosis. Support: K.D. is a REPID-scholar, supported by NIH-5-R25-HL108864 award to E.C, and NIH-R01-5K22CA18814902 Award to R.D.

Annual Killifish Hatching Enzymes and Candidate Genes for Teleost Diapause
Myles Davoll
Category & Time: Cell Biology, Genetics & Genomics, Section 2, 1:00 PM - 2:15 PM
Poster: 191
Mentor: Ingo Braasch, Andrew Thompson

Hatching from the egg is an essential process in animals that differs between various vertebrate groups as it can occur internally or externally during different stages of embryonic development. In teleost fish

species, two enzymes referred to as high choriolytic and low choriolytic enzymes promote embryonic hatching. Every species has its own hatching process, and we are examining one of the more unique processes in an annual killifish, the Rio Pearlfish, (Nematolebias whitei), due to their easiness to control and maintain in the laboratory. This species has the ability to undergo three distinct embryonic diapause stages in response to a stressful environment that is unfavorable for maturation. Diapause is a form of embryonic dormancy involving intentional delayed development and metabolism depression. Annual killifish use diapause to survive dry seasons until annual rains form temporary bodies of water where N. whitei hatches and carries out their lifespan. Using the genomes of Japanese medaka, Oryzias latipes, and Turquoise killifish, Nothobranchius furzeri, as models to identify diapause gene expression of low and high choriolytic enzymes, we compared these to N. whitei and determined possible gene locations, number of gene copies, phylogenetic relationships, and eventually gene expression. We can compare this knowledge of hatching enzymes to other vertebrate species to study their development under different environmental conditions.

ROLE OF BONE MARROW-DERIVED CELLS IN DIABETIC RETINOPATHY PATHOLOGY
Kandis Fox
Category & Time: Cell Biology, Genetics & Genomics, Section 2, 1:00 PM - 2:15 PM
Poster: 192
Mentor: Julia Busik

Introduction: Diabetic retinopathy (DR) is a microvascular complication considered as the number one cause of blindness among adults. Diabetes-induced dysfunction of bone marrow (BM)-derived progenitor cells plays a central role in DR development. Previous studies revealed that BM-derived progenitor cells fail to migrate into the retina to stimulate vascular repair in diabetes. Objective: To investigate whether Fenofibrate, a lipid lowering agent would normalize the reparative functions of BM-derived progenitor cells in diabetic conditions. Methods: Mice tibias and femurs were flushed and cell suspension was collected. The erythrocytes were removed, and a negative selection using magnetic beads was used to isolate hematopoietic stem/progenitor cells from mouse BM. To mimic diabetic conditions, cells were incubated overnight with control and diabetic human serum and treated with or without fenofibrate. Cells were tagged with a fluorescent dye, Calcein-AM and the migration set-up was incubated at 37°C in humidified air with 5% CO2 for 4-hours. To determine the number of migrated cells, fluorescence emitted at 515 nm was measured using a microplate reader. Results: Data is currently in progress and will be discussed at the conference. Conclusion: The data will support further studies to investigate potential use of Fenofibrate as novel strategy targeting normalization of the pro-inflammatory and reparative functions of BM-derived cells in diabetes. Support: K.F, a REPID scholar, supported by NIH-5-R25-HL108864 award to E.C., and NIH/NEI-R01-EY025383 award to JVB.

Diabetes Induced increase in Acid Sphingomyelinase activity and mitochondrial Ceramide leads to changes in Mitochondrial Function in Retinal Endothelial Cells.
Travan Gentles
Category & Time: Cell Biology, Genetics & Genomics, Section 2, 1:00 PM - 2:15 PM
Poster: 193
Mentor: Julia Busik, Elahe Crockett-Torabi, Denis Proshlyakov, Yan Levitsky, Kiera Fisher

Introduction: Diabetic retinopathy (DR), the most common complication of diabetes, is the leading cause of blindness among working-age adults. DR is ultimately a vascular disorder, caused by chronic hyperglycemia, dyslipidemia, and inflammation. Diabetes induces acid sphingomyelinase (ASM) activity, promoting ceramide generation which is a potent pro-apoptotic lipid. Recent reports suggest that ceramide causes mitochondrial dysfunction leading to cell death, however, the role of ASM in mitochondrial ceramide (mCer) generation is unknown. Methods: Mitochondria from rodent retina, human- and bovine retinal endothelial cell (REC) culture were isolated using centrifugation and a magnetically assisted cell sorting kit (MACS). Mitochondrial purity was assessed using western blots and sphingolipids were measured by mass spectrometry (MS). Bovine REC (BREC) were cultured on microrespirometer chips and mitochondrial function was examined using microrespirometry. Results: Diabetes leads to increased mitochondrial short-chain ceramides whereas knock out of ASM gene leads to decreased mitochondrial ceramide compared to control. Western blot analysis showed that lysosomal depletion was superior using MACS kit compared to centrifugation. BREC microrespirometry showed that no loss of cellular respiration following six continuous hours of media flow. Inhibition of ASM did not affect basal respiration but increased the maximal respiratory capacity in BRECs. Conclusion: The study shows that diabetes-induced ASM activation leads to mCer accumulation and changes to mitochondrial function. Support: T.G. is a REPID scholar, supported by NIH-5-R25-HL108864 award to E.C., and NIH/NEI-R01-EY028049 Award to DAP and JVB.

Does XEN Cell Epigenetic Memory Influence Reprogramming Outcomes?
Victor Gipson II
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 194
Mentor: Amy Ralston

Pluripotent stem cells have the potential to be utilized for a variety of biomedical applications. In 2006, Takahashi and Yamanaka published a paper that detailed their success in deriving pluripotent stem cells from a non-embryonic source. Although this discovery was monumental, the production efficiency of induced pluripotent stem cells (iPS cells) was low. In 2016, Parenti, from the Ralston lab, discovered that the ratio of iPS cells to extraembryonic endoderm cells (iXEN cells) is one to three. The iXEN cells are multipotent, so they cannot become all of the cells in the body. The goal is to find out why some cells become iPS cells and some others become iXEN. Discovering the reason why this happens will inform us more about what controls cell fate during development or reprogramming. Our hypothesis is that epigenetic memory can influence reprogramming outcomes. To test this, we will derive XEN cell lines from mice with the rtTa Tet-on OSKM gene which makes the reprogramming factors inducible through doxycycline treatment. After inducing the OSKM reprogramming factors, we will use immunofluorescence and qPCR analyses to determine if XEN cells are primed to become iXEN cells due to epigenetic memory. If our hypothesis is correct, only iXEN cells will be reprogrammed from the XEN

cell lines. If this does not happen, epigenetic memory does not influence reprogramming outcomes. Understanding the role of epigenetic memory will help better understand cell fate determination.

Determining the ability of bacterial codominance of Burkholderia thailandensis and Staphylococcus aureus in varying nutrient media and its consequenting growth.
Hannah Grindling, Zaria Contejean
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 195
Mentor: Poorna Viswanathan

Cystic Fibrosis (CF) is a genetic disease that causes the production of thick mucus in the lungs. This mucus allows many bacteria to easily colonize the lungs leading to infection. CF patients are susceptible to a wide variety of opportunistic pathogens, and many of these strains are antibiotic resistant. Over time infection typically becomes polymicrobial, in which there is an initial infection that increases susceptibility and allows for multiple subsequent infections. Staphylococcus aureus typically colonizes first and over time the lungs can be infected with Burkholderia pseudomallei, Pseudomonas aeruginosa, Haemophilus influenzae and other pathogens. This study focuses on the interactions between S. aureus and B. thailandensis in water, a nutrient rich media (LB), and a nutrient poor media (M9), to understand how they grow and interact based on nutrient availability. This was quantified via flow cytometry using viability stains to measure live and dead cells as well as a viable cell count on differential media to confirm the results. Overall it was found that when any nutrients are available, regardless of amount, the bacteria are able to coexist. However, in starvation conditions B. thailandensis will inhibit the growth of S. aureus and will become the dominant infection.

Identifying Links between Complex Traits and Tissues in the Human Body based on Text and Genetic Data
Abdullah Hashsham
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 196
Mentor: Arjun Krishnan

Understanding gene networks and how they relate to complex diseases and traits is crucial to properly treating and understanding those diseases. A complex disease has multiple genes related to it with those genes being found in relation to each other, which is known as a gene network. Using statistical software, such as R and Python, analyses and tests can be run on big data from various sources to determine these correlations. One such source, known as the UK Biobank, comprises of data ranging from fully sequenced genomes to an array of phenotype data of over 500,000 individuals. Using this data, we can map the phenotypes to specific tissues in the human body via a text based approach. Although we are unsure of what this text based approach will find, we hope to be able to construct a confident method of matching phenotypes to types of tissue, which will allow us to answer previous questions regarding tissue dependence. One limitation of this is that the UK Biobank phenotype descriptions are loose and difficult to work with, which will require standardization using controlled vocabulary via ontologies. These loose definitions are also an obstacle to standardizing, and requires

manual effort on top of any simple text tagging program that it is run through or revision of the program itself.

Increasing Mixed-Linkage Glucan in Sorghum and Arabidopsis Plants Using a Two-Fold Approach
Sarah Herring
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 197
Mentor: Sang-Jin Kim, Starla Zemelis-Durfee

Mixed-linkage glucan (MLG) is a polysaccharide mainly present in the cell wall of grasses. This hemicellulose holds great value for the biofuel industry due to its simple composition and structure. Therefore, engineering energy plants such as Sorghum with high levels of MLG is a strategy to improve biofuel feedstock. To achieve this goal, we have set up two approaches. The first project focuses on increasing MLG in Arabidopsis plants lacking xyloglucan. Xyloglucan one of the most abundant hemicelluloses in Arabidopsis, which has a high content of pentose. We want to introduce MLG to replace xyloglucan, expecting to increase the hexose/pentose ratio in the cell wall as hexose is more desirable for downstream application. We have created constructs using the xyloglucan promoter to express MLG synthases tagged with fluorescent protein (YFP). These constructs will be transformed into the mutant lacing all xyloglucan backbone synthases as well as Arabidopsis wild-type plant (as a control). The resulting transgenic plants will be analyzed for cell wall composition such as xyloglucan and MLG with assessment of plant biomass. The second project focuses on two MLG synthases that produce different physical properties of MLG. The research goal is to identify an optimal MLG synthase to overproduce MLG in sorghum. Overexpression of BdCLSF6 in Brachypodium has been reported to achieve high levels of MLG, but negatively impacts plant growth. We want to test if MLG synthases from other species would accumulate high levels of MLG without negative impacts. Using Sorghum plants overexpressing Brachypodium BdCLSF6 and Sorghum CSLF6, and we will analyze MLG accumulation, plant development, biomass to identify the most optimal MLG synthase. In the future, we want to translate the information from both projects to achieve a plant with optimal MLG expression, least impact on biomass, and best downstream convertibility.

SLAMF7 Promotion of T Cell Exhaustion In Vitro
Sean Hyslop
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 198
Mentor: Yasser Aldhamen

The signaling molecule SLAMF7 plays an important functional role in regulation of multiple immune cell subsets, and has been shown to be upregulated in diseases characterized by chronic immune activation. Previous research has indicated that blockade of SLAMF7 signaling may be of therapeutic use in stimulating the immune system as a vaccine adjuvant and as a cancer therapy. However, the mechanisms behind these finding are ill-defined. Using high-dimensional single cell spectral cytometry, we investigated the phenotypic effects of chronic SLAMF7 signaling in human T lymphocytes. Compared to controls, SLAMF7-stimulated cells expressed higher levels of checkpoint inhibitors and exhaustion

markers such as TIM-3, LAG-3, and PD-1. Targeting of these molecules in cancer has led to breakthroughs in treatment, thus, understanding possible mechanisms which may regulate these markers, such as SLAMF7, is of the utmost importance in furthering current immunotherapies.

Prediction of gene expression under environmental stresses in Oryza sativa
Ketan Jog
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 199
Mentor: Shinhan Shiu

Plants respond to environmental stresses in diverse ways. This diversity allows some plants to thrive and others to decline in different environments and is largely driven by species-specific differences in complex gene expression regulatory networks. Although expression data is vastly present for model plant organisms, similar repositories for plants with practical relevance are lacking. Transcription factor binding motifs (TFBMs) tell us which transcription factors can bind to it and subsequently regulate gene expression. Few of these TFBMs are known. These binding sites are found around the promoter and terminator regions of each gene. Since these spatially local sequences are relevant to predicting expression in genes, we use attention mechanisms in conjunction with convolutional neural networks to build our prediction model. We leverage existing data from the model organism A. thaliana using transfer learning to build a prediction model for gene expression under stress (e.g. cold, drought, saline) in O. sativa. The convolution layer identifies regulatory motifs as features while the attention mechanism identifies combinatorial relationships and dependencies between these motifs to improve predictions. We observe an improved performance in prediction of gene expression in O Sativa, after transferring to it the binding motif information from A. thaliana. We perform a comparative study of the motifs generated by the model with a library of existing TFBMs responsible for gene expression.

Differential Gene Expression Between Leaf and Root Tissue in Desiccation Tolerant Craterostigma Plantagineum
Michael Kalinowski
Category & Time: Cell Biology, Genetics & Genomics, Section 3, 1:00 PM - 2:15 PM
Poster: 200
Mentor: Robert VanBuren, Ching Man Wai

Craterostigma plantegineum is a desiccation tolerant 'resurrection plant' native to South Africa, with the ability to survive near complete dehydration for months or years of prolonged drought. The dormant C. plantegineum can resume normal functions within hours of rehydration. We sought to understand of the genetic basis of this intriguing trait. We surveyed gene expression changes in root and leaf tissue throughout the dehydration and rehydration process, effectively gathering 'snapshots' of expression as the plant was coping with lack of water. The mRNA samples were sequenced using RNAseq, and the resulting data files were processed and expression was quantified against the draft C. plantegineum genome. After pseudoaligning the reads, we analyzed the data, quantifying the expression of the genes at different time points. Through comparing expression dynamics of C. plantegineum to similar experiments from other resurrection plants, we identified particular genes that are differentially

expressed in order to protect internal cellular structures from the harmful effects of dehydration. In the future, we hope to gather more information on chromatin dynamics and gene co-expression networks in resurrection plants, and how gene duplications serve the evolution of this extreme trait.

Effects of Early Life Adversity on Mast Cells: Potential Mechanism Underlying Adult Sensitivity to Stress
Sonia Khalid
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 201
Mentor: Natalia Duque-Wilckens, Alfred Robison

Early life adversity (ELA) is linked to an increased susceptibility to adulthood major depressive disorder (MDD), one of the most common and debilitating psychiatric diseases and for which available treatments are largely ineffective. Inflammation in the brain is a key mechanism underlying the pathophysiology of MDD, and studies across species suggest that ELA increases vulnerability to depression by priming the immune system for an amplified and more persistent inflammatory response to environmental stressors. However, the cellular and molecular mechanisms of this long-lasting effect are not fully understood. Mast cells (MCs), the effector cells of the innate immune system, are an ideal candidate to fill this role: first, they are distributed throughout the body, including the brain and meninges, and are highly activated in response to psychological stress. Second, they can release a variety of mediators responsible for initiating, amplifying, and prolonging inflammation; and third, they can disrupt blood-brain barrier integrity, allowing peripheral proinflammatory substances to enter the brain. Using a mouse model consisting of neonatal maternal separation (NMS) combined with early weaning, here we investigate whether exposure to ELA affects a) susceptibility to adult stress and b) MCs number, distribution, and level of activation in the meninges, location at which MCs are most abundant within the central nervous system. Preliminary data suggest that exposure to ELA renders females but not males more susceptible to develop anhedonia in response to adult stress as measured by the sucrose preference test, and that meningeal MCs are more active in ELA females compared to control females. This suggests that ELA may have sex-specific, long-lasting impact on meningeal MCs, and that this may be associated to susceptibility to developing depressive-like phenotypes during adulthood. Future studies will use pharmacological and genetic tools to further explore these hypotheses.

Effect of Dietary Flavonoids on Tumor Growth and Metastasis in Human Triple Negative Breast Cancer
Jessica Kim
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 202
Mentor: Andrea Doseff, Michael Ramirez Parra, Meenakshi Sudhakaran

Introduction: Breast cancer (BC) remains the second leading cause of cancer-related mortality in women. Triple-negative BC (TNBC), characterized by its aggressive and heterogeneous nature, is associated with poor survival and lack of effective therapeutics. Therefore, identifying effective novel therapies is critical. Flavonoids are plant polyphenols that are emerging as potential candidates for

targeting tumor owing to its antioxidative, anti-inflammatory, anti-mutagenic and anti-carcinogenic properties. Objective: Our goal was to evaluate the structure-activity relationship and the mechanism by which flavonoids impact on TNBC tumor growth and metastasis. Methods/Results: The effect on migration of structurally different flavonoids was investigated in wound healing migration assays using human MDA-MB-231 TNBC cells. We found that apigenin and kaempferol inhibited migration in a dose responsive manner. In high contrast, glucosides and flavanones had no effect suggesting the presence of sugars and lack of double bonds within the flavonoid structure can affect their anti-metastatic activity. To understand anti-cancer activity of flavonoids and to replicate an in vivo tumor heterogeneity, we will test the effects of flavonoids on patient derived tumors. For this purpose, we have developed 3-dimensional culture organoids from TNBC patient-derived xenograft to estimate its effect on organoid cell viability. Conclusion: Together, these findings will contribute to understanding the roles of flavonoids in clinical applications for TNBC prevention and treatment. Support: J.K. is a REPID scholar, supported by NIH-5-R25-HL108864 awarded to E.C., USDA-AFRI-2018-03994, NSF-IOS-1733633 and MSU general funds to A.I.D.

Trends in DNA Methylation Context of Gene Duplicates
Marshall Ledford
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 203
Mentor: Chad Niederhuth

As a major source of genetic diversity, gene duplication events have had a large impact on the adaptive evolution of all plant species. Thus, selective retention, alteration, and maintenance of these duplicate genes has been vital to their role in evolution. DNA methylation, a process necessary in regulating gene expression levels, is one way in which these duplicates and their effects can be managed. DNA methylation can occur in a variety of contextual patterns within the genome, each directed by different molecular pathways and ultimately having a unique effect on expression of the genes they associate with. Preliminary evidence suggests over-representation of silencing (non-CG contexts) in small-scale duplications (tandem duplication, transposition, etc), and under-representation of silencing in duplicates resulting from large scale, whole genome duplication events (unmethylated and CG gene-body methylated contexts). By comparing genomic and epigenomic data across diverse flowering plant species, we aim to better understand this relationship between DNA methylation context and gene duplication while further exploring why genes are targeted for silencing.

Genetic factors regulating the infection process and virulence of C. acutatum on blueberry fruits and other important small fruit crops
Vicki Meraz
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 204
Mentor: Marivi Colle, Timothy Miles

Anthracnose fruit rot caused by the fungal pathogen Colletotrichum acutatum is a major constraint in blueberry (Vaccinium corymbosum) production. C. acutatum infects blueberry through adhesion of

conidia on fruit surface, germination and production of germ tubes, appressoria formation, and penetration of the fruit cuticle. Previous studies have indicated that the colonization and infection strategy of C. acutatum in blueberry fruit tissue varies in an incompatible and compatible infections. However, genetic components underlying these infection strategies have not been investigated. In this study, we leveraged existing phenotypic and transcriptomic data collected from anthracnose-resistant and susceptible blueberry cultivars to examine gene expression profile from 0 to 4 days post-inoculation of C. acutatum. Our results showed distinct transcriptome profile of C. acutatum in the resistant and susceptible cultivars. We identified a number of differentially expressed genes ($p<0.01$) involved in cellular differentiation and other biological processes, such as cell wall stability, mycelial growth, sporulation, and virulence. Moreover, principal component analyses on the susceptible cultivar showed the first two components constituted 60% of the variation and divided the developmental stages of C. acutatum into three groups: day 0, day 1-3, and day 4 post-infection however, this is not the case with the resistant cultivar. In addition, virulence of different isolates of C. acutatum was also examined by evaluating replicated sets of infected blueberry, strawberry, red raspberry and blackberry 3 days post-inoculation. Results from this study, coupled with findings from differential gene expression analyses, will provide insights into the developmental regulation and pathogenicity of C. acutatum.

Predicting the Effect of IR Injury on Cardiomyocyte Function
Jeremy Mysliwiec
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 205
Mentor: Jason Bazil

A cardiac ischemia-reperfusion injury (heart attack) can be the cause of up to 50% of the damage to the heart for an individual who has suffered from a heart attack. We update the 2004 Kyoto model with a new metabolism model to explore how calcium overload impacts the cardiomyocyte energetics and contractility. The model simulates excitation, contraction, and metabolism of the heart and allows us to run the system such that it mimics calcium overload. We perturb selected parameters and initial conditions individually in an effort to gain perspective of how the parameter affects the model by quantifying how much the perturbation impacts the system; the technique is called local sensitivity analysis. We then tested several hypotheses linking oxidative stress to myocyte function believed to occur in I/R injury. To do this, we added free radical signaling mechanisms to the ECC and calcium handling processes in the model. We found that oxidative-induced modifications of the ryanodine receptor significantly altered electrophysiological and mechanical behavior closely mimicking what was observed in other studies. Oxidative stress dependent effects are then added to explore the damage caused by this addition.

How plant-fungal interactions impacted the colonization of land
Carson Pearl
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 206
Mentor: Patrick Edger

There are many theories currently proposed to explain how aquatic plants managed to make the transition to land and begin colonization. One hypothesis is that microbiota in the soil assisted in this process and allowed early land plants to survive on land. This mediator is unknown and we are testing to see if the Mortierella fungi fit this role. Mortierella fungi are root endosymbionts that assist in nutrient uptake and water acquisition, but the full extent of their impact on plant life remains poorly understood. These fungi are being tested for being this mediator due to their widespread distribution in the soil as well as being the sister group to the Glomeromycota, fungi with arbuscular mycorrhizae and are crucial to the survival of many plant species. So to test the impact of these fungi and to identify candidate genes that assisted in land plant evolution, we will be doing a variety of tests across the viridiplantae. My project is specifically looking at the monocot clade, and I will be testing how 2 grasses, Brachypodium distachyon and Setaria viridis, are affected phenotypically and at the gene expression level by exposure to Mortierella. By comparing the growth rate and coexpression of transcriptomic data from these grasses inoculated to 2 Mortierella species, M. elongata and M. gamsii, to a control and positive control, Serendipita indica, I will be testing to see if we can see over represented genes associated with land plant colonization.

Diurnal intraocular pressures (IOPs) in dogs with ADAMTS10-open-angle glaucoma (ADAMTS10-OAG)
Vanessa Raphtis
Category & Time: Cell Biology, Genetics & Genomics, Section 4, 1:00 PM - 2:15 PM
Poster: 207
Mentor: Andras Komaromy

Glaucoma is a leading cause of incurable blindness affecting the optic nerve. The most common form is open-angle glaucoma (OAG). Elevation of intraocular pressure (IOP) is a major risk factor. At the Michigan State University College of Veterinary Medicine, we house a unique, well-established and clinically relevant large animal model: dogs with OAG due to a G661R missense mutation in the ADAMTS10 gene. The purpose of this study was to perform a large-scale diurnal IOP screening in dogs with ADAMTS10-OAG as a function of age/disease stage and compare the findings with those of normal control dogs. Diurnal (8am, 11:30am, 3:30pm) IOP measurements (via tonometry) were performed over a 7-year period on 37 ADAMTS10-mutant and 31 unaffected control dogs between the ages of 2 weeks and 7 years. Changes of diurnal and average daily IOPs were evaluated as a function of age by generalized linear model, estimating equation, and fitted trendline over time. In contrast to normal dogs with no major age and diurnal effects, there was a significant, gradual, age-related IOP increase in ADAMTS10-mutant dogs (mean +/- standard deviation): year1=18.5+/-1.99, year2=20.5+/-3.44, year3=24.1+/-4.23, year4=24.7+/-3.63, year5=25.0+/-4.47, and year6=27.9+/-3.41 mmHg ($p<0.05$). There was a significant diurnal effect between the ages of 2.7-4.8 years with IOPs being highest at 8am ($p<0.001$). Overall average normal IOP was 13.56+/- 1.55 mmHg. To date, this is the largest scale description of diurnal IOP in dogs with detailed documentation of gradual IOP increase with age and disease progression in ADAMTS10-mutant dogs, an important large animal model of human OAG.

REGULATION OF PIGMENTATION AND TUNING OF PHOTOSYNTHETIC POTENTIAL DURING COMPLEMENTARY CHROMATIC ACCLIMATION IN FREMYELLA DIPLOSIPHON

Karina Rodríguez
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 208
Mentor: Beronda Montgomery

Cyanobacteria are an evolutionarily and ecologically important group of prokaryotes. They exist in diverse habitats, and this can be attributed to their ability to sense and respond to changing environmental conditions. Cyanobacteria are photosynthetic organisms capable of responding to different light conditions in a process called chromatic acclimation (CA). CA is a form of photomorphogenesis (any change in form or function of an organism occurring in response to changes in the light environment), whereby cyanobacteria alter light-absorbing pigments of a super molecular antenna complex called the phycobilisome. This complex is important for light absorption and its conversion to chemical energy. Tuning of the pigments of the phycobilisome cause changes in organismal color and ability to absorb light at different wavelengths of light. The goal of this research is to investigate the role of the psoR gene in the cyanobacterium Fremyella diplosiphon when exposed to red and green light conditions, the wavelengths responsible for CA in this organism. The color phenotype and the level of phycobiliprotein, chlorophyll and carotenoid accumulation in a psoR mutant (psoR::IS701) were analyzed in order to compare with its parent strain (MRGL-2) and wild type (SF33 WT). The study is based on the central hypothesis that the psoR gene plays a role in controlling the size and quantity of phycobilisomes, thereby altering the absorbance capacity of light and associated cellular fitness during chromatic acclimation.

Developing a bioluminescent dopamine indicator using circularly permuted luciferases
Gabriel Santana
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 209
Mentor: Assaf Gilad

Dopamine is a neurotransmitter that is involved in several critical brain functions and behaviors. There are few tools available to study how dopamine changes in respect to time. A new fluorescence-based dopamine indicator has been developed that can track dopamine dynamics in vivo. Currently fluorescence imaging is efficacious and widely used to image biological processes, although there are several complications associated with fluorescence that may hinder performance. Fluorescence imaging requires an intense light source to excite the protein and record its emission light. The use of this high energy light can adversely affect the sample and imaging quality; it may cause autofluorescence of the tissue, phototoxicity, heat, inflammation and disruption of light sensitive biological processes. All these complications can be avoided using bioluminescent proteins instead of fluorescent proteins, as the latter does not require the use of an excitation light. In order to test this, we will design a bioluminescence-based indicator that will respond and detect the presence of dopamine. This sensor will be engineered using a circularly permuted luciferase. The indicator will be tested in E.coli bacterial cells, and in human cells. We expect to see an increase in brightness in the presence of dopamine, which will allow us to image dopamine dependent events without the drawbacks that are associated with fluorescent imaging.

Phytochrome A (PHYA) regulated Sigma factor 6 (SIG6) controls genes contributing to the far-red block of greening response in Arabidopsis thaliana
Audrey Searing
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 210
Mentor: Hussien Alameldin, Beronda Montgomery

Photosynthesis provides carbon energy essential to plant survival. For photosynthesis to occur, chlorophyll must be synthesized in chloroplasts. Photoreceptors known as phytochromes are responsible for receiving red and far-red light signals, thereby regulating chlorophyll biosynthesis. Wild-type seedlings germinated in far-red light lack chlorophyll and appear small and colorless with an inability to green in subsequent white light exposure. This response is called far-red block of greening (FR BOG). Sigma Factor 6 (SIG6) is a plastid-targeted sigma factor regulated by phytochrome A and phytochrome B. Plants which carry a mutation in the SIG6 gene (i.e., sig6) are able to green after germination in far-red light followed by exposure to white light. Our unpublished transcriptome data suggested that SIG6 regulates genes encoding Early Light Induced Proteins (ELIP1 and ELIP2), Protochlorophyllide oxidoreductase A (PORA) and Elongated Hypocotyl 5 like (HYH) transcription factor. In this study, we test the hypothesis that SIG6 regulates one or more of these genes in the SIG6-mediated FR BOG response.

Curating a List of Lipid Genes in Chlamydomonas reinhardtii
Kenia Segura Aba
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 211
Mentor: Yair Shachar-Hill

Microalgae are attractive biofuel feedstock candidates due to their ability to accumulate a high percent of their dry weight as carbon storage compounds, such as starch and neutral lipids, when nutrient deprived. There have been many studies about nitrogen deprivation in Chlamydomonas reinhardtii and the resulting lipid accumulation, but recovery from this stress has not been elucidated (Miller et al., 2010, et al., Park et al., 2015). Understanding neutral lipid breakdown during stress recovery could lead to engineering microalgae that retain high neutral lipid levels without sacrificing population growth rates. In this study, the relationship between lipid metabolism genes and recovery from nitrogen deprivation are examined. A list of 393 C. reinhardtii lipid genes were identified by blasting known Arabidopsis thaliana acyl lipid gene families against the C. reinhardtii genome. We investigated several sub-classes of lipid genes (particularly triacylglycerol lipases and transacylases) using transcriptomic data from a previous study (Tsai et al., 2018) and PFAM domains. We identified C. reinhardtii triacylglycerol lipases which are coregulated with LIP4, a previously characterized triacylglycerol lipase, using k-means clustering. We will characterize the lipid phenotype of these predicted triacylglycerol lipases under a range of conditions, including nitrogen replete, nitrogen starved, and nitrogen resupply, using C. reinhardtii mutants for comparison (Warakanont et al, 2019).

Identifying Diagnostic Targets for Nontuberculous Mycobacteria
Lauren Sosinski
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 212
Mentor: Janani Ravi

Nontuberculous mycobacterial (NTM) infections are incredibly detrimental to livestock in the agriculture community and cause secondary infections in humans. Currently, there are no effective vaccines against NTM, and diagnosis techniques include, but are not limited to, testing clinically healthy cattle fecal matter and lymph nodes at slaughter. However, the bacterial diagnoses between the lymph nodes and fecal matter drastically differ. The only way to get an accurate diagnosis is after the infection has spread or the animal is near death. Secondary infections by NTM that occur in humans require long-term treatment and can become a chronic, and expensive, issue. Therefore, there is a critical need for improving the methods for diagnosing, treating, and vaccinating against NTM. In this project, I plan to identify protein targets for diagnosis in NTM by first determining known virulence factors and diagnostic targets in other mycobacteria, such as M. tuberculosis, and identifying the homologs in NTM using the BLAST database. I will use molecular evolutionary approaches (sequence-structure-function and phylogenetic) to determine the domains and genomic neighborhoods of these homologs. These analyses will show how these genes have evolved, what their putative functions are and whether they can be used as diagnostic targets. Finally, I will compare the genomes of pathogenic NTM to both Mycobacterium tuberculosis and nonpathogenic NTM to ensure specificity and sensitivity of the identified targets. This will allow me to find unique proteins in pathogenic NTM, which could be used for early and effective diagnosis.

CD2 regulates AHR and lung inflammation in allergen-induced severe asthma
Kanedra Thaxton, Tanwir Hashem, Devika Bahal
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 213
Mentor: Hariharan Subramanian, Rupali Das

Background: Asthma is a major public health problem, affecting 300 million people worldwide, and its prevalence has increased considerably in recent years. The current anti-inflammatory drugs for asthma treatment are effective for most of asthma patients. However, these drugs are ineffective for patients with severe asthma (SA), highlighting an urgent need for the development of novel and effective therapies. Hypothesis: Our recent studies have identified a novel role for cell surface receptor CD2 in allergen-induced Th2-allergic response. The goal of this study is to examine the role of CD2 in regulation of the immune responses associated with SA. Methods: We injected Balb/c (wild-type) and Cd2−/− age-matched mice intranasally with house dust mice extract (HDME) and c-diGMP or PBS. Twenty-four hours after the last injection, mice were anesthetized and lung mechanics was measured using flexiVent. Broncho alveolar lavage fluid was collected and analyzed for cytokines. Gene expression of cytokines and chemokines in the lungs was measure by real-time quantitative PCR. Results and Conclusions: We observed that HDME-exposed Balb/c mice have increased airway hyper responsiveness (AHR), and elevated levels of IFN-g and IL-17 in the lungs as compared to the control Balb/c animals. In contrast, AHR and both IFN-g and IL-17 levels are significantly reduced in HDME and c-diGMP-exposed Cd2−/−

mice. Studies are underway to further dissect the immunological and molecular basis for CD2-mediated SA, so that it can be harnessed for the treatment of SA patients. Support: This work is supported by the CNS undergraduate research scholarship to Kanedra and a NIH-K22 (5K22CA18814802) Award to Rupali Das.

Early Cell-Cell Coupling Impairs Stem Cell Retention when Co-cultured with Ischemic Cardiomyocytes
Jack Tietema
Category & Time: Cell Biology, Genetics & Genomics, Section 5, 1:00 PM - 2:15 PM
Poster: 214
Mentor: David Greenen

Background: Bone marrow-derived mesenchymal stem cells (BM-MSC) are reported to induce beneficial effects in the heart following ischemia but a loss of these cells within hours of administration could significantly diminish their long-term effect. We hypothesized that early coupling between BM-MSC and ischemic cardiomyocytes through gap junctions (GJ) may play an important role in stem cell survival and retention in the acute phase of myocardial ischemia. Cardiomyocytes express connexin 43 (Cx43) as their predominant gap junction protein and the presence of this protein in human BM-MSC (hBM-MSC) may explain the loss of stem cell retention previously observed in acute myocardial infarction. Methods: We seeded HL-1 cardiomyocytes in either normoxic (Nx) or ischemic (Isc) conditions for four hours. Subsequently, murine BM-MSC (mBM-MSC) were seeded on top of the HL-1 monolayer and the co-cultures were returned to incubation under previous conditions (Group 1, Nx, Group 2, Isc) or switched to ischemia-reoxygenation (Group 3, Isc/Nx) for an additional two hours. For the final two-hour co-culture period a GJ inhibitor (Carbenoxolone, CBX; 100 uM) was added to half of the culture plates in each of the three groups. Co-cultures were labeled with Annexin V, Sytox Red, and Sca-1 (mBM-MSC), to identify apoptotic cells and distinguish between HL-1 and mBM-MSC with flow cytometry. We also cultured hBM-MSC and performed immunofluorescence studies for the presence of Cx43. Results: Ischemia induced a greater proportion of dead mBM-MSC in co-culture compared to the Nx group. Isc/Nx resulted in significantly higher early apoptotic but fewer dead mBM-MSC. The presence of the GJ inhibitor CBX in the co-culture reduced the number of dead and apoptotic cells in Isc and Isc/Nx groups by 3-5 fold ($p<0.05$). Immunofluoresence studies demonstrated that Cx43 is expressed in hBM-MSC. Conclusions: While functional GJ are critical for long-term integration of stem cells within the myocardium, early GJ communication may represent a novel paradigm whereby ischemic and apoptotic cardiomyocytes induce a "bystander effect" when coupled to newly transplanted mBM-MSC and thus impair cell retention. Furthermore, the expression of Cx43 indicates that hBM-MSC possess the capability of forming GJ with cardiomyocytes and may also be impacted by a "bystander effect".

Investigating the role of the COP9 signalosome in proteolytic cleavage of EIN2
Austin VanDenTop
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 215
Mentor: Matthew Christians

The gaseous phytohormone ethylene has a myriad of effects on every stage of plant development, regulating various responses from seed germination to leaf abscission. Even with the variety of effects, ethylene is perceived similarly in all plant species, with the pathway conserved even in algae. The signaling cascade starts with binding to a family of receptors at the endoplasmic reticulum, and branches at the key regulating protein Ethylene Insensitive 2 (EIN2). EIN2 is cleaved during the cascade, with the C-terminus translocating from the ER to alter gene expression. Currently, the protease involved in this cleavage is unknown. Previous work demonstrates an interaction between EIN2 and the protease complex COP9 Signalosome (CSN), suggesting that the CSN plays a role in ethylene signaling. With this study, we will be investigating the role of the CSN in relation to EIN2, with the hypothesis that the CSN is responsible for the cleavage of EIN2. To demonstrate this interaction, we are using protein blotting to detect and quantify the amount of cleaved EIN2 under conditions were the CSN is inhibited or mutated. Additionally, we plan to visualize EIN2 cleavage by confocal microscopy. The localization of GFP-tagged EIN2 (in the nucleus or at the ER) will show the amount of cleaved EIN2 and can be viewed under the effects of CSN mutants or inhibitors. Comparing the amount of cleaved EIN2 under different levels of CSN inhibition will allow us to determine if the CSN is responsible for cleavage of EIN2.

Functions of two mitochondrion-targeted Nitrogen-fixing-subunit- type proteins in mitochondrial iron-sulfur cluster assembly
Michael Voyt
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 216
Mentor: Yan Lu

Iron-sulfur (Fe-S) clusters are essential to a variety of biological processes, such as electron transport in chloroplasts and mitochondria. The assembly and transfer of Fe-S clusters requires the participation of Fe-S carriers, such as Nitrogen-fixing-subunit-U (NFU)-type proteins. The nuclear genome of Arabidopsis thaliana, a flowering plant, encodes five NFU proteins. The three chloroplast-targeted NFUs (NFU1, NFU2, and NFU3) are involved in the assembly and transfer of chloroplastic Fe-S clusters. The functions of mitochondrion-targeted NFU4 and NFU5 have not been studied. NFU4 and NFU5 contain a redox-active NFU domain; therefore, we hypothesize that they are involved in the assembly and transfer of mitochondrial Fe-S clusters. To test this hypothesis, we expressed NFU4 and NFU5 in Escherichia coli. Spectroscopic analysis of recombinant NFU4, and NFU5 showed that these proteins can bind to labile Fe-S clusters. We also analyzed nfu4 and nfu5single mutants, which had normal phenotypes. To further study the functions of NFU4 and NFU5, we attempted to generate nfu4 nfu5 double mutants. We obtained nfu4-1 nfu5-1 and nfu4-1 nfu5-2double homozygous mutants. However, we were unable to generate nfu4-2/3 nfu5-1/2 double homozygous mutants. The nfu4-1mutant has T-DNA inserted in the untranslated region whereas other four mutants have T-DNA inserted in an intron or exon. We think that nfu4-1 may be an incomplete loss-of-function mutant and that double complete loss-of-function mutations in NFU4 and NFU5 may result in embryo-lethal phenotypes. To examine this, we will investigate segregation patterns of seeds from nfu4-2/NFU4-2 nfu5/nfu5 and nfu4-2/nfu4-2 nfu5/NFU5 plants.

Defining the mechanisms behind Pseudomonas syringae-induced mitochondrial dysfunction in Nicotiana benthamiana cells
Tuesday Danielle Weaver
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 217
Mentor: Masaki Shimono

Agriculture and food production sciences focus towards combating the effects of disease or disorders to increase overall crop yield. This study utilizes Pseudomonas syringae pv. tomato DC3000, a model bacterial pathogen that is classically used to study plant-microbe interactions with the model plant Arabidopsis thaliana. DC3000 is known to target the host cell actin cytoskeleton (Henty-Ridilla et al., 2013; Shimono et al., 2016). Influence from the bacterial gene HopG1 is known to result in amplified disease symptom development, due to the perturbation of the host cell's actin cytoskeleton (Shimono et al., 2016). This research focuses on the effects of HopG1 induction by transient expression assay. HopG1 was induced in Nicotiana benthamiana leaves; HopG1 protein accumulation has been confirmed at 48 hours after induction by western blot analysis. Cell death was observed in fresh tissue after both incubation times. Hydrogen peroxide (H-2O2) was also found after both 48 and 72 hours through 3,3'-Diaminobenzidine (DAB) staining. The production of H--2O2 in plants is an indicator of cell stress (Petrov and Breusegem, 2012), therefore, the induction of HopG1 is concomitant. Overall, the results of the transient expression assay determine that the induction of HopG1 in plant host cells lead to production of H-2O2 in the mitochondria. Subsequent rupture of this organelle releases this chemical and leads to cell death. Future directions include confirming this relationship; in addition to an overview of the present works, this poster will therefore discuss additional projects that may lead to refined insight into this pathogenic interaction.

The Role of Mating Type Proteins in Mating Type Recognition of Tetrahymena thermophila
Tyler White
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 218
Mentor: Marcella Cervantes

Normally, the species Tetrahymena thermophila reproduces asexually. However, when starved, T. thermophila are able to sexually reproduce. There are seven different mating types for sexual reproduction. The two genes that are involved in mating and that code for a specific mating type have been coined MTA and MTB. There are seven different versions of these genes, one for each mating type. The MTA and MTB genes are necessary for sexual reproduction in T. thermophila cells. These genes are also located side by side in the genome of T. thermophila. Research has shown that a cell can mate only with cells that have a different mating type. In other words, cells are incompatible for mating if they have the same mating type. This project aimed to create T. thermophila cells with the mating type 2 MTA gene and the mating type 3 MTB gene. The mutant population will then be introduced to a normal population is see if the mutants are sterile, mate with themselves, or any other outcome. That outcome will provide a better understanding of the mechanisms of these genes operate in T. thermophila.

Bioinformatical Coding of Mitochondrial DNA, Genes, and Genomes
Brooke Wood
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 219
Mentor: Jeanette McGuire

Humans are naturally curious about their ancestral origin, and the United States of America represents a unique mix of different individuals, backgrounds and cultures. A university environment is similarly diverse as Michigan State University has over 7,266 international students, from at least 49 countries (2018)! At Victoria university, there are 3,000 international students out of 7,165 (found in a 2014 study). This study was conducted at a partnering school of Michigan State University, Victoria University of Wellington, Wellington, NZ. To evaluate the ancestral origins of students, we sequenced the mitochondrial D-loop, or displacement loop. We use the D-loop in mtDNA as it acts as an early replication intermediate, and usually this part of the mitochondrial DNA is referred to as the control region. Evaluating this region allows for the user to connect and look at the differences between ancient humans, Neanderthals, as well as other species. We performed an NCBI BLAST of the sequenced mitochondrial D loop sequences, as well as through a sequence server through Cold Spring Harbor Laboratories to identify single nucleotide polymorphisms and mitochondrial haplogroups. The outcome solicited a close similarity between myself, Greece, and the Native American Nuu Chah Nulth clan #3. Then a group average was also taken from the class, allowing Modern Students to compile an average against other modern and ancient beings.

Is More Studying Better? Assessing Self-reported Student Preparation Practices for Chemistry Exams
Catrina Stephan
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 220
Mentor: Rachel Barnard

The manner in which each student learns can differ strikingly; there is no single or best way to study for every exam. However, there are, presumably, more and less effective strategies for studying. At Michigan State University's Lyman Briggs College, students taking LB172 (General Chemistry II Lecture) complete exam debrief worksheets following each midterm exam. These worksheets ask students to report their exam preparation activities (hours studied, choice and distribution of study techniques for each exam) and the mistakes they believe they have made on the exam. The data collected from these worksheets was organized into a database and connected to the grades each student earned on midterm exams, quizzes and the final exam. The data was anonymized before analysis. The two aims of this project are to understand which study habits students self-report and if there is any correlation to exam and subsequent quiz performance. From the worksheets, the following items were explored: reported hours studied, frequency of techniques used, percent of studying time using each technique, and mistakes the students report making. Insights from this work may allow suggestions to future LB172 students for more effective studying.

Functional Analysis of Mitochondrial Carrier Proteins in Arabidopsis
Thomas Young
Category & Time: Cell Biology, Genetics & Genomics, Section 6, 1:00 PM - 2:15 PM
Poster: 221
Mentor: Danny Schnell, Emily Pawlowski, Bibin Paulose

Novel strategies to increase crop productivity are required to meet rising demands from ever increasing population and prepare for the potential negative impacts of an unstable climate. This includes crop adaptations that allow for more efficient usage of resources to deal with abiotic and biotic stresses such as drought, flooding and disease. Mitochondrial carrier proteins have been observed to greatly impact the growth and success of plants. We previously studied the impacts of the mitochondrial carrier protein, LIP36, from Chlamydomonas reinhardtii in the oilseed crop, Camelina sativa. Under limiting environmental conditions, LIP36 plays an essential role in mitochondrial metabolism, improving resilience by improving carbon assimilation, increasing water and nitrogen use efficiency, and increasing seed yields. We hypothesize that LIP36 functions by transporting dicarboxylates into the mitochondria for use in the TCA cycle, thereby improving photorespiration, decreasing oxidative stress, and increasing anaplerotic metabolism. To test this hypothesis, we will investigate the ability of LIP36 to complement T-DNA insertional mutants in known mitochondrial dicarboxylate transporters from Arabidopsis thaliana (DIC1, DIC2, and DIC3). Detailed analysis of these lines will reveal more insight into the physiological role of dicarboxylate transporters in plants.

Inhibition of PLK, AURK, and Tubulin in BRaf Inhibitor Resistant Melanoma Cells
Maisah Akram
Category & Time: Pharmacology & Toxicology, Section 1, 1:00 PM - 2:15 PM
Poster: 225
Mentor: Richard Neubig

Melanoma is the deadliest form of skin cancer and results in approximately seven thousand deaths annually. More than 50% of all melanoma tumors contain mutations in the BRAF gene, most occurring in valine 600. While tumors are initially responsive to BRaf inhibitors, most tumors develop resistance within years. In our prior work, we discovered that BRAFi-resistant melanoma cells are more sensitive to PLK and AURK inhibitors. In an effort to understand why, we are observing mitosis in both the drug resistant cells and the parental non-resistant cells. We hypothesize that the resistant cells have inherently dysregulated mitotic progression. Melanoma cell lines were engineered to express GFP-tubulin which labels the mitotic spindle and Scarlet-histone 2A (H2A) to label the DNA. Fluorescent live-cell microscopy is used to visualize and track cells undergoing mitosis. In our preliminary experiments, I developed methodology to perform live-cell imaging of these cells with images taken at two-minute intervals. Work to characterize differences between the parental and resistant cells under untreated and drug-treated conditions is now underway. Characterizing compounds that are selective for resistant cells may yield new mechanisms to prevent or reverse drug resistance in melanoma.

Investigating the role of the mevalonate pathway in visceral adipose tissue-stimulated epithelial cell malignant transformation

Amni Azhar
Category & Time: Pharmacology & Toxicology, Section 1, 1:00 PM - 2:15 PM
Poster: 226
Mentor: Jamie Bernard

Obesity increases the risk of cancer, however, the mechanisms are unclear. Our laboratory previously demonstrated that secretions from visceral adipose tissue (VAT) stimulate the transformation of non-tumorigenic cells (breast and skin epithelial) as measured by growth in soft agar, a surrogate marker for malignant transformation. Transformation is the steps and stages a cell undergoes to become malignant. We have also shown that Fluvastatin, an HMG-CoA reductase inhibitor, prevented VAT-stimulated transformation, suggesting that proteins downstream of HMG-CoA reductase may be involved in carcinogenesis. HMG-CoA reductase is an enzyme in the mevalonate pathway. The mevalonate pathway leads to cholesterol biosynthesis through the activation of enzymes responsible for isoprenoid production. Isoprenoids undergo prenylation, a process that increases the activity of the RAS oncogene. Thus, in this study, we hypothesized that mevalonate pathway signaling promotes VAT-stimulated malignant transformation. To test our hypothesis, we used non-tumorigenic skin and breast epithelial cells and stimulated them with VAT for different time periods. We analyzed enzymes in the mevalonate pathway by Western blotting. We anticipate that VAT will induce proteins in mevalonate pathway. These studies have the potential to lead to new targets for prevention and provide rationale for how Fluvastatin has chemopreventive action.

A Nanoformulated PARP Inhibitor Induces an Immune Response in BRCA-Deficient Breast Cancer
Joseph Brenner
Category & Time: Pharmacology & Toxicology, Section 1, 1:00 PM - 2:15 PM
Poster: 227
Mentor: Karen Liby, Ana Sofia Mendes Leal

For individuals with BRCA-deficient hereditary breast cancer, traditional anti-estrogen and targeted therapies are largely ineffective. BRCA and PARP proteins regulate two different pathways that repair DNA breaks. BRCA-deficient cancers depend on PARP proteins for DNA repair, so the use of PARP inhibitors causes apoptosis in these cells. The PARP inhibitor, Talazoparib, was approved in 2018 for the treatment of triple negative BRCA-deficient breast cancer. This drug effectively kills tumor cells, but low bioavailability when taken orally causes off-site toxicity. To overcome these challenges, a nanoparticle formulated Talazoparib was developed that is highly efficacious in a BRCA-deficient mouse model of breast cancer. The goal of our work is to understand the different effects of free Talazoparib versus the nanoparticle encapsulated Talazoparib. Nanoparticle Talazoparib increased the recruitment of CD11c+ dendritic cells into the tumor, which is consistent with a higher activation of the innate immune system. Both Talazoparib and nanoparticle-Talazoparib increased phospho-STING and phospho-NFkB p65 in W780 murine BRCA deficient cancer cells, suggesting that damage to cancer cells can lead to the recruitment of immune cells. Our studies indicate that when the drug Talazoparib is administered via lipid-based nanoparticles, which have fewer side effects, it caused more DNA damage in cancer cells and

recruited innate immune cells.

Assessment of the effect of acute methylmercury (MeHg) exposure on the expression of GABAA receptors in the brain of ALS mouse model
Ashley Burgos-Sánchez
Category & Time: Pharmacology & Toxicology, Section 1, 1:00 PM - 2:15 PM
Poster: 228
Mentor: William Atchison, Yukun Yuan

The Gamma-Amino Butyric Acid A receptor (GABAAR) is a ligand-gated ion chloride channel, which mediates fast inhibitory synaptic transmission in the adult mammalian brain. The agonist of GABAAR is the Gamma-Amino Butyric Acid (GABA), the primary inhibitory transmitter that plays a crucial role in controlling neuronal excitability. However, whether activation of GABAARs induces excitation of inhibition mainly depends on the intracellular chloride concentration [Cl-], which is regulated by age-dependent differential expression of the Cl−cation co-transporters (CCCs), Na+, K+-2Cl-cotransporter-1 (NKCC1) and K+-Cl−cotransporter-2 (KCC2). In the mature neurons, the level of intracellular chloride is relatively low, activation of GABAARs induces an influx of chloride and hence facilitates GABA-mediated inhibition. Previous studies from our lab suggested that the GABAAR could be a sensitive target to MeHg. On the other hand, changes in GABAAR function have been implicated to be involved in the pathophysiology of amyotrophic lateral sclerosis (ALS). Most importantly, we previously showed that chronic MeHg exposure accelerates the onset of ALS phenotype. Here we hypothesize that MeHg may alter the expression pattern of GABAAR subunit, contributing to the etiology of ALS. Therefore, the purpose of this research is to explore the potential effects of MeHg on the expression pattern of GABAA receptors subunits, in the cortex, brainstem, spinal cord and cerebellum. Following in vitro exposure of brain slices from different regions of the mouse brain in order to analyze changes in the expression of a subset of GABAAR subunits using Real-Time PCR.

Diesel exhaust particle induced neurotoxicity: exploring mechanisms in human iPSC-derived cells
Noah Croasdill
Category & Time: Pharmacology & Toxicology, Section 1, 1:00 PM - 2:15 PM
Poster: 229
Mentor: Colleen Hegg

Alzheimer's disease (AD) is the most common neurodegenerative disorder and in most cases the cause is not known. Many genes have been implicated in the cause and progression of the disease, but very little research has been done on contributing environmental factors. Airborne pollutants are potential causative toxicants due to their ability to cause Alzheimer's-like pathologies. Our preliminary studies show that diesel exhaust particles (DEP), a model air pollutant, decreases neurogenesis in the mouse hippocampus and induces Alzheimer's-like pathologies. There is also evidence that ramified microglia can exacerbate AD pathologies by engulfing synapses and releasing inflammatory factors that can lead to neuronal cell death. We hypothesize that DEP will induce neurotoxicity in human induced pluripotent stem cell (hiPSC) derived cells. For this project, I will be exposing hiPSC-derived neural precursor cells,

neurons, and neurons co-cultured with microglial cells to DEP or vehicle control. I will measure the amount of reactive oxygen and nitrogen species produced to determine potential mechanisms of toxicity. I predict, based on my hypothesis, that DEP treatment will increase the production of reactive oxygen and nitrogen species in neuronal precursor cells, mature neurons and microglial co-cultures compared to vehicle control treatment. With this information we can demonstrate that neurons and microglia are susceptible to DEP toxicity and work on developing practical in-vitro assays to test for neurotoxicological agents.

Investigating the Efficacy of Statins in Preventing Visceral Adipose Tissue-Stimulated Breast Epithelial Cell Malignant Transformation
Anaís Cruz García
Category & Time: Pharmacology & Toxicology, Section 1, 1:00 PM - 2:15 PM
Poster: 230
Mentor: Jamie Bernard, Blair Bullard

Obesity increases the risk of post-menopausal breast cancer (all subtypes) and visceral obesity increases the risk of pre-menopausal triple negative breast cancer, the most aggressive and difficult breast cancer to treat. Our laboratory previously demonstrated that secretions from visceral adipose tissue (VAT) stimulate the malignant transformation of MCF-10A cells, non-tumorigenic breast epithelial cells. We demonstrated this by measuring growth in soft agar, a surrogate marker for malignant transformation. Our previous data showed that malignant transformation by VAT is prevented with a statin drug, Fluvastatin, an HMG-CoA reductase (HMGCR) inhibitor. HMGCR is an enzyme in the mevalonate pathway and activation of this pathway leads to cholesterol biosynthesis. The mevalonate pathway also leads to the production of isoprenoids farnesyl pyrophosphate (FPP) and geranylgeranyl pyrophosphate (GGPP). These isoprenoids undergo prenylation with proteins like the RAS oncogene and induces membrane localization that enables signaling. We hypothesize that the activation of the mevalonate pathway is important for malignant transformation stimulated by secretions from VAT. I have demonstrated by Western blotting that treating MCF-10A cells with secretions from VAT increases the protein expression of enzymes critical in the mevalonate pathway and H-RAS at 24 hours and that this is prevented with statin pre-treatment. We plan to further investigate other proteins in the mevalonate pathway by western blotting at different time points. These studies have the potential to lead to new targets for prevention and provide rationale for the chemopreventive activity of statins for breast cancer.

Ketamine directly alters vascular tone in the rat urinary bladder
Kat Ebert
Category & Time: Pharmacology & Toxicology, Section 2, 1:00 PM - 2:15 PM
Poster: 231
Mentor: Nathan Tykocki

Ketamine is a noncompetitive NMDA receptor antagonist that has recently been approved for the treatment of Major Depressive Disorder (MDD). However, a side effect of chronic ketamine use is the

development of ketamine-induced interstitial cystitis. Interstitial cystitis is characterized by constant, chronic pain in the bladder, with an increase in frequency of urination and a decrease in bladder capacity. While the mechanisms responsible remain unknown, a defining feature of ketamine-induced cystitis is capillary rupture and hemorrhage in the bladder wall, suggesting a disruption in vascular tone and blood flow control. We hypothesize that ketamine causes bladder arterioles to dilate and venules to constrict. When this occurs, capillaries then rupture due to the increase in blood flow and blood pressure . To investigate this hypothesis, we will isolate and cannulate bladder arterioles and venules from male Sprague-Dawley rats for pressure myography experiments. Increasing concentrations of ketamine will be applied directly to the exterior of the vessel, and vessel pressure and diameter will be measured. We will additionally test arteriolar and venular responses to ketamine's major metabolite norketamine, which is predominantly cleared in urine. These results will potentially lead to effective prevention of ketamine-induced cystitis for patients using ketamine to treat their depression, and may provide insights into the mechanisms responsible for other types of interstitial cystitis. Funded by NIH K01-DK103840 (NRT) and ASPET SURF Program (KME).

Efferocytosis of Cell Corpses by Alveolar Macrophages (AMph) is enhanced by Docosahexaenoic Acid (DHA)

Augie Evered

Category & Time: Pharmacology & Toxicology, Section 2, 1:00 PM - 2:15 PM

Poster: 232

Mentor: Madduma Hettige Lichchavi Rajasinghe, James Pestka

Exposure to crystalline silica (cSiO2) has been linked to the autoimmune diseases including lupus. Intranasal instillation with cSiO2 triggers profuse inflammation in the lung and onset of autoimmunity in lupus-prone mice; notably, DHA supplementation abrogates these responses. AMph phagocytoses cSiO2 resulting in their death and insufficient removal of cell corpses by efferocytosis potentially contributes to profuse inflammation and onset of autoimmunity. Here we tested the hypothesis that DHA enhances the clearance of apoptotic, pyroptotic, and silica-induced cell corpses by MPI macrophage cells (AMph Surrogate). ASC-transfected RAW 264.7 cells (target cells) were pre-incubated with or without DHA (25 μM), labeled with pHrodo red dye, and then were treated with staurosporine (0.5uM), nigericin (1uM) prior priming with lipopolysaccharide(LPS) (20ng), or silica (50ug/mL). Resultant cell corpses were incubated up to 4hrs at a 1:4 ratio with CFSE-green labeled MPI cells that were pre-incubated with or without DHA (25 μM). After co-culturing, free corpses were washed away and percentages of MPI cells and internalized ASC-RAW corpses by MPI cells was calculated from images from an EVOS FL2 microscope. The time courses analysis reveals that MPI cells reached maximal efferocytosis index at 80 % with single engulfment within 2 hours of co-culturing and continued and multi-cell engulfment. MPI shows more tendency to phagocyte cSiO2 or staurosporine-induced cell corpses compared to cell corpses from nigericin and LPS treatment. The highest clearance of cell corpses was observed when target cells were pre-incubated with DHA regardless of cell death inducer of target cells suggesting DHA as an efferocytosis enhancer. Therefore, the improvement of efferocytosis by DHA may be related to suppressed systemic autoimmunity in lupus-prone mice consuming DHA.

Excitotoxicity Observed in NSC-34 Cells Following Methylmercury Exposure
Midori Flores
Category & Time: Pharmacology & Toxicology, Section 2, 1:00 PM - 2:15 PM
Poster: 233

Excitatory amino acid transporters (EAATs) are proteins that achieve glutamate reuptake and therefore, maintain concentrations of Glu in the synaptic cleft in absolute homeostasis for proper brain functioning. Cell exposure to methylmercury (MeHg), a common environmental neurotoxicant, has been found to produce a large, spontaneous release of glutamate in extracellular environments. This spontaneous increase of the amino acid subjects neurons to lethal toxicity, as EAATs are not able to maintain the Glu levels and are even damaged by the MeHg. Both acute and chronic concentrations of MeHg have been found to induce excitotoxicity in motor neurons, causing symptoms similar to those seen in patients with amyotrophic lateral sclerosis (ALS). Astrocytes are known to take on many roles in the CNS, including the role of offering strong neuronal support, and MeHg preferentially collects in astrocytes and causes astrocytic swelling. Therefore, the pathology of toxicity in astrocytes and in motor neurons is of significant interest, especially at varying concentrations. To evaluate the pathology of toxicity in astrocytes and neurons, astrocytes from both wild-type and SOD-1 G93A (mouse model for fALS) genotypes were exposed to different concentrations of MeHg, as well as NSC-34 cells. Following MeHg exposure, the cells were assessed using immunocytochemistry. Examining the effects of MeHg-induced excitotoxicity may be fundamental in counteracting or reducing the consequences from exposure, which includes phenotypes similar to ALS.

Effects of ambient air pollution from Compton, CA on human lung cancer cells
Jade Gmitter
Category & Time: Pharmacology & Toxicology, Section 2, 1:00 PM - 2:15 PM
Poster: 234
Mentor: Ning Li, Carine Holz

Outdoor particulates are a major risk factor for lung cancer, one of the leading cancers worldwide with 1.8 million deaths in 2018. A study by Eckel et al concludes that air pollution exposure shortens lung cancer patients' survival. Compton is one of the most polluted cities in California. We hypothesized that outdoor particles in Compton, CA would exert pro-oxidant, pro-inflammatory and growth stimulating effects on human non-small cell lung cancer (NSCLC). Organic chemicals of outdoor particle- and vapor-phase pollutants from Compton were extracted with methanol and dichloromethane, respectively. NSCLC cells (H1975) were stimulated with these extracts at various concentrations and time points. Cellular proliferation, oxidative stress and activation of inflammatory response were analyzed by cell counting kit-8 assay, western blot of antioxidant enzyme heme oxygenase-1 (HO-1), and enzyme- linked immunosorbent assay, respectively. Stimulation of H1975 cells with organic extracts of particles from Compton strongly up-regulated HO-1. Exposure of H1975 cells to particle extract also enhanced cell proliferation and increased release of inflammatory cytokines IL-6 (2.4-fold) and IL-8 (1.6- to 2.9- fold). Moreover, our results showed that vapor-phase organic chemicals, an understudied group of air pollutants, also had a strong effect in up-regulating HO-1 in H1975 cells. Data suggests that organic chemicals in ambient particles from Compton, CA may promote NSCLC cell growth by up-regulating HO-

1, which has been shown to protect cancer cells, and inducing inflammatory response. More research is urgently needed to understand the link between vapor-phase pollutants and lung cancer.

Drug Target Residence Time as a New Parameter for Optimization of Drugs
Rachel Grewette
Category & Time: Pharmacology & Toxicology, Section 2, 1:00 PM - 2:15 PM
Poster: 235
Mentor: Kin Sing Lee

In the drug development process, many drugs fail due to lack of efficacy although most candidates showed promising potency in vitro. This indicates that we need to identify a better parameter to evaluate the potency of drugs. This will greatly facilitate the drug discovery process, improve the success rate of drugs, and save billions of dollars. Recent research suggests that drug residence time (tR), or the reciprocal of the dissociation rate constant (koff) of the drug-target complex, is an important in vitro parameter complementary to the affinity of a drug. Recent studies have shown that drugs with a longer tR have extended biological effects. However, how the structure of a compound affects its tR remains largely unknown. In this project, we are investigating the structure-kinetic relationship (SKR) of compounds to improve their drug-target residence time and we use soluble epoxide hydrolase (sEH) as a biological model. Soluble epoxide hydrolase is an enzyme that hydrolyzes polyunsaturated fatty acid epoxides to their corresponding 1,2-diols. The inhibition of sEH stabilizes these epoxides which have anti-inflammatory, anti-hypertensive, and analgesic effects. Thus, sEH inhibition is a promising therapeutic target. It is a good model for our study because there is a large amount of inhibitors with diverse structural features and high-throughput screening assays available in our laboratory. Finding the SKR of these inhibitors helps improve our understanding of the translation of their in vitro to in vivo efficacy. In this presentation, we will describe the high-throughput screening assay and the preliminary SKR of sEH inhibitors.

Docosahexaenoic Acid (DHA) suppresses human Lupus Specific key Autoantibodies in Murine Model of Lupus Flaring.
Shamya Harris
Category & Time: Pharmacology & Toxicology, Section 2, 1:00 PM - 2:15 PM
Poster: 236
Mentor: Madduma Hettige Lichchavi Rajasinghe

Lupus is a systemic autoimmune disease that occurs when your body's immune system basically self-antibodies , a.k.a auto-antibodies (auto Abs), attacks its own tissues and organs. Intranasal instillation of lupus-prone mice with crystalline silica (cSiO2), an environmental toxicant linked to human lupus, accelerates systemic autoimmunity and glomerulonephritis. Notably, these effects were prevented when mouse diets were supplemented with DHA. Here, we assessed how cSiO2 induces and DHA suppresses the human lupus specific auto Abs over time in this novel preclinical model. Female NZBWF1 mice at 6 weeks of age were fed is caloric diets supplemented with DHA or control before 2 weeks mice were intranasally instilled with 1 mg cSiO2 or saline vehicle alone once per week for 4 weeks at 8 weeks of age. Cohorts were sacrificed at 1, 5, 9, or 13 weeks post-instillation of the last cSiO2 dose. BALF and

Plasma was collected for auto Abs profiling using microarray. Here we tested known IgG and IgM human lupus auto abs markers namely anti-chromatin, anti-complement C1q, anti-dsDNA, anti-Histone, anti-H2B, anti-KU (P70/P80), anti-La/SSB, anti-MPO, anti-PR3, anti-Ro-52/SSA, anti-Ro-60/SSA, anti-SmD1, anti-SmD2, anti-SmD3, and anti-U1-snRNP-68. Our analysis revealed that cSiO2 triggered production of aforementioned IgG and IgM auto Abs markers starting at week 5 and peaked at week 9th. DHA supplementation before and after cSiO2 installation inhibited above auto abs markers belongs to IgG and IgM isotypes between weeks 5-13th. Our results highlight a newly identified function of DHA in suppressing production of human lupus auto abs markers in Murine Model of Lupus Flaring.

TGM2-crosslinked Fibrinogen and its interaction with the inflammatory response
Jazmin Johnson
Category & Time: Pharmacology & Toxicology, Section 3, 1:00 PM - 2:15 PM
Poster: 237
Mentor: James Luyendyk

Background: The blood clotting protein fibrinogen acts as a bridge between the hemostatic system and the inflammatory response. Previously, fibrinogen was believed to only interact with inflammatory cells in its clotted form; however, recent studies in our lab have shown that a form of fibrinogen that has been cross-linked in a coagulation-independent manner by tissue transglutaminase-2 (TGM2) may uniquely affect the function of macrophages. We hypothesize that TGM2- crosslinked fibrinogen will prolong the macrophage response to the pro-inflammatory stimulus, lipopolysaccharide (LPS), by suppressing the induction of anti-inflammatory cytokines. Methods: Bone Marrow-derived Macrophages will be isolated from mice and cultured. These cells will be plated in cell culture wells that have been coated with Fibrinogen or TGM2-crosslinked fibrinogen. Macrophages will be stimulated with lipopolysaccharide (LPS) for 4 and 24 hours to induce an inflammatory response. Messenger RNA and supernatant will be collected, and gene induction and protein levels of pro-inflammatory cytokines will be measured using qPCR and ELISA. Results: We predict that over longer periods of time, the amount of anti-inflammatory cytokines will continue to decrease. We expect that this decrease in anti-inflammatory cytokines will cause an overproduction of pro-inflammatory cytokine. Conclusion: Our results will suggest that fibrinogen that has been modified in a coagulation-independent manner is capable of altering the pro-inflammatory response of macrophages. The Fibrinogens ability to control the production of anti-inflammatory cytokines can change the understanding of how tissue is repaired. Funding: Student support was provided by NIH grant R25 HL103156.

A Role for Translocator Protein 18kDa in Modulating the Efficiency of the Electron Transport Chain through an Aryl Hydrocarbon Receptor Mediated Pathway
Winnie Kamindo
Category & Time: Pharmacology & Toxicology, Section 3, 1:00 PM - 2:15 PM
Poster: 238

Mentor: John LaPres, Elahe Crockett-Torabi

Introduction: Translocator protein-18kDa (TSPO) is a protein located in the outer mitochondrial membrane. TSPO's cellular function is not understood, however, it can modulate mitochondrial cholesterol transport and interact with the intermediate products of heme synthesis. The aryl hydrocarbon receptor (AHR) is a ligand activated transcription factor that controls the cellular response to environmental toxicants, such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Interestingly, putative endogenous ligands for the AHR include cholesterol, heme and their metabolites. Adding another layer of possible interaction between the AHR and TSPO, recent research in our laboratory has shown that a portion of cellular pool of AHR is located in the intermembrane space of the mitochondria (mitoAHR). Based on similarities in location and metabolite interactions, we hypothesized the possible involvement of TSPO in modulating the efficiency of the electron-transport-chain (ETC) through an AHR-mediated pathway. Methods: We measured the oxygen consumption rate (OCR) of naive and activated wild-type and TSPO knockout-mouse microglial cells (BV2s) treated with TCDD and/or PK11195, a high affinity ligand for TSPO. Additionally, we utilized Quantitative-RT-PCR to analyze mRNA expression of genes indicative of AHR and mitochondria activity. Results/Conclusion: Our hypothesized model suggests that TSPO-/- cells will yield a higher OCR in comparison to the wild type cells due decreased efficiency in the ETC. Discussion: Insight into how TSPO impacts AHR-mediated toxicity could be vital in the development of effective pre-exposure and post exposure treatment methods for populations exposed to such environmental pollutants. Support: W.W.K. is a REPID-scholar, supported by NIH-R25-NHL108864 award to E.C., and NIEHS SBRP P42ES4911 to J.J.L.

Exploring the physiological roles of unsaturated fatty acids using C. elegans
Benjamin Kessler
Category & Time: Pharmacology & Toxicology, Section 3, 1:00 PM - 2:15 PM
Poster: 239
Mentor: Jamie Alan, Kin Sing Lee

Monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs), classified broadly as unsaturated fatty acids, are macronutrients that have a wide range of physiological benefits. It is known that unsaturated fatty acids play a crucial role in a healthy diet, but it is unclear which specific MUFAs AND PUFAs are required and what the physiological consequences of having different amounts of these fatty acids and their metabolites in the body are. Omega-3 and omega-6 PUFAs have been shown to treat or prevent human disease, such as cardiovascular disease, inflammatory conditions, and certain cognitive impairments. This study aims to investigate the physiological roles of individual MUFAs and PUFAs. From this study, we will gain the preliminary knowledge for making dietary and treatment suggestions for patients with various disease states, like cardiovascular disease. To do this, we will use the model organism C. elegansbecause of itsshort lifespan and abundance of genetic tools available (including single and multiple genetic knockouts of fatty acid desaturase enzymes). Additionally, findings from studies in C. elegans reliably translate to human disease. Preliminary data suggests that specific MUFAs and PUFAs are essential for normal lifespan, physiological function, and neurodevelopment. This study will expand on this by examining every available genetic knockout of fatty acid desaturase enzymes in the worm. We hypothesize that certain unsaturated fatty acids play more important bodily

roles than others. Preliminary results from the lab confirm this hypothesis, as the genetic strains tested thus far show variations in lifespan, fitness, and neurodevelopment.

Effects of epoxy polyunsaturated fatty acids on lifespan and neurodevelopment of Caenorhabditis elegans
Kaitlyn Lumpkins
Category & Time: Pharmacology & Toxicology, Section 3, 1:00 PM - 2:15 PM
Poster: 240
Mentor: Kin Sing Lee, Jamie Alan, Devon Dattmore

Soluble epoxide hydrolase (sEH) is a major enzyme that degrades bioactive polyunsaturated fatty acid epoxides (ep-PUFA's) to their corresponding 1,2-diols. Increasingly, studies show that stabilizing endogenous ep-PUFA's via inhibition of sEH, is beneficial to human health, due to the neuroprotective, anti-inflammatory, anti-hypertensive, analgesic and organ protective properties of ep-PUFA's. However, the molecular mechanism for these effects remains largely unknown. To address this dilemma, we utilized Caenorhabditis elegans (C. elegans) as an in vivo model to screen sEH inhibitors. C.elegans is an ideal model because their PUFA metabolic pathways are almost identical to humans, they are genetically malleable, and findings in this model organism are often translatable to human health. Additionally, these worms are ephemeral, saving time and cost expenditures. Our preliminary results suggest that fat-1 and ceeh-1 null (worms lacking the ability to synthesize omega-3 PUFA's, and worms with decreased sEH, respectively) have significantly reduced lifespans, in opposition to current literature results. Inhibition of sEH increases levels of both omega-3 and omega-6 ep-PUFA's, and it has been reported that the effects of omega-3 ep-PUFA's may have different effects than omega-6 ep-PUFA's. Thus, we hypothesize that co-treating the worms with a sEH inhibitor (AUDA) and specific omega-3 or omega-6 ep-PUFA's will significantly effect worm lifespans. Wild-type (N2) worms treated with corresponding ep-PUFA's are used as a control. Here, we report the results sEH inhibition, along with co-treatment with specific ep-PUFA's on C. elegans lifespan. In addition, we also report their corresponding effect of the neuron development using thrashing assays.

Genotype-Phenotype Correlation of GNAO1 Mutations in Patients
Alexis McCalla
Category & Time: Pharmacology & Toxicology, Section 3, 1:00 PM - 2:15 PM
Poster: 241
Mentor: Richard Neubig, Huijie Feng

Mutations in GNAO1 have been associated with epilepsy, movement disorders, and developmental delay. GNAO1 encodes Gαo, which is the α subunit of the Go protein. This G protein has multiple downstream effects, including inhibition of cyclic AMP (cAMP) production. There are at least 55 different mutations within this gene discovered in patients. These mutations lead to diverse effects on the downstream targets of Gαo protein, and further correlate with the variety of clinical features seen in

GNAO1 patients. Previously, we reported that these clinical features are associated with either loss-of-function (LOF) or partial-loss-of-function (PLOF) mutations, which are seen in patients with epilepsy, or a gain-of-function (GOF) or normal-functioning (NF) mutations, which are seen in patients with primarily movement disorders. Here, using the most canonical downstream pathway of Gαo (inhibition of cAMP), I intend to verify the genotype-phenotype correlation that our lab has identified earlier with newly reported GNAO1 mutations that have not been characterized before.

Deficiency of the BMPR2 Gene in Fibroblasts increases activity of Rho signaling and susceptibility for fibrosis in Pulmonary Arterial Hypertension
Shane Mecca
Category & Time: Pharmacology & Toxicology, Section 3, 1:00 PM - 2:15 PM
Poster: 242
Mentor: Richard Neubig, Yajing Ji

Pulmonary Arterial Hypertension (PAH) is a cardiovascular condition in which blood flow is restricted by vascular stiffness, vasoconstriction or blockage in the arteries of the lungs. This leads to increased pulmonary blood pressure. The most common genetic cause of PAH is a mutation in the BMPR2 (bone morphogenic protein receptor type 2) gene, which plays an important role in the growth and differentiation of many types of cells. Deficiency of BMPR2 affects the activity of the TGFβ downstream SMAD pathway and the Rho/MRTF pathway. TGFβ causes fibroblasts to convert into myofibroblasts, leading to fibrosis. Adventitial fibrosis contributes to vascular stiffness which can cause PAH. My hypothesis is human lung fibroblast WI38 cells with a BMPR2 deficiency will show high activity of SMAD or Rho/MRTF signaling. This makes these fibroblasts more susceptible to convert into myofibroblast. We used shRNA to knock down (KD) BMPR2 in these cells and measured protein levels by western blot to calculate the KD efficiency. The activities of SMAD and Rho/MRTF pathway are tested by pSMAD3/SMAD3 and pMLC2/MLC2 respectively through western blot. The mRNA levels of αSMA, Col1a1 and vimentin are used as fibrosis markers. Once the BMPR2 gene is knocked down in fibroblasts, the stimulation of TGFβ will increase these fibrosis markers to a higher level compared to controls. From this, we will have a better understanding of the mechanism of pathogenesis of PAH. This provides a new perspective in which we can look for novel treatments for this disease.

Gene-Environment Interaction in ALS: Viability of forebrain astrocytes from G93A mice after MeHg exposure
Ariana Miller
Category & Time: Pharmacology & Toxicology, Section 4, 1:00 PM - 2:15 PM
Poster: 243
Mentor: Gretchen Rivera Lopez, William Atchison

The consumption of methylmercury (MeHg) through fish-rich diets has been linked with neurobehavioral and cognitive decline, causing similar symptomology to Amyotrophic Lateral Sclerosis (ALS). The organic mercury compounds have been reported to agglomerate in the cerebral cortex, brainstem, and spinal cord, which are the same areas known to degenerate during ALS. Astrocytes

represent the most abundant macroglia and the largest and most heterogeneous group of glial cell types. The objective of the present study is to test viability of forebrain astrocytes from superoxide dismutase-1G93A (G93A) mice after MeHg exposure. We predict that the higher concentration of methylmercury in astrocytes, more dead cells will result.

Investigating the Effects of PREX2 Mutations on Drug Resistivity in Melanoma
Danny Mitchell
Category & Time: Pharmacology & Toxicology, Section 4, 1:00 PM - 2:15 PM
Poster: 244
Mentor: Richard Neubig

Melanoma is one of the most common forms of cancer, leading to the death of over 9,000 Americans every year. The most frequent mutation in melanoma tumors is the BRAFV600Emutation. Tumors which harbor these mutations initially respond to BRAF inhibitors, but resistance almost always develops within weeks or months. Further characterization of resistance mechanisms will assist in the development of new therapeutic strategies to prevent or reverse drug resistance. Rac1 is frequently mutated in melanoma tumors and cells harboring these mutations are resistant to BRAF inhibitors. PREX2 is a Rac1 GEF that facilitates the conversion of GDP-Rac1 (inactive) to GTP-Rac1 (active). Despite the high frequency of PREX2 mutations in melanoma tumors, the role of these mutations in drug resistance has yet to be characterized. The goal of this study is to test whether cells with PREX2 mutations are resistant to BRAF inhibitors. To do so, I first cloned PREX2 into a lentiviral vector. I then used site directed mutagenesis to create mutant PREX2 variants that were discovered in patient samples and are predicted to be activating mutations. We are now working to characterize whether these mutations promote BRAF inhibitor resistance. By characterizing the role of these mutations in drug resistance, we hope to use this information to develop new therapeutic strategies to prevent or reverse drug resistance, or predict whether a tumor will be resistant to BRAF inhibitors outright.

The Effect of Acute Methylmercury (MeHg) Exposure on AMPA Receptor Expression in the Central Nervous System of Mouse
Kevin Nieves
Category & Time: Pharmacology & Toxicology, Section 4, 1:00 PM - 2:15 PM
Poster: 245
Mentor: William Atchison, Yukun Yuan

α-Amino-3-hydroxy-5-methyl-4-isoxazolepropionicacid receptors (AMPARs) are ligand-gated ionophoric receptor-operated channels who's naturally occurring agonist is glutamate, and mediate fast excitatory neurotransmission in the central nervous system (CNS). AMPARs are tetrameric assemblies of different combinations of four subunits designated GluA1–GluA4. When one of the four AMPARs subunits, GluA 2, is not present, or is an RNA unedited state, the AMPARs become Ca^{2+} permeable and can produce significant increases in $[Ca^{2+}]i$, which can cause excitotoxicity, leading to neuronal dysfunction and death. In patients with amyotrophic lateral sclerosis (ALS), an increase levels of unedited GluA 2 have

been observed. ALS is a neurodegenerative motor neuron (MN) disease in which progressive MN loss in the cerebral cortex, brainstem, and spinal cord occurs. This could occur by interaction with known genetic predispositions to ALS, or more likely, with yet undetermined genetic or epigenetic targets. Previous work from our lab has shown that MeHg exposure, a prominent environmental neurotoxicant, causes increases in [Ca ^{2}+]i in the brainstem and hastens the onset of ALS phenotype in a well described mouse model over-expressing a human mutation in Cu/Zn-containing superoxide dismutase-1 (SOD1G93A mouse, G93A) and expression of GluA2 in the brainstem and increased in MNs. These effects appear to be mediated by AMPARs. We hypothesize that MeHg exposure may change the expression pattern of AMPAR subunits. If this occurs in disease-free human MNs, then this degeneration might be hastened in the presence of MeHg for a population that has some genetic predisposition to ALS. Thus, the purpose of the present study is to identify if changes in gene expression occur in the AMPARs after MeHg exposure in the CNS including: the neocortex, brainstem, cerebellum and spinal cord.

Investigating the Involvement of Apical Transport Mechanisms in the Cytotoxicity of Iodinated Contrast Media on Renal Tubular Epithelial Cells
Veronica O'Connor
Category & Time: Pharmacology & Toxicology, Section 4, 1:00 PM - 2:15 PM
Poster: 246
Mentor: Adam Lauver

Iodinated contrast media (ICM) is used to aid in imaging during coronary angiography. A possible side-effect of the procedure is contrast-induced acute kidney injury (CIAKI); the third most common acute kidney injury resulting from a medical procedure, which accounts for 11% of the total recorded cases. Patients who experience CIAKI have increased odds of mortality. While the exact pathophysiology of ICM is uncertain, it is known that CIAKI results from renal epithelial cytotoxicity, the generation of reactive oxygen species, and ischemia due to vasoconstriction of ?afferent arterioles. Prevention of its toxic effects on kidney cells is limited to preprocedural oral or intravenous hydration. Our laboratory is focused on better understanding the mechanisms underlying CIAKI, and we hypothesize that ICM is transported into proximal tubular cells via apical transporter proteins. This study will focus on the inhibition of multiple transporter mechanisms expressed by RPTEC/TERT1 cells, specifically the OAT and OCT families of transporters, by using known selective transporter inhibitors such as the P2Y12 antagonist ticagrelor (a competitive inhibitor of OAT1 and OAT3). To study the importance of specific transporter mechanisms, cells will be incubated with cytotoxic concentrations of iohexol in the presence of transport inhibitors. Cell viability will be assessed using the CellTiter-Glo® Luminescent Cell Viability Assay. The results of this study will improve our understanding of how ICM mediates its toxic effects.

Studying the Role of n-3 Polyunsaturated Fatty Acids (PUFAs) on Neurodevelopment and Neurodegeneration Diseases Using C. elegans as a Biological Model
Angel Ojeda
Category & Time: Pharmacology & Toxicology, Section 4, 1:00 PM - 2:15 PM
Poster: 247

Mentor: Kin Sing Lee, Jamie Alan

Omega-3 polyunsaturated fatty acids (PUFAs) are essential fatty acids that are suggested to be critical for neurodevelopment and health in general. Although several cohort studies showed that omega-3 PUFAs play an important role in neurodevelopment and are neuroprotective, the effects of omega-3 PUFAs on neurodevelopmental diseases and neurodegenerative diseases remains controversial and by which mechanism is largely unknown. While omega-3 PUFAs is an important class of essential lipids which include several specific PUFAs, we hypothesize that each specific omega-3 PUFA plays a unique role in neurodevelopment. In this project, we will use Caenorhabditis elegans (C. elegans) as a model to study the effect of each omega-3 PUFA on neurodevelopment and neurodegeneration. C. elegans is a transparent nematode which its protein encoded gene is very similar to human and its neurons is almost identical to humans. More importantly, C. elegans has its own biosynthetic pathway for both omega-3 and omega-6 fatty acids; therefore, we can study the effect of omega-3 and omega-6 PUFAs on neurodevelopment by genetically knock out gene along the biosynthetic pathway of PUFAs. More specifically, we will create a novel genetic hybrid C. elegans which the neuron will be labeled with green fluorescent protein and the enzyme along the biosynthetic pathway of PUFAs will be specifically knockout. In addition, we will treat the genetical modified C. elegans with specific PUFAs. We will study how the PUFAs treatment and the specific enzyme knockout along the biosynthetic pathway affects neurodevelopment. Together, the results from these studies will allow us to dissect the role of omega-3 and omega-6 PUFAs on neurodevelopment process.

Bone Morphogenic Protein Receptor Type 2 And Its Role In Pulmonary Arterial Hypertension Pathogenesis
Yan Pacheco
Category & Time: Pharmacology & Toxicology, Section 4, 1:00 PM - 2:15 PM
Poster: 248
Mentor: Richard Neubig, Yajing Ji

Pulmonary arterial hypertension (PAH) is a disease characterized by high blood pressure in the lungs. The pressure increase is caused by the obstruction in the small arteries or vasoconstriction in the lung. Some of these obstructions can be attributed to fibrosis. In pulmonary fibrosis, the lung tissue becomes scarred and ultimately reduces alveoli space and oxygen consumption declines. It is a severe disease with three-to-eight years a survival rate following diagnosis. Deficiency of bone morphogenic protein receptor type 2 (BMPR2) is found in PAH patients. It is hypothesized that silencing of BMPR2 is profibrotic and promotes EMT. We used wi38, human lung fibroblast to test our hypothesis. To knock down BMPR2, short hairpin RNA was cloned into a pLKO vector. HEK-293T cells were then transfected with the shRNA. The virus was then harvested from these cells and WI38 lung tissue derived fibroblast cells were infected. The knock down efficiency is measured by protein level of BMPR2 using western blot. We will test the differences between the BMPR2 KO cells and control cells using immunofluorescence staining. Stress fibers, vimentin, etc were used as a readout of EMT. Differential response of the BMPR2 knockdown cells and control cells are also tested with stimulation with fibrosis stimulators such as TGFb. With these findings, we will have a better understanding of the pathologic mechanism of PAH and how BMPR2 deficiency contributes to disease development.

Comparing the Effects of Clopidogrel and DT-678 on Vascular Function in the Middle Cerebral Artery
Amari Parris
Category & Time: Pharmacology & Toxicology, Section 5, 1:00 PM - 2:15 PM
Poster: 249
Mentor: Adam Lauver

Introduction: Despite the development of newer, more efficacious antiplatelet agents, clopidogrel remains as a broadly used agent in clinical cardiology due to its favorable bleeding risk. However, the effectiveness of clopidogrel in reducing the risk of cardiovascular events is contingent upon formation of the active metabolite clop-AM via cytochrome P450 (CYP) enzymes. As a result, clopidogrel is subject to a complex bioactivation pathway, resulting in unfavorable responses in 40% of patients. Our research team has previously developed DT-678, a novel conjugate of clopidogrel that is not subject to bioactivation by CYP enzymes. Past studies have shown that DT-678 possesses favorable pharmacokinetic and pharmacodynamic properties when compared to clopidogrel. However, a specific comparison of the purinergic effects on vasculature of clopidogrel and DT-678 has not yet been performed. We hypothesize that clopidogrel demonstrates disparate effects on myogenic tone and purine dependent effects on vasculature when compared to DT-678. Methods: We will acquire blood and middle cerebral arteries from rabbits treated with DT-678 or clopidogrel. The blood will be used to test platelet function via light transmission aggregometry. Middle cerebral arteries will be cannulated for pressure myography to determine antagonists effects on myogenic tone and purine dependent effects on the vasculature. Results: We expect to see effects on myogenic tone and purine dependent effects on vasculature from clopidogrel when compared with DT-678, indicating the presence of actions beyond the inhibition of P2Y12. Conclusion: By comparing the effects of DT-678 and clopidogrel on myogenic tone and purine dependent actions on vasculature we can contribute to the development of safer antiplatelet therapeutic strategies.

Immunohistochemical analysis of alpha synuclein overexpression in the mouse myenteric plexus
Marina Perez
Category & Time: Pharmacology & Toxicology, Section 5, 1:00 PM - 2:15 PM
Poster: 250
Mentor: James Galligan, Krishna Yelleswarapu

Parkinson's disease (PD) is a progressive nervous system disorder that is associated with constipation. Constipation, due to dysfunction in colonic motility, is a predominant complaint in 61.4% of PD patients, and the symptom precedes the onset of motor symptoms by up to 20 years. Colonic motility is mediated by the coordinated activity of the excitatory and inhibitory motor neurons found within the myenteric plexus of the enteric nervous system (ENS). Alpha synuclein (α-syn), a presynaptic terminal protein involved in vesicular neurotransmitter release, is found to aggregate in the brain and the gastrointestinal (GI) tract, specifically within the enteric nervous system (ENS), in PD patients. Disruptions in neurotransmission within the ENS may lead to colonic dysmotility. Therefore, our objective is to find which neurotransmitter neurons and nerve fibers overlap with α-syn neurons and nerve fibers within the myenteric plexus of the mouse colon that regulate colonic motility. We will

perform immunohistochemistry on longitudinal muscle myenteric preps (LMMP) of the mouse proximal colon of using vesicular nucleotide transporter (VNUT), tyrosine hydroxylase (TH), choline acetyltransferase (ChAT) and nitric oxide synthase (NOS) to label for neurotransmitters: ATP, dopamine, acetylcholine, and nitric oxide. Because α-syn aggregation may disrupt vesicular neurotransmitter assembly and release, we hypothesize that α-syn will be immunoreactive with cholinergic and purinergic neurons.

Synthesis and Biological Evaluation of Photoswitchable c-Raf Inhibitor
Marah Ranger
Category & Time: Pharmacology & Toxicology, Section 5, 1:00 PM - 2:15 PM
Poster: 251
Mentor: Craig Streu

Chemotherapeutics and other anticancer drugs have come a long way since their discovery, however; the main issue with many cancer medications is the high rate at which healthy, noncancerous cells are damaged along alongside the cancer cells. The death of these healthy cells causes off-target side effects including nausea, fatigue and hair loss. Highly desirable new treatments for cancer can selectively target cancerous cells while excluding healthy cells. One way that we can achieve a more selective therapy is by using photoisomerizable compounds, more specifically azo-stilbenes. Azo-stilbene in particular undergo a trans to cis isomerization when irradiated with blue or UV light. This isomerization is easily reversible and can be accomplished quickly by irradiating the molecule with a longer wavelength of light (typically >500 nm) or more slowly at room temperature in the absence of light. Given that shape complementarity is critical for many drug-target interactions, this change in shape results in a change in bioactivity. When in their trans form the azo-compounds cannot bind to the same target that they can in their cis form. One potential target for photo-switchable therapeutics is c-Raf. C-Raf is a kinase that plays a key role in a pathway that regulates the cellular cycle including cell proliferation and apoptosis, which is dysregulated in some cancers. This work will describe the design, synthesis, photokinetic analysis, and preliminary bioactivity measurements for three lead molecules with potential as photoswitchable drugs based upon a previously reported c-Raf inhibitor.

Investigating the role of dopamine D2 receptor in the aversive effects of methamphetamine
Erin Reasoner, Kalyn Peterson
Category & Time: Pharmacology & Toxicology, Section 5, 1:00 PM - 2:15 PM
Poster: 252
Mentor: Zeni Shabani

Innate avidity for methamphetamine (MA) use is influenced by sensitivity to its rewarding and aversive effects. MA induces these effects through mass release of the neurotransmitter dopamine, stimulating receptors throughout the mesocorticolimbic pathway, including dopamine D2 receptor (D2R). Presently, little is known about the extent to which D2R contributes to MA-induced motivational effects. In this study, we sought to investigate motivational effects of D2R activation by using a genetic mouse model in which mice were selectively bred for low MA drinking (MALDR) and high MA drinking (MAHDR). Mice

were subjected to a condition place preference (CPP) procedure wherein administration of a D2R agonist, quinpirole, at doses of 0.1 and 0.5 mg/kg was paired with specific contextual cues. Subjects were later tested in the presence and absence of the drug for CPP or aversion (CPA). Thermic responses to quinpirole were also measured at the end of the experiment, as MA has shown opposite thermic effects on MALDR and MAHDR mice. In MALDR and MAHDR mice, quinpirole induced significant CPA in both drug-free and drug-present CPP tests. Additionally, MALDR mice alone demonstrated a significant increase in locomotor activity, regardless of dose, in a drug-free CPP test. In a drug-present CPP test, significant locomotor suppression was identified in both mouse lines across both doses. Thermic responses to quinpirole were minimal. Overall, our findings indicate that D2R plays an important role in the aversive effects of MA and suggest consideration as a potential therapeutic target for curbing MA intake.

Protective effect of docosahexaenoic acid against crystalline silica induced cell death in Max Planck Institute cells
Alexa Richardson
Category & Time: Pharmacology & Toxicology, Section 5, 1:00 PM - 2:15 PM
Poster: 253
Mentor: James Pestka, Preeti Chauhan

Respiratory exposure to crystalline silica (cSiO2) has been etiologically linked to the development of autoimmune diseases such as Systemic Lupus Erythematosus (SLE). Phagocytosis of cSiO2 by alveolar macrophages can facilitate its clearance but can also result in cell death and autoantigen release leading to loss of self - tolerance. In our study, we determined in vitro how omega-3 fatty acid docosahexaenoic acid (DHA) protects alveolar macrophages from cSiO2-induced cell death by using a self-renewing primary alveolar macrophage cell line derived from fetal liver named Max Planck Institute cells (MPI). To achieve this objective, cells were preincubated with DHA (10 and 25uM) for 24h and then exposed to cSiO2 (25 and 50 ug/ml) for 6h. After cSiO2 treatment, medium and cells were used for assessment of cell death by lactate dehydrogenase (LDH) assay, CellTiter 96® AQueous One Solution Cell Proliferation Assay (MTS), and acridine orange (AO) and Propidium iodide (PI) staining. Data was processed in terms of cytotoxicity by measuring LDH release, cell viability by MTS and dead cell percentage by counting of AO and PI positive cells by microscopic examination. Our findings suggest cSiO2 dose-dependently induced cytotoxicity and cell death in MPI cells. Additionally, DHA pre-treatment ameliorated death of MPI cells. DHA significantly prevented cell death as compare to vehicle treated groups, supporting the protective effect of DHA. Therefore, we can conclude that DHA may have protective intervention against cSiO2-induced cell death.

Role of methylmercury in GABA receptor development through expression of NKCC1/KCC2 in C57BL6J mouse spinal cord, cerebellum, brain, and brain stem slices
Nicole Rivera
Category & Time: Pharmacology & Toxicology, Section 5, 1:00 PM - 2:15 PM
Poster: 254
Mentor: Yukun Yuan

Methylmercury (MeHg) is an organic environmental contaminant. Exposure to MeHg can lead to neuro-degeneration and eventual pathological effects, affecting neurons. In mature brains, Gamma-aminobutyric acid (GABA) is a major inhibitory transmitter that plays an essential role in controlling neuronal excitability. When GABA bind to GABAAreceptor, a ligand-gated chloride channel that facilitates passive influx or efflux of chloride ions (Cl-) depending on the neuronal intracellular Cl- concentration ([Cl-]i). GABA action is initially depolarizing when GABAAreceptors are activated in immature neurons, after the first two postnatal weeks. The GABA action then becomes inhibitory when GABAAreceptors are activated in mature or adult neurons. This age-dependent switch of GABA action is due to developmental changes in relative expression of the Cl–-cation co-transporters (CCCs) Na+, K+-2Cl--co-transporter-1 (NKCC1) and K+-Cl–- co-transporter-2 (KCC2). NKCC1 and KCC2 are the primary importer and exporter of neuronal intracellular [Cl-]i, respectively. The aim of this project is to test if MeHg exposure reverses this development course by affecting NKCC1/KCC2 expression. To do this, spinal cord, cerebellum, neocortex, and brain stem slices of a C57BL6J mouse will be exposedin vitroto MeHg at 10µM and 5µM for 2 hours and 4 hours, respectively. After this acute exposure to the slices, the total RNA is extracted. Afterward, qPCR is performed to examine if acute MeHg exposure affects the relative expression levels of the NKCC1 and KCC2 cotransporters. Based on electrophysiological evidence obtained from our lab, we hypothesized that the NKCC1 and KCC2 expression levels will be affected by the MeHg exposure.

Understanding the Relationship Between the Aryl Hydrocarbon Receptor (AhR), Translocator Protein (TSPO), and Mitochondrial Function in Mouse Lung Epithelial Cells
Andrés Rivera-Ruiz
Category & Time: Pharmacology & Toxicology, Section 6, 1:00 PM - 2:15 PM
Poster: 255
Mentor: John LaPres

The aryl hydrocarbon receptor (AHR) is a ligand-activated transcription factor, part of the Per-Arnt-Sim (PAS) superfamily of environmental sensors. The AHR mediates most, if not all, of the toxicity induced by environmental pollutants, such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). In contrast to TCDD-induced toxicity, the AHR also plays a role in developmental and homeostatic processes, presumably upon binding to putative endogenous ligands, such as cholesterol, heme, and tryptophan derivatives. Interestingly, studies suggest that a portion of the cellular pool of AHR resides within the mitochondria, though its function in this organelle is not defined. Another important mitochondrial protein is the translocator protein (TSPO). TSPO was identified several decades ago, however, its cellular function is not understood. TSPO is also known to interact with cholesterol and heme derivatives, similar to the AHR. Given their shared location (i.e. in the mitochondria) and ability to bind similar metabolites, we hypothesized that crosstalk between the AHR and TSPO regulates mitochondrial metabolism and the efficiency of the electron transport chain (ETC). To test this hypothesis, we measured the oxygen consumption rate (OCR) and mRNA expression of critical genes via quantitative real time polymerase chain reaction in wild type mouse lung epithelial cells (i.e. MLE12s) and MLE12s that are null for the AHR and TSPO. Our model suggests that we will observe higher basal OCR in AHR-/- and TSPO-/- cells in comparison to wild type cells due to a decrease in ETC efficiency and that this will be partially due to

changes in gene expression.

Dietary supplementation with omega-3 docosahexaenoic acid suppresses silica-induced lung inflammation and gene expression in acute autoimmunity
Liz Ross
Category & Time: Pharmacology & Toxicology, Section 6, 1:00 PM - 2:15 PM
Poster: 256
Mentor: Preeti Chauhan, James Pestka

Development of autoimmune disease involve multistep processes in which genetic and environmental factors play important roles. Type I IFNs are one of the key signals associated with the pathogenesis of the autoimmune disease (SLE) via the sustained activation of autoreactive T and B cells necessary for the production of pathogenic autoantibodies. Previously, our lab has shown that instillation of the environmental toxicant, crystalline silica (cSiO2), triggers premature loss of self-tolerance in the lung of lupus-prone NZBWF1 mice, evidenced by cell infiltration, pro-inflammatory cytokine release, and tissue pathology. Dietary supplementation with the ω-3 polyunsaturated fatty acid (PUFA), docosahexaenoic acid (DHA), can abrogate this cSiO2-accelerated autoimmunity. However, the acute phase of this response has never been characterized. To assess early time-dependent effects of DHA consumption on cSiO2-triggered acute inflammation, cohorts (n=8/gp) of 6-week-old female NZBWF1 mice were fed an isocaloric AIN-93G diet supplemented with 1% DHA. At 8 weeks of age, mice were intranasally instilled with 2.5 mg cSiO2 or saline vehicle and maintained on control or DHA-rich diets. Cohorts were sacrificed at 1, 7, 14, 21, or 28 days post-instillation (PI) and the lung and bronchoalveolar lavage fluid (BALF) collected for analysis of mRNA and immune cell infiltration. Preliminary analysis demonstrates that diet containing DHA significantly suppresses silica-triggered macrophage and lymphocyte recruitment to the lung in later timepoints, as well as gene expression of most of type 1 IFN related genes. These results suggest that DHA may play a role in preventing early cell-signaling pathways required for lymphocyte response, and therefore the autoimmune response present in lupus and other autoimmune diseases.

Livestock Farm-Derived PM2.5 Induces Allergic Inflammatory and Mucous Cell Responses that are Associated with the Source of the Particulate Matter
Sarah Shareef
Category & Time: Pharmacology & Toxicology, Section 6, 1:00 PM - 2:15 PM
Poster: 257
Mentor: James Wagner

Airborne fine particulate matter (PM2.5) derived from livestock farming is a combination of dusts, biogenic materials and anthropogenic emissions. Allergic individuals that work in or live near high density animal operations may be at a higher risk for adverse health effects associated with exposure to particulate pollutants. We tested the hypothesis that exacerbation of allergic airway responses to livestock farm particles is dose-and-source-dependent. We collected PM2.5 from two chicken farms, two pig farms, and two goat farms in the Netherlands. Female BALB/c mice (6-8 weeks old) were sensitized and boosted with ovalbumin (OVA; days 0, 10, respectively), and then challenged with intranasal saline or OVA for 2 consecutive days (days 17, 18) prior to a single intranasal exposure to 0,

0.9, or 3 µg of farm-derived PM2.5. Twenty-four hours later mice were euthanized and bronchoalveolar lavage fluid (BALF) was collected for differential cell analysis and lung tissues were processed for light microscopy to analyze intraepithelial mucosubstances (IM). OVA sensitization and challenge induced allergic airway inflammation, indicated by accumulation of eosinophils in BALF and increased IM in conducting airways. PM2.5 alone had no adverse effects, but increased BALF eosinophils in allergic airways (rank potency goat PM>>pig PM>chicken PM). Particles enhanced IgE responses (chicken>>goat>pig) with dose-dependent effects only in chicken. However, no farm particles affected OVA-induced IM increases in allergic mice challenged. Our results suggest that exacerbation of allergic airway inflammatory responses by livestock-farm associated PM2.5 caused an exacerbation in BALF inflammatory cells but not in epithelial remodeling and mucous production.

INHIBITION OF TAM RECEPTORS PREVENTS RESOLUTION OF INFLAMMATION AFTER ACUTE LIVER INJURY
Jan Smith
Category & Time: Pharmacology & Toxicology, Section 6, 1:00 PM - 2:15 PM
Poster: 258
Mentor: Bryan Copple

Acetaminophen (APAP) hepatotoxicity is the most common cause of acute liver failure (ALF) in the United States. In ALF, resolution of hepatic inflammation fails to occur leading to persistent proinflammatory cytokine induction. This can ultimately lead to multiorgan failure. Unfortunately, the mechanisms that regulate the resolution of inflammation following acute liver injury are poorly understood. Elucidation of the mechanism underlying persistent cytokine induction in ALF could lead to development of therapies aimed at stimulating the resolution of inflammation. Hypothesis:In the present studies, we tested the hypothesis that TAM receptors, a group of phosphatidylserine receptors, are important for resolving inflammation. Methods/Results:To examine the role of TAM receptors, mice were treated with a TAM receptor inhibitor, (LDC1267; 20 mg/kg) after APAP. Inhibiting TAM receptors did not affect liver injury, but prevented clearance of necrotic cells. Furthermore, in mice treated with APAP alone, cytokine levels returned to baseline at 72 hours. However, inhibiting TAM receptors prevented resolution of cytokine induction. Conclusion: Collectively, these studies indicate TAM receptor activation is important for stimulating phagocytosis and reducing cytokine induction. In future studies, we will evaluate whether TAM signaling is disrupted in ALF and whether stimulating this pathway would initiate resolution of inflammation.

The Role of Childhood Obesity in Future Development of Dementia
Christina Straham
Category & Time: Pharmacology & Toxicology, Section 6, 1:00 PM - 2:15 PM
Poster: 259
Mentor: Anne Dorrance

Mid-life obesity poses many health risks, including the development of cognitive impairments and dementia. However, long-term cognitive effects of childhood obesity are unknown. We hypothesize young mice fed a high fat diet to induce obesity (HFD mice) will exhibit cognitive impairments. Cognitive

function will be assessed by behavior tests. Three-week-old C57BL/6 male mice were separated into two groups (n=4 per group) post-weaning and were fed a 60% or a 10% fat control diet. Behavioral testing was conducted after 17-21 weeks on the diet. Novel object recognition test evaluates non-spatial memory, Barnes maze evaluates spatial memory, and nesting tests evaluate executive function. All data are analyzed by a T-test. HFD mice weighed more than control mice (52.8g ± 1.3 vs. 37.4g ± 1.0). In nest scoring tests, the controls scored the same as HFD mice (2.4 ± 0.6 vs. 2.3 ± 0.3). Controls shredded the same amount of nesting material as HFD mice (25.3% ± 7.8 vs. 29.5% ± 4.2) and took the same amount of time to integrate new nesting material to their nests (21.5s ± 5.5 vs. 47.3s ± 17.5). Controls had the same latency to the escape hole as HFD mice (5.8s ± 1.6 vs. 12.0s ± 4.2). Further cognitive function tests will be performed. As childhood obesity becomes more prevalent, our studies will raise awareness for the risk of developing dementia as a result.

The role of Nrf2 in polarization of the Th17, CD4+ T cell subset in Mice
Gloria Yarandi
Category & Time: Pharmacology & Toxicology, Section 6, 1:00 PM - 2:15 PM
Poster: 260
Mentor: Cheryl Rockwell, Elahe Crockett-Torabi

Introduction: The Nuclear factor erythroid 2 related factor 2 (Nrf2) transcription factor responds to cell stress such as reactive oxygen species, electrophilic xenobiotics, and heavy metals by inducing transcription of a battery of antioxidant and detoxification genes. Previous data from our lab indicates a regulatory role of Nrf2 in polarization of CD4+ T-cells towards a Th2 phenotype (allergic), following activation by the food additive and known Nrf2 activator, tBHQ. However, little is known regarding the role of Nrf2 in the regulation of additional T-helper subsets. Therefore, the goal of this study is to understand the role of Nrf2 in TH17 CD4+ T-cell regulation. Hypothesis: Nrf2 will play a role in the regulation of Th17 differentiation. Methods: Isolated splenocytes or CD4+ T-cells from wild-type or Nrf2 null mice are activated with T-cell specific antibodies and IL1-7α, and then IFNγ cytokine production will be analyzed by ELISA and intracellular labeling. Results and Conclusion: The results of these studies will provide further information on the role of Nrf2 in CD4+ T-cell function. Support: G.Y. is a REPID scholar, supported by NIH, 5-R25-HL108864 award to Dr. Elahé Crockett, and R01ES024966 award to Dr. Cheryl Rockwell.

Fighting Klebsiella pneumoniae via Nanoparticles
Mahlet Adugna
Category & Time: Biosystems & Agricultural Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 265
Mentor: Evangelyn Alocilja

Klebsiella pneumoniae causes pneumonia, which is a leading cause of death in children worldwide. The growing resistance and virulence of K. pneumoniae has led to research of alternative means to fight these bacteria via nanotechnology. The exact mechanism of how the proprietary antimicrobial nanoparticles work is unknown, but they overcome many of the barriers of traditional antibiotics, such as resistance. Due to their smaller size and greater surface area to volume ratio, nanoparticles penetrate

and carry on their effects through the bacteria's membrane more efficiently. The efficiency of these antimicrobial nanoparticles in killing and stopping the growth of K. pneumoniae was explored by incorporating the antimicrobial nanoparticles at different times of the bacterial growth process: early in the growth period, during the platting period, and after the incubation period. The bacteria were incubated at 37 degrees Celsius and grown overnight following each trial. The efficiency of each method was measured as a percentage of bacterial colonies killed compared to the control variable, which contained no antimicrobial nanoparticles. Knowing the most effective method in incorporating these antimicrobial nanoparticles may help in future studies looking more into the exact mechanisms by which the nanoparticles work as components of the method can be further analyzed. The research is to support the eventual use of nanoparticles as a cheaper, more efficient way to treat K. pneumoniae as well as other strains of resistant bacteria.

Engineering approach to Eradication of Invasive Red Swamp Crayfish in Michigan
Douglas Clements
Category & Time: Biosystems & Agricultural Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 266
Mentor: Wei Liao

An invasive species of crayfish was introduced to southeastern Michigan in 2015. The Red Swamp Crayfish (Procambarus clarkii) is more aggressive than native species, can rearrange food webs, and causes damage to civil infrastructure by burrowing. The Michigan Department of Natural Resources (MDNR) responded to the infestation with a control plan. The MDNR funded previous work with P. clarkii which shows that they are attracted to a band of white noise between 10 and 15 kHz. Current trapping methods involve the use of semi-cylindrical minnow traps, modified with larger inlets, and filled with dog food as a bait. This research focuses on improving trapping rates through a combination of sound lure and food bait. Food-baited traps were placed along the inside perimeter of two ponds in Novi. An underwater speaker was placed at random locations along the perimeter and played for two days. Bait was removed for two days for a sound only condition. Empty traps were then allowed to sit in silence for two days. The traps were checked and emptied each day and crayfish quantity, species, and carapace length were recorded. An N-mixture model framework was developed to account for environmental variables. The expected results are a 50% catch per unit effort (CPUE) increase, based on laboratory trials.

Sorption of Phosphorus from Agricultural Tile Drainage: Isotherm Studies
Emily Dettloff
Category & Time: Biosystems & Agricultural Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 267
Mentor: Steven Safferman

Tile drain systems are common in areas with a high water table or a lot of rainfall because it removes water from farm fields quickly. However, this water may have high levels of nutrients, specifically phosphorus. When tile drainage reaches surface water, the nutrients cause algal blooms and eutrophication. Different media can be used to absorb phosphorus from tile drainage before it reaches

surface water. Isotherm studies were conducted in bottles using synthetic tile drain water (STDW) and granular media. The isotherms were kept in a shaker at 25oC and shaken at 125 rpm. Over the course of 24 hours, the bottles were removed from the shaker at staggered times. Some isotherms were tested using 4 different amounts of media with all being tested after 24 hours in order to determine the phosphorus capacity of each. Soluble phosphorus was tested using HACH analysis kits and results compared over time. If the phosphorus showed substantial removal, the media was tested in a column study. Columns of working media were made and STDW was pumped upward through the media. Influent and effluent phosphorus levels were tested, as well as flow rate to determine how well the media worked in a more realistic application. Ideally, media that is most effective in removing phosphorus and is economically feasible will be identified and it will be able to be applied to drainage tiles on farms in the future.

Optimization of Bag-in-Box Technology for Cucumber Fermentation
Lauren Kaltz
Category & Time: Biosystems & Agricultural Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 268
Mentor: Steven Safferman

Food loss refers to the amount of available, edible food that is not consumed and enters the waste stream. According to the USDA, 31% of available food in the United States ends up as waste. Preserving this food would not only minimize environmental impacts, but also increase profitability. In previous studies, it has been shown that bag-in-box technology for brining cucumbers is an effective method of food preservation, as it enables a low salt process that allows the brine from fermentation to be reused in the finished product. This also reduces washing, which prevents the production of high salt wastewater. The purpose of this research is to investigate the bag-in-bog technology as a way to preserve food at an industrial scale for growers, processing facilities, and retailers. The design of this system replaces the blanching and cooling steps with a nitrogen purging system that creates anoxic conditions to discourage the growth of unwanted microbes and remove carbon dioxide formed during fermentation. In current experiments, carbon dioxide is being pumped into the bag-in-box system as a way to stimulate the carbon dioxide formed during fermentation. This allows for determining the optimal flow rate of nitrogen for the purging process.

Estimation Exposure of PFAS in Dental Floss
Breanna Lawrence
Category & Time: Biosystems & Agricultural Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 269
Mentor: Courtney Carignan

Per and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that include Perfluorooctanoic acid (PFOA), which are used in many products for their stain and water-resistant properties. PFOA was phased out of use in 2010 due to health concerns, and replaced in products with other PFAS chemicals. One surprising product that uses PFAS is dental floss. A 2005 study by the Food and Drug Administration (FDA) reported PFOA in a new type of unwaxed gliding dental floss. Human

exposure was thought to be low from this use, as previous studies suggested PFOA has low dermal absorption. However, a recent study reported that women who reported using that same type of dental floss (i.e., Glide®) had higher levels of PFOA in their blood compared to women who used other types of floss. This suggests that absorption of PFAS from dental floss may be higher than previously thought, possibly due to increased absorption through the gums compared to skin. Therefore, we aim to estimate total exposure to PFAS in dental floss from contact with the gums, hands, and mouth.

A Robust Algal Assemblage to Capture CO2 in Air and Flue Gases
Annaliese Marks
Category & Time: Biosystems & Agricultural Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 270
Mentor: Yan Liu, Wei Liao

Rapid growth of the world's population, along with accelerating industrialization and expanding urbanization, has led to a dramatic increase of carbon emissions that have exceeded the amount that can be taken up by natural sinks. Reducing CO2 emission is urgently needed to stabilize Earth's surface temperature and avoid catastrophic consequences in the future. The objective of this study is to investigate robustness and stability of an algal assemblage that was selected and screened from the Great Lakes region that demonstrates a good capacity to capture and sequester CO2 in air and flue gases. Algae and bacteria that are symbiotically present in the assemblage were analyzed using advanced genetic technologies. DNA was extracted from the samples. Both qPCR and metagenomic analysis were performed to understand the dynamic changes of algae and bacteria during the cultivation of CO2 capture. Non-metric multidimensional scaling (NMDS) analysis was applied to elucidate the relationship between algal and bacterial communities, CO2 capture, and other culture conditions.

Using machine learning to aid tuberculosis detection using nano-biosensors
Paul McKinley
Category & Time: Biosystems & Agricultural Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 271
Mentor: Evangelyn Alocilja

Although highly treatable, tuberculosis (TB) remains responsible for an average of 1.5 million deaths per year, making it one of the deadliest infectious diseases in the world. This is due in large part to the fact that treatment effectiveness is highly dependent on a timely diagnosis, a task that becomes increasingly difficult in developing countries which lack access to advanced medical resources. The last ten years have seen noticeable improvements in TB diagnostics to the standard Ziehl-Neelsen sputum smear method which yields an average 50% success rate. While some methods now result in much higher accuracies, many take days and sometimes weeks to complete. The use of gold and magnetic nanoparticles, however, can yield a diagnosis on the scale of hours, using extremely cost-effective methodology. Yet even with effective experimental results, a trained microscope operator is still needed to analyze samples which can be an exhausting and slow process, especially when such specialists are often overloaded with patients. In the rapidly-expanding area of machine learning, however, images can be processed automatically, using trained neural networks to recognize infected samples and provide

diagnoses automatically. This project aims to expand on this growing body of research, coupling a rapid detection method using nanoparticles with efficient image processing through neural networks. In doing so, we hope to lay the groundwork for a system that can eventually yield TB diagnoses with mobile applications in the field, saving lives in the process.

Microscopic Evaluation of Gamma-valerolactone Pretreatment on Biomass.
Abisola Ojoawo
Category & Time: Biosystems & Agricultural Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 272
Mentor: Cynthia Collings

With the global rise in energy consumption and the adverse effect of petroleum-based products on the environment, there has been more effort geared towards sustainable means of producing liquid fuels and other products from lignocellulosic biomass. Lignocellulosic biomass is composed primarily of cellulose, hemicellulose, and lignin. Biofuels can be produced from the fermentation of sugars found in the cellulose and hemicellulose in the biomass, which can only be accessed after the breakdown of lignin during the pretreatment process. An ideal pretreatment process should remove lignin without degrading the sugars in the cellulose and hemicellulose to ensure maximum product yield, and make the cellulose and hemicellulose more susceptible to further treatment, thereby reducing the number of downstream enzymes, making the overall biomass processing as cost-effective as possible. This project involves the study of the effectiveness of γ-valerolactone (GVL), a biomass-derived and recyclable solvent, in removing lignin and improving cellulose digestibility. A microscale pretreatment was carried out on cross sections of poplar using GVL, and the cellulose accessibility was measured by adding green fluorescent protein (GFP) tagged carbohydrate binding modules and imaged with the aid of fluorescence microscopy and Stimulated Raman Scattering microscopy (SRS). There was a significant improvement in cellulose accessibility in the biomass after GVL pretreatment and also an improvement in cellulose digestibility after adding enzyme. Developing the right pretreatment strategy will ensure maximum utilization of each biomass component and enable successful integration of sustainable fuels into the society.

Electrocatalytic Hydrogenation (ECH) of 4-Propylguaiacol, a Bio-oil Model Compound
Kaung Su Khin Zaw, Meheryar Kasad
Category & Time: Biosystems & Agricultural Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 273
Mentor: Christopher Saffron, Meheryar Kasad

Bio-oil, the liquid product from fast pyrolysis of biomass, contains reactive oxygenates, it polymerizes and corrodes metallic surfaces which hampers long-term storage and transportation. Electrocatalytic hydrogenation (ECH) stabilizes and upgrades bio-oil under milder conditions compared to the classical hydrotreatment. Ruthenium supported on activated carbon cloth (Ru/ACC) was used as an electrocatalyst in this study on ECH of 4-propylguaiacol, a bio-oil model compound. The effect of potential difference between the electrodes and temperature was investigated. The products were analyzed using gas chromatography–mass spectrometry (GC-MS). Analysis shows that trials run at high

potential difference and high temperature resulted in increased conversion of 4-propylguaiacol.

Detection of Waterborne Pathogens in Water using Magnetic Nanoparticles
Kristen Trinh
Category & Time: Biosystems & Agricultural Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 274
Mentor: Evangelyn Alocilja

Escherichia coli can be found in the intestines of animals and humans. However, some strains of E. coli are harmful, causing symptoms including stomach cramps, diarrhea, and vomiting. E. coli, a fecalindicator bacteria (FIB) regardless of what strain, is readily transmitted through contaminated water or food. Because of the dangers associated with these strains, recreational water that could be potentially contaminated with E. coli must constantly be tested to ensure the area is clean and safe for public use. Current conventional methods of sampling require lengthy testing times, can only detect levels of bacteria higher than pathological levels. We hypothesize that magnetic nanoparticles (MNPs) can efficiently detect FIB in water samples in six hours. We will test our hypothesis by adding positively charged MNPs to water samples with negatively-charged bacteria to form MNP-cells and extracted using a neodymium magnet and then plated on selective agar to differentiate the types of bacteria present. MNP-cells will then be viewed on a microscope to confirm. MNPs are projected to be able to detect as little as 10 CFU/mL in the samples and shorten the process to provide water quality test results to the public as soon as possible compared to conventional methods. This method of detection is cheaper and faster than conventional testing methods, making it ideal for developing countries with limited access to technology. MNPs can also be used to test for bacteria in drinking water and food which can help reduce the levels of pathogenic bacterial outbreaks worldwide.

Lipids alterations associated with oxidative stress in brain neurodegeneration
Lisa Zou
Category & Time: Biosystems & Agricultural Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 275
Mentor: Ilce Medina Meza

Neurodegenerative diseases, mental disorders, stroke and central nervous systems (CNS) traumas are problems of vast clinical importance. The crucial role of lipids in tissue physiology and cell signaling is demonstrated by the many neurological disorders, including bipolar disorders and schizophrenia, and neurodegenerative diseases such as Alzheimer's, Parkinson's, Niemann-Pick and Huntington diseases, that involve deregulated lipid metabolism. Oxidative stress is one of the major contributors to the altered lipid metabolism. Brain contains a highest amount of lipids, especially cholesterol, and is vulnerable to oxidative stress and lipid peroxidation. The aim of this study is to evaluate lipid alterations and cholesterol oxidation products (COPs) deposition in brain and liver from mice and rabbits. Lipidomics and sterolomics along with biochemical assays were performed. Tissues were collected from various animal models and humans. Biochemical analysis, includes catalase, superoxidase dismutase, lipid hydroperoxide and COX fluorescence assays, give insight into the connections between how oxidative stress and antioxidant defenses play a role in neurological diseases. Regarding the catalase

assay, increased catalase activity due to high levels of hydrogen peroxide molecules in tissue samples indicates higher oxidative stress. Concerning the superoxide dismutase, higher levels of superoxide dismutase activity due to high levels of the superoxide anions further denote increased antioxidant defenses. The sterols of the samples are also extracted to observe both the cholesterol content and the COPs profile. Further research in this area can benefit neurological disease screening in critical diseases such as Alzheimer and Parkinson's diseases.

Flexible Boron-Doped Diamond Wearable Sensors used in Chemical Detection
Katie Albus
Category & Time: Chemical Engineering & Materials Science, Section 1, 2:30 PM - 3:45 PM
Poster: 276
Mentor: Thomas Schuelke

Wearable, flexible electrochemical sensing devices are a new development in the health and exposure assessment industry. While wearable electrochemical sensors have been used to detect analytes such as lactate, chloride, and pH, detection of toxic metals is also feasible. Such devices, typically made of printed carbon, gold (Au), and bismuth (Bi), have been reported to detect toxic heavy metal ions such as lead (Pb), copper (Cu), cadmium (Cd), and zinc (Zn) in human perspiration. Epidermal measurements represent a non-invasive sampling procedure to monitor the health and environment of a patient. While the aforementioned materials have proven capable, a more robust electrode material is desired to further expand on the suite of detectable analytes. In this study, we used electrochemical sensors comprised of boron-doped diamond (BDD) to increase the applications possible for these devices. For BDD, key advantages over Au, Bi, and SPC include a wide potential window (expands suite of analytes) and low capacitive background current (lowers the limit of detection (LOD)). Lastly, the batch fabrication procedures used to produce the BDD sensors enables better reproducibility from sensor to sensor. To evaluate the BDD in detecting Pb and Cu analytes, square-wave anodic stripping voltammetry (SWV) experiments were used and optimized to generate the best current response by manipulating the amplitude, frequency, and step properties of the applied waveform. These BDD, flexible sensors are an opportunity for further development in the industry of health and wearable technology and with more research can expand the possibilities of non-invasive toxic chemical detection.

Pyrazine-Bridged Dysprosium Complex as a Potential Single-Molecule Magnet
Nelson Candelaria
Category & Time: Chemical Engineering & Materials Science, Section 1, 2:30 PM - 3:45 PM
Poster: 277
Mentor: Selvan Demir

Single molecule magnets (SMM) are molecules that have a bistable magnetic ground state. These molecules have a number of potential applications such as in high-density data storage. One limitation of such molecules is that their magnetic bistability is only retained at very low temperatures. Currently, a goal in the field is to synthesize SMMs that can retain a bistable magnetic ground state above the boiling temperature of liquid nitrogen (77 K). This would increase the potential applications of SMMs to include industrial processes. The lanthanides are an interesting candidate for SMMs due to their high

magnetic anisotropy. Previously, it has been shown that through use of a radical bridged lanthanide system, magnetic hysteresis can be observed up to 30 K. In this presentation, I will report on a synthetic strategy to obtain a pyrazine bridged SMM. The analogous radical-bridged system was also investigated. Analysis of the systems include use of single crystal x-ray diffraction and SQUID magnetometry, to determine the structural and magnetic properties of the molecules, respectively.

A Comparison of the Physical Properties of Different Concentrations of Silver-Doped Bioactive Glass Coated on Metallic Substrates
Kayla Chuong
Category & Time: Chemical Engineering & Materials Science, Section 1, 2:30 PM - 3:45 PM
Poster: 278
Mentor: Xanthippi Chatzistavrou

Bioactive glass has garnered much attention, particularly for its use in dental and orthopedic applications. One specific application is the coating of metallic implants with bioactive glass in order to improve the implant's longevity and prevent complications that may require additional surgery. As such, this study focuses on the physical and chemical characteristics of two different concentrations of silver-doped bioactive glass (AgBG) in order to evaluate which concentration exhibits more favorable properties. The morphological and microstructural characteristics were correlated with the fabrication processes, which then affect the hardness and adhesive properties of the AgBG coating. Additionally, while previous work has been done to show that silicon-based glass, coated using the sol-gel technique, increases the longevity of metallic implants, the extent to which bioactive glass increases corrosion resistance has yet to be fully explored. As a result, multiple layers were coated to determine if an increase in coatings improved the performance of the AgBG. Corrosion and bioactivity were evaluated under different soaking conditions with simulated body fluid (SBF) for the varying layers, but it is clear that future work is required as the samples did not reveal favorable corrosion resistance or bioactivity.

Stem Cell-derived Beta Cell Tracking using Magnetic Particle Imaging in Mouse Models
James Raynard Dizon
Category & Time: Chemical Engineering & Materials Science, Section 1, 2:30 PM - 3:45 PM
Poster: 279
Mentor: Ping Wang

Type 1 diabetes (T1D) affects millions of people globally with symptoms such as fatigue and weakness caused by the immune system attacking insulin-producing β cells. While insulin injections are effective at achieving normoglycemia, complications of T1D are still present; heart disease and nerve damage are just few examples. Patients can reach normal glucose levels, or normoglycemia, via islet transplantation. Despite this, there is a shortage of islet donors, which limits the feasibility of islet transplantation. A novel approach to solve this is the use of stem cell-derived β (SC-β) cells. Nonetheless, cell-based therapies require precise imaging techniques to monitor transplanted cell grafts. Magnetic Particle Imaging (MPI) can be used to detect the number of SC-β cells in vivo and monitor graft outcome after transplantation; we expect to determine the relationship between MPI signals and cell count. Differentiated insulin-producing organoids from induced pluripotent stem cells will then be labeled with

Vivotrax™ dextran-coated superparamagnetic iron oxide nanoparticles. To optimize labelling efficiency, labelled cells will be imaged in vitro using MPI. We will then transplant 100, 200, 400, 800, or 1600 labelled organoids in the liver through the portal vein or under kidney capsule in NOD/scid mice and monitor in vivo using MPI after transplantation up to one week. We expect to detect signal of grafts in recipient mice using MPI up to 7 days due to renal clearance. Through these proposed experiments, we hope to showcase the utility of MPI as a powerful tool for tracking transplanted SC-β in vivo.

Synthesis and Optimization of Lignin-based Polyurethane Adhesives
Kevin Dunne
Category & Time: Chemical Engineering & Materials Science, Section 1, 2:30 PM - 3:45 PM
Poster: 280
Mentor: Mojgan Nejad

Lignin is a crosslinked, highly variable, phenolic polymer that is found in plant cell walls. As the second most abundant naturally occurring polymer on Earth, it is both a renewable resource and inexpensive. Polyurethane (PU) is a highly versatile and commercially important polymer, that is often used as an adhesive, coating, and foam, among many other applications. PU is formed from a reaction between polyols and isocyanates, which forms long chains of urethane linkages. Unfortunately, polyols and isocyanates are typically petroleum derivatives; meaning that PU production can be costly and harmful to the environment. The aim of the present research is to replace 100% of petroleum-based PU with lignin, which contains many hydroxyl groups, as a polyol. The ultimate objective of this research was to optimize the resin production process and determine the most efficient, cost effective, and environmentally friendly procedure for producing lignin-based PU adhesives in an industrial setting. Several resins were synthesized under differing conditions. The free isocyanate content and the lap-shear strength of the various lignin-based PU resins were tested to evaluate the performance of developed bio-based adhesives. Additionally, qualitative properties of the formulated PU samples were observed. Preliminary results have indicated that resins synthesized at lower temperatures may produce higher performance adhesives, suggesting that developed lignin-based adhesives can significantly reduce energy consumption during manufacturing, because they can cure at room temperature.

Nonlinear Rheology of Molten Polymer Nanocomposites
Daniel Ejsmont
Category & Time: Chemical Engineering & Materials Science, Section 1, 2:30 PM - 3:45 PM
Poster: 281
Mentor: K Jayaraman

Polymer nanocomposites (PNCs), consisting of a polymer and nanoparticles (NPs), are studied to observe changes in material properties by inserting NPs into the polymer matrix. NPs can have great effects due to their large surface area when compared to other particles. Both PNC properties and polymer-particle interactions will be studied to understand how they change as a nonlinear function of applied shear. To preserve the polymer molecular weight and the particle size, a solvent technique is used. The PNCs are formed by dissolving the polymer, polystyrene (PS) or poly(2-vinylpyridine) (P2VP), in toluene or ethanol solvent, respectively, and then mixing with organically modified laponite dispersed

in ethanol. The laponite is modified through ion exchange so it interacts well with the polymer chains. The solution is transferred to Teflon molds in a vacuum oven to remove the solvent. Disks may be cut out of the dried material for X-ray diffraction (XRD) and rheological testing. XRD testing determines the extent of dispersion within the particles due to expansion of laponite layers when compared to laponite powder. Large amplitude oscillatory shear (LAOS) rheological testing determines both elastic and viscoelastic properties of the PNCs as a two-phase system, when subjected to different temperatures above and below the glass transition temperature. The dynamic and mechanical properties tested will be compared to literature for a reference case; others are new research with no basis of comparison. Some properties that are expected to increase include barrier to gases and processability. The findings will be evaluated for future research.

PREPARATION AND CHARACTERIZATION OF MALETAED THERMOPLASTIC STARCH VIA REACTIVE EXTRUSION

Melissa Joslyn, Apoorva Kulkarni

Category & Time: Chemical Engineering & Materials Science, Section 2, 2:30 PM - 3:45 PM
Poster: 282
Mentor: Ramani Narayan

Increasing concern about the environment and sustainability of petroleum products has led to the invention of various bio-based materials. Starch has received a considerable attention recently as an inexpensive, bio based and biodegradable material. The glass transition temperature of pure, dry starch is above its decomposition point. So, it does not soften or flow. In order to make it processable, it is often plasticized with compounds like water, glycerol, sorbitol etc. However, these small plasticizer molecules often tend to leach out from the phase over time giving poor dimensional stability and mechanical properties. To overcome this, efforts were done to covalently link the glycerol to starch backbone to form a graft copolymer. This work elaborates the production and characterization of maleated thermoplastic starch (MTPS) using reactive extrusion. MTPS was synthesized in a properly configured twin screw extruder by reacting glycerol with corn starch in presence of maleic anhydride as a promotor. Maleic anhydride (MA) promoted cleavage of the starch molecule resulting in lower molecular weight and increased hydroxyl groups. Soxhlet extraction with acetone showed that around 80 % of added glycerol was grafted on the starch backbone. The results were further confirmed by thermogravimetric analysis (TGA) and fourier-transform infrared spectroscopy (FTIR) of residue and extracts. The hydroxyl content of MTPS was found using ASTM E222 method.

Indium Tin Oxide Electrodes for Cathodic Stripping Voltammetric Detection of Harmful Metals

Greg Landis

Category & Time: Chemical Engineering & Materials Science, Section 2, 2:30 PM - 3:45 PM
Poster: 283
Mentor: Thomas Schuelke

Indium tin oxide (ITO) has been investigated as a promising electrode material due to its conductivity, wide potential window, and optical transparency. ITO has previously been used to detect trace metals,

including manganese (Mn), via cathodic stripping voltammetry (CSV). Trace amounts of Mn are required to carry out normal bodily functions, but it can be a neurotoxin in high concentrations. CSV is a common electrochemical method for determining heavy metal concentrations. CSV is performed by depositing metals onto the electrode surface, then stripping them from the surface and measuring the current generated to quantify the contaminant concentration. However, electrode characterization and optimization of ITO on a non-transparent substrate has only recently been studied. The lack of necessity in transparency opens the door for simpler and safer fabrication procedures. Four different ITO surfaces, based on combinations of heating and annealing, were characterized using surface and electrochemical measurements. Each film exhibited electrochemical capability, but the optimum film was fabricated with heating (substrate temperature of 190°C) and annealing (1 hour of 400°C in air). This film exhibited a limit of detection (LOD) of 0.1 ppb (1.8 nM) for Mn. This is well below the maximum contaminant level in water set by the Environmental Protection Agency at 50 ppb, as well as normal concentrations in blood (4-15 ppb), urine (1-8 ppb), and serum (0.4-0.85 ppb). This shows ITO's capability and potential to monitor water quality for Mn, as well as other trace metal ions, on a non-optically transparent substrate.

Adapting Transparent Luminescent Solar Concentrators for use in Greenhouses
Jonathan Leasure
Category & Time: Chemical Engineering & Materials Science, Section 2, 2:30 PM - 3:45 PM
Poster: 284
Mentor: Richard Lunt

Solar power is one of the most promising forms of renewable energy, having the potential to power the world many times over. With the recent development of transparent luminescent solar concentrator (TLSC) technology, it is possible to harvest solar energy in new applications and over even greater area. A standard TLSC generates electricity by absorbing and reemitting light towards the edges of the panel where it is collected by photovoltaic cells. Each TLSC in this project utilizes a different organic salt dye which absorbs and reemits light in the infrared, allowing the cell to appear transparent. We are exploring the differences in height, biomass accumulation, and fruit yield of plants grown underneath the different TLSCs, the goal being to determine the effects of varying light wavelength cutoffs and total light intensity. Based on the experimental results we will achieve a more complete understanding of how these variables affect photosynthesis and how the conditions relate to plant growth. Using these results, creation of TLSC's will be optimizable for use in greenhouses.

Material Characterization of PLA
Nicole Mancina
Category & Time: Chemical Engineering & Materials Science, Section 2, 2:30 PM - 3:45 PM
Poster: 285
Mentor: Ramani Narayan

PLA is a biodegradable material that has been used as a bioplastic for water bottles, plastic containers, 3D printing, and medical devices. As a chiral molecule, the polymer and monomer (lactide) possess enantiomers that are non-superimposable mirror images of one another. Specifically, lactide can be an

optically active compound – levorotatory (L) and dextrorotatory (D) – or an optically inactive meso compound. While L-lactide and D-lactide have similar physical properties (i.e. boiling point, melting point, etc.), their optical rotations are equal but opposite in value since they are enantiomers of one another. Based on the optical rotation of each monomer, one can assess its purity in order to produce high molecular weight neat PLLA/PDLA. Purity of these stereoisomers were analyzed and compared to commercial grade PLA, and different trials were conducted to correlate the optical purity with other material properties. Once the purity (99.9%) of the monomer was confirmed, bulk polymerization was performed to produce high purity PLLA, using Stannous Octoate as the catalyst. A focus on the thermal properties, crystallinity, molecular weight, polarimetry, and optical purity of the resulting polymers was studied using DSC, TGA, and GPC. Different monomer initiator ratios of L-lactide were produced to observe the effect on the molecular weight and thus the thermal properties. Based on this study, we will conclude the next steps to produce stereocomplex PLA using neat PLLA and PDLA.

Quantitative Analysis of Hydrogen Bonding in Alcohols using Fourier Transform Infrared Spectroscopy
Andrew Norfleet
Category & Time: Chemical Engineering & Materials Science, Section 2, 2:30 PM - 3:45 PM
Poster: 286
Mentor: Carl Lira

Industrially, chemical separations processes such as distillation and extraction comprise nearly one-third of plant expenditures. Separation processes rely on accurate phase equilibrium models. A goal of this work is appropriate interpretation of spectroscopy for alcohols to determine model parameters. Yet, there exist challenges in the extraction of quantitative information from spectroscopy. In mixtures with hydrocarbons alcohols self-associate via hydrogen bonding, and spectroscopic quantification of the extent and types of hydrogen bonding requires: proper subtraction of background; proper subtraction of hydrocarbon contributions; proper scaling of cleaned spectra using the correct form of the molar extinction coefficient; and proper curve fitting to determine population of bond types. This work demonstrated new techniques to perform the spectral processing successfully. The data obtained from this method provides relevant parameters for the thermodynamic model as well as a fundamental description of hydrogen bonding at the molecular level.

Optimization of Eu2Zn1+xSbBi Thermoelectric Materials
Megan Rylko
Category & Time: Chemical Engineering & Materials Science, Section 3, 2:30 PM - 3:45 PM
Poster: 287
Mentor: Alexandra Zevalkink

In previous works, the thermoelectric properties of the layered Zintl compounds Eu2ZnSb2 and Eu2ZnBi2 have been characterized. They have been shown to have "holes" (i.e., vacancies) in the layers where Zinc is present, as Zinc is only at about 50% occupancy in the structure. By varying the amount of Zinc in the compound, it effectively changes the amount of electrons and how they move around, which is quantified by the electron carrier concentration and electron mobility. In the current study, the thermoelectric material Eu2Zn1+xSbBi (where x=0.1, 0.04, 0.02) will be prepared via spark plasma

sintering, and the samples' Seebeck coefficients and conductivities will be measured. By varying the amount of Zinc in the compound, carrier concentration (which is inversely proportional to the Seebeck coefficient and proportional to conductivity) will be optimized in order to maximize zT, the thermoelectric figure of merit. zT is calculated by the equation zT=S^2σT/κ where S = Seebeck coefficient, σ = electrical conductivity, κ = thermal conductivity, and T = absolute temperature.

Functionalization of Double-Decker Shaped Silsesquioxanes with Boronic Acids
Shaquwana Simpson
Category & Time: Chemical Engineering & Materials Science, Section 3, 2:30 PM - 3:45 PM
Poster: 288
Mentor: Robert Maleczka, Andre Lee

Spacecrafts encounter immense heat and need to be fitted with thermal protection systems and heat shields that protect the vehicle from excessive heat on launch and on re-entry into the earth's atmosphere. The material used in the construction of these heat shields must be a thermally-stable material at temperatures in excess of 1000oC. Silsesquioxanes are high thermal stability hybrid molecules that possess an inorganic Si-O-Si core and organic groups attached at the corners of the cage. The versatility of the cage makes it very flexible and gives it high thermal stability while having a low dielectric constant. Research is focused on preparing phenyl-substituted, double-decker shaped silsesquioxanes (DDSQ) that are corner capped with different types of boronic esters. Using the Sonogashira coupling reaction, our group has synthesized a series of such DDSQ's for the first time, incorporating alkynyl subunits into the aryl boronic acids. In this presentation, the synthesis, characterization and initial evaluation of the thermal properties of a series of DDSQ analogs prepared from different boronic acids will be discussed.

Understanding Esculetin Fluorescence in Water through Models
Yukun Tu
Category & Time: Chemical Engineering & Materials Science, Section 3, 2:30 PM - 3:45 PM
Poster: 289
Mentor: Mark Muyskens

We are looking for a better way to model esculetin fluorescence by including solvent molecules in the model. Time-dependent density functional theory was used to understand the fluorescence of esculetin in water. Conventional modeling of solvents is achieved by adding a diffuse function to represent water solvent. Adding a water molecule to the model involved in hydrogen bonding, we found some structures showing an absorbance wavelength closer to experimental data than the diffuse model. The modeling technique is also used to understand deprotonated esculetin in water.

To Develop a Bimodal Distribution of Gamma Prime in Allvac 718Plus
Raul Vega-Torres
Category & Time: Chemical Engineering & Materials Science, Section 3, 2:30 PM - 3:45 PM
Poster: 290
Mentor: Carl Boehlert

Ni-based superalloys are considered as the best type of materials for the applications of turbine engines in the aerospace industry due to their high creep and corrosion resistance at high temperatures. There are various types of Ni-based superalloys being used for the application. However, in 2005 a new alloy called Allvac 718Plus was developed by the group of W. D. Cao showing enhanced properties with a service temperature of 704℃ which is 55℃ above the service temperature of the alloy Inconel 718. Allvac 718Plus has γ' (Ni3Al) as a major strengthening phase. The γ' phase size and distribution mostly determine the final strength of the material.In this research we will study how to generate a bimodal distribution of γ' (Ni3Al) in Allvac 718Plus. After the detailed characterization of as-received alloy, a solutionizing heat treatment at 1000℃ for 1 hour will be performed to dissolve the existing precipitate phases followed by aging process. Aging heat treatment will be conducted at three different stages: 900℃ for 2 hours, creating unimodal larger γ' precipitates; 721℃ for 10 hours, creating smaller γ' precipitates; and 900℃, 2 hours + 721℃, 10 hours, creating a bimodal γ' precipitates. Characterization of the samples to identify the γ' phase will be performed using a Scanning Electron Microscope (SEM), Optical Microscope (OM), X-Ray Diffraction (XRD) and a Vicker's microhardness tester for hardness measurement. All the obtained results will be compared and rationalized with the existing data available in literature for further analysis.

Breakdown of the Cox-Merz Rule of Polymer Melts in Capillary Extrusion at High Stresses
Zipeng Xu
Category & Time: Chemical Engineering & Materials Science, Section 3, 2:30 PM - 3:45 PM
Poster: 291
Mentor: Shiwang Cheng

Understanding the constitutive relation of polymer melts for polymer processing remains one of the ultimate goals in polymer science. While various constitutive equations have been developed in the past, their validation and comparison with steady state shear are usually take place at low and moderate stresses, leaving the region associated with high shear stresses largely unexplored. In this work, we have carried out capillary extrusion for polymer melts in absence of flow instabilities that allow to access flow stresses larger than their rubbery plateau. At low and intermediate stresses when the applied stress is lower than the rubber plateau, the flow curve follows classical Cox-Merz rule. Shear thinning with power index of has been observed, where the h and are the steady state viscosity and the shear rate. At stresses larger than the rubbery plateau, the scaling between the h and gradually changes from to , indicating a breakdown of the Cox-Merz rule at the high stress region. Further molecular weight dependence study clearly demonstrated the breakdown of the Cox-Merz rule at high stress applies for unentangled polymer melts as well. We poise the anomalous breakdown in the Cox-Merz rule to an unexpected stress hardening of polymer melts that has not be anticipated in any existing constitutive equations.

GHG Emissions of Electric Versus Combustion Vehicles over Time in the United States
Rohan Challa
Category & Time: Civil & Environmental Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 292

Mentor: Annick Anctil, Dipti Kamath

Transportation accounts for 29% of Greenhouse Gas (GHG) emissions in the United States. Regulations such as the CAFE standards are set to counter the GHG emissions by increasing the fuel economies of internal combustion engine vehicles (ICEVs). Electric vehicles are another option that can reduce GHG emissions, especially given the planned decarbonization of the electric grid. As per previous studies, EVs reduce GHG emission by 56.7% compared to ICEVs. However, the changing fuel economy and electricity grid mix can alter the relative benefits of EVs. A comparative life cycle assessment of EV and ICEV was conducted to test this hypothesis. The GHG emissions associated with the use phase of a typical 5-seater EV and ICEV were calculated over the period of 2018 to 2030. The vehicle miles driven were an average of 11,346 in the US and varied with location. Fuel economy also varied with location, as it depended on weather and miles driven. To account for this variation, the current study was conducted for the US as a whole, as well as four states, namely California, Arizona, New York and Oregon. To estimate the fuel use over time, the ICEV fuel economy was assumed to change from 27mpg in 2018 to 30mpg in 2020. For EVs, electricity used per mile was assumed to be a constant, while the electricity generation mix was assumed to change based on EIA's Annual Energy Outlook 2019. The GHG emission change for EVs and ICEVs over time for the different locations will be presented.

Remediation of Perfluroroalkyl Substances (PFAS) by Electrochemical Oxidation with Boron-Doped Diamond Electrodes
Emma Davis
Category & Time: Civil & Environmental Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 293
Mentor: Thomas Schuelke

The carbon-fluorine bond is one of the strongest bonds in organic chemistry. Per- and polyfluoroalkyl substances (PFAS) are manmade chemicals primarily composed of carbon-fluorine bonds. They are used in many applications including nonstick coatings, waterproofing, food packaging, firefighting foams, and vapor suppressants. Due to their nearly indestructible molecular structure, PFAS are difficult to degrade and, therefore, persist in nature. High concentrations of these compounds in blood have been discovered to cause severe health effects, including cancer, neurodevelopment problems, and organ malfunction. With these issues in mind, efforts are being made to remediate PFAS through several methods, including electrochemical oxidation (EO). EO involves degradation of organic compounds using an applied electric current through the electrode surface. When boron-doped diamond (BDD) electrodes are used, this process is a promising method for degrading different types of PFAS. Furthermore, EO with BDD can successfully remediate the two most common types of PFAS found in the United States, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). This report will focus on assessing the different electrochemical systems in regards to the degradation of PFAS in various aqueous media including wastewaters and landfill leachates. In addition, results from said experiments were analyzed in order to determine if EO processes can be geared towards large-scale remediation in the future.

The Aging Conditions of Adhesives and their Effect
Seungyeon Lee
Category & Time: Civil & Environmental Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 294
Mentor: Mamoon Shaafaey

Adhesives can be found easily in useful items in daily life. They tend to deform as they are aged. Therefore, it is suggested to identify the effect of the aged adhesives in different aging conditions. Three different types of adhesives, Silicone, Acrylic, and Polyurethane, were investigated as adhesive samples. They were each aged in a different combination of aging conditions: temperature (60C, 80C, 95C), humidity (28%, 50%, 80%), and aging duration (1,10,30 days), submerged in distilled water and salinated water. Salt solutions that allow adhesives to be aged in a desired humidity are created by mixing distilled water with a compatible chemical compound (Magnesium Chloride, Sodium Bromide, and Potassium Chloride). Salinated water solutions are created by adding simulated sea-salt compound in a distilled water. The effect of the aged adhesives can be determined by visually inspecting the front and back of each adhesive and by measuring the difference of their weight and dimensions (width and thickness).

Interactive 3D Computer Model of Mackinac Bridge
Phillip Meffert
Category & Time: Civil & Environmental Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 295
Mentor: Nizar Lajnef

America's infrastructure at all levels is aging and requires maintenance and upkeep if it will support 21stcentury demands. One prime case of this is the Mackinac Bridge, which is the longest suspension bridge in the western hemisphere and has been in service for sixty years, and needs major renovations. A team of engineers from Michigan State University and Washington University in St. Louis have designed piezoelectric floating gate (PFG) sensors that monitor the cumulative voltage time (CVT) in the members of the bridge. The data is analyzed through a system of functions and codes to determine the damage that the bridge is experiencing from general loads such as traffic, wind, and vibration. A dense array of low cost sensors will be able to identify the specific members and sections of the bridge that need the most urgent attention and save costs on large maintenance projects. The study is planning a large scale project to install more sensors on the bridge. For the larger scale project, a 3 dimensional computer model of the suspension bridge is needed to provide a visual platform and user friendly interface to input and retrieve data. The model will be drawn using AutoCAD and will be viewed and edited in Autodesk DWG TrueView using the original draftsmen drawings of the bridge. The final result of the project will be completed 3D computer model of the suspension bridge part of the Mackinac Bridge with a few simplifications from the original drawings.

The Relationship between Hydrology, Sediment Transport, and Fisheries in the Lower Mekong River Basin in Southeast Asia
Khanh Nguyen
Category & Time: Civil & Environmental Engineering, Section 2, 11:30 AM - 12:45 PM

Poster: 296
Mentor: Yadu Pokhrel

The Mekong river is one of the largest rivers in the world, which flows from the Tibetan plateau to Cambodia and the southern part of Vietnam, the Mekong Delta. One of the most crucial concerns besides climate change regarding hydrology, sedimentation, biodiversity, and the livelihood of inhabitants is the accelerating anthropogenic activity across the river basin, especially the boom in hydropower dam construction. Studies on the adverse impacts of hydroelectric dams have shown that both main stem and tributaries dams could permanently alter the hydrology that governs the amount of sediment generated and distributed across the basin. Further, irrigation activities within the basin also contribute to the fluctuation of hydrology and sediment transport. Sediment is one of the most critical factors that contribute to the fertility and stability of soils for agriculture across the Mekong river basin, especially the coastal areas in Cambodia and Vietnam. Sediment dynamic influences nutrient availability which determines the productivity of a region due to its ability to carry phosphorus and nitrogen for primary producers in the Tonle Sap Lake such as algae, an important food source for any natural fish population. It is essential to assess the potential outcomes of hydrology and sediment alteration due to dam construction on aquaculture, fisheries, and agriculture for the integrity of the river basin. This study aim is to examine the relationship between sediment, hydrology, and fisheries for sustainable development of the whole region.

Examining Trends in Seat Belt Use Across Michigan
Jarod Parker
Category & Time: Civil & Environmental Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 297
Mentor: Peter Savolainen

Seat belts have been demonstated as one of the most effective means to prevent injuries resulting from traffic crashes. Michigan is one of 33 states with a primary belt use law, which means a driver can be pulled over and receive a citation solely for not wearing a seatbelt. Each year, all states are required by the National Highway Traffic Safety Administration (NHTSA) to estimate the statewide belt use rate. During a three-week period in June 2019, MSU conducted a statewide belt use survey using student teams who traveled to counties across Michigan. Data were collected at 200 sites regarding belt use by drivers and front-seat passengers. Data were also collected regarding each occupant's age, race, and gender, in addition to information regarding vehicle type and use, as well as the total volume of vehicles observed at each location. These data were used to estimate the statewide belt use rate, in addition to identifying trends in belt use among various demographic groups and geographic areas of the state. The results of this survey provide important insights to guide public awareness and law enforcement campaigns by the Michigan State Police and its Office of Highway Safety Planning.

The Effects of Existing Dams on the Environment of the Mekong River
Faisal Shahin
Category & Time: Civil & Environmental Engineering, Section 2, 2:30 PM - 3:45 PM

Poster: 298
Mentor: Yadu Pokhrel

The broad objective of this research is to examine how the existing dams have affected the environment of the Mekong River, and how proposed dams will continue to alter it. Currently, over 60 million people live around the Mekong river, and rely on it for their livelihood. For example, the primary source of protein for most people who live around the river is fish, and dams can greatly reduce the amount of fish in a river. Moreover, rice production is heavily reliant on the water and sediment flux in the Tonle Sap lake, and dams could, again, affect the lake dynamics. The question I am exploring, is how discharge and water level have been affected by the existing dams, how their cycles have been affected, and how much of that is due to climate change versus dam construction. To quantify those, I have been using the data provided by the Mekong River Commission (MRC); use Matlab to plot, find trends, and organize these data points. The expected outcome is that dams and climate change do have a significant impact on water level and discharge. However, I hypothesize that the impacts of dams outweigh that of climate change.

Economic Benefit of Photovoltaics in Michigan Field Crop Farms
Sedzro Tamakloe
Category & Time: Civil & Environmental Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 299
Mentor: Annick Anctil

The total annual consumption of energy in the U.S. agricultural sector is 1,872 trillion Btu which was 1.9% of U.S. consumption in 2016. Photovoltaics (PVs) are an option to r-educe this high consumption from the grid on agricultural farms. There has recently been changes in policy in Michigan which earlier restricted the installation of PV on agricultural land. The number of agricultural farms installing PV onsite is likely to increase because of these changes. In this study, the economic benefits to farmers are quantified when a PV system is installed in agricultural field crop farms of Michigan. The optimal design of PV panels in farms is possible using hourly energy use data which is not currently available in public domain. To bridge this data gap, the hourly electricity consumption from a typical agricultural farm operation is modeled using BEopt 2.8. Homer Pro is used to optimize capacity and assess the economic benefits of a PV system by simulating its operation on an agricultural farm for one year. The effect of weather conditions on PV generation is simulated by using the weather file from National Renewable Energy Laboratory (NREL). The required capacity of PVs to offset the electricity demand and sell-back to the grid is determined and the associated cost benefits are calculated for a grid-connected agricultural farm. The farm electricity consumption and cost of operation are expected to reduce with the use of PVs.

Paving the Way to Better Roads
Sean Wills
Category & Time: Civil & Environmental Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 300
Mentor: Muhammed Kutay

Asphalt mixtures containing crumb rubber (CR) from end-of-life (EoL) tires are used in paving applications due to their enhanced performance in terms of resistance to fatigue, permanent deformation, aging and water damage. When incorporated into asphalt wearing (surface) layer, CR modified mixtures generally exhibit good skid resistance and noise absorption. Due to positive performance records, world-wide use of such mixtures is continuously increasing, and several applications have been reported, especially on a local scale for maintenance and rehabilitation purposes. However, the performance of CR modified mixtures depends significantly on the mode of interaction between CR and the other components of the asphalt mixture. There have been studies on various techniques of including scrap tire rubber into asphalt mixtures, with varying degrees of success and cost. The main objective of this project is to evaluate an emerging CR technology, the Polymer Coated Rubber (PCR). The disk-shaped compact tension (DCT) fracture test will be performed in the laboratory to compare the PCR modified asphalt mixtures with traditional and polymer modified asphalt. The DCT detects statistical differences in fracture energy for tests conducted across a useful range of test temperatures and loading rates. In this project, the asphalt samples were tested at -10°C and a constant rate of displacement was applied until the sample is completely cracked and split into half.

Classification of Thyroid Nodules using Machine Learned One Class Autoencoders
Joe Adams
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 301
Mentor: Adam Alessio

Thyroid nodules are an extremely common occurrences in adults though only a small portion of these nodules are malignant. Fine Needle Aspiration (FNA) biopsies are commonly performed to identify malignancy and there is a pressing need for reliable, non-invasive methods to reduce unnecessary FNA procedures. In this study, we explore different architectures of one class autoencoders as a means to make this classification from a dataset of 964 Shear Wave Elastography and B-mode ultrasound images. The different autoencoders were constructed with varying numbers of layers and layer depths and were trained to encode and reconstruct images of benign nodules only. The intention is that images of benign nodules will have a lower reconstruction error than malignant nodules. This reconstruction error can then be used as the test statistic to classify images. The success of each autoencoder was evaluated using the area under a curve (AUC) and accuracy of classification. The highest AUC achieved was 0.872, with an accuracy of 88.2% for the determination of malignancy. This study demonstrates that autoencoders offer a viable approach for thyroid nodule classification on ultrasound images.

MQTT Security: Evaluating Payload Encryption with AES 384 against TLS
Chigozie Asikaburu, Caitlin Jung
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 302
Mentor: Dae-Kyoo Kim

The Internet of Things (IoT) consists of any device that can be connected to the Internet. These devices can communicate with each other and gather data, which can be analyzed to help someone or be sent to different networks to solve other problems. With its rapid rise in society, the need for more security in machine-to-machine (M2M) communication becomes increasingly necessary. Therefore, the success of IoT is dependent on sufficiently addressing concerns surrounding data privacy, cryptocurrency mining attacks, home invasion, remote vehicle access and more. To address these concerns, we will improve the existing security in Message Queuing Telemetry Transport (MQTT) using payload encryption with AES 384 and compare it with the TLS approach. MQTT is a lightweight communication protocol for IoT that uses broker-based communication and publishing/subscribing operations to create a connection and communicate between devices. Our project aims to improve the current standard by increasing the maximum 256-bit key size to 384-bits and the number of rounds of AES to combat cyberattacks. In this project, we propose a secure communication scheme using Elliptic Curve Diffie Hellman (ECDH) and Secure Hashing Algorithm 3 (SHA) 512 internally for key distribution to encrypt and decrypt topic keys. Topic-based key sharing is proposed to create keys for each topic that is used to encrypt/decrypt the payload. Our work is built upon this proposition and evaluates the performance of AES 384.

Studying Behaviors Using Motion-Capturing Software
Jordan Barrett-Elder
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 303
Mentor: Mark Reimers

Many questions in behavioral science and kinesiology would be illuminated by comprehensive real-time measures of behavior and motion in natural situations. Recently developed computer vision methods, tracking joints of humans or animals, hold the promise of doing so, but this promise has not yet been realized, largely because of high rates of error in inferred measures. We are developing methods to overcome these errors. We apply our methods to tracking animals in motion during brain recording experiments, and to assessing attention in autistic children. To track animal motion, we used DeepLabCut which uses a deep convolutional neural network to assign markers according to each of the body position/limbs researcher wishes to label. Then once the user hand labels a few frames then the network should be able to recognize the few frames the user labeled then label the subsequent ones or even on new videos. The application of DeepLabCut would be that we observe the animal during the experiment and based off their patterns of motion we could accurately assess pain and engagement during the experiment. We study human behaviors by using Open Pose which is a pre-trained neural network that can localize human limb and head position location with confidence. Using Open Pose, we will record behaviors of children that give off signs of Autism from their body language and accurately infer who have the disorder or not.

Automated Data Set Generation for Single Camera Gaze-Detection
Matthew Bellafaire
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 304

Mentor: Osamah Rawashdeh

With the rise of semi-autonomous vehicles there is a growing need for a general driver monitoring system, this driver monitoring system needs to be able to determine whether the driver can or should resume control of the vehicle. One of the best indicators of attention is gaze direction, however, there currently exists no publicly available data set to train a neural network for this function. Creating a data set requires time and participants, reducing the amount of time required by the participants and increasing the amount of useable data can reduce the overall cost of the final data set. For this purpose, a simple game written in Java was designed to run on a driving simulator in conjunction with a webcam attached just above the steering wheel. The game was specially designed to attract the user's eyes to specific areas of the screen and then capture the appropriate data. The webcam was integrated with the code of the game to capture the participant's gaze, the images obtained were then automatically annotated and exported. This paper details the methods and considerations made to reduce time and work associated with data collection for gaze detection.

A Machine Learning Approach to Predicting Twitter Unfollowing Events
Aaron Brookhouse
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 305
Mentor: Hamid Karimi, Tyler Derr, Jiliang Tang

As the world is becoming more and more interconnected through the web, an increasing number of people are making connections online. This also means more people are un-connecting online. To better understand these "unfollowing events," we have been collecting data on roughly 128,000 Twitter users for the past year. The main objectives of collecting this data are to predict when a user will unfollow another user, and to more qualitatively understand what leads a person to unfollow another. There are two main challenges with this: Twitter does not directly provide data about how likely people are to unfollow each other, and it is currently uncertain exactly what variables are most likely to cause a user to unfollow another user. To solve these problems, we will extract network and text features from the collected Twitter data and use it to train a Deep Recurrent Neural Network to anticipate when a user is going to unfollow another user. To train the network, we collected tweet texts, and a list for each user, of who was following and being followed by that user, for each week. This data will be turned into features that will be fed into the Neural Network as input. This model, along with more quantitative and qualitative analysis of the data will help us understand how people interact online. Future work could expand on this by exploring the similarities and differences of online and real-world social connections, especially how and why they end.

Using Deep Learning to Analyze Human Motion
Jatwon Burkes
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 306
Mentor: Mark Reimers

Many questions in behavioral science and kinesiology would be illuminated by comprehensive real-time measures of behavior and motion in natural situations. Recently developed computer vision methods, tracking joints of humans or animals, hold the promise of doing so, but this promise has not yet been realized, largely because of high rates of error in inferred measures. We are developing methods to overcome these errors. We apply our methods to tracking animals in motion during brain recording experiments, and to assessing attention in autistic children. For some animals and even humans, it could be difficult for them to communicate. Such as expressing how one feels or if someone is in pain. This communication matter could occur with autistic people and maybe with someone's pet. My research team would like to know if there is a way to monitor a person's (or an animal's) attention using visual data. Based on this concern, we hypothesized that using visual data, we may be able to analyze if there is any correlation between brain activity and motion. By using deep learning and artificial neural networks, we are detecting key points of the bodies and one's movement by using just visual data collected from FLIR cameras. My team is working on engineering the software that will make the computational visual analysis successful so that perhaps the neuroscientists, veterinarians, and psychologists will be able to utilize this data for their study. My research is focused especially on any matter of computer science and data analytics.

Optimizing Bioinformatics Workflow and Organizing Big Data with iRODs
Victoria Cao, Will Dixon
Category & Time: Computer Science & Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 307
Mentor: Andrew Keen

Due to the large amount of data involved in bioinformatics research, it has become increasingly necessary to find an effective way to move, organize, and analyze this data. Managing workflows, from sequencers to HPC centers to results, can be complex, and the large data set sizes are challenging to distribute and analyze. It is also important to maintain metadata information for reproducibility as well as data lifecycle management. To automate metadata collection, efficiently query data, and customize data storage hierarchies, we are experimenting with integrating OSIRIS's Amazon S3-compatible services with an iRODS (Integrated Rule-Orientated Data System) middleware server, and making these resources available to MSU's supercomputing center. By employing this multi-layered software architecture, a user can readily access all of the files they need from any server-side storage system and, based on file type, tag the files with metadata. This condensation of multiple services has the potential to make the data workflows much more space- and time-efficient, leading to a more productive outcomes in computational science.

Automatic Machine Learning Architecture Selection for Breast MRI Classification
Peter Carras
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 308
Mentor: Adam Alessio

Convolutional neural networks (CNN) are increasingly used for image classification tasks. In general, the architecture of these networks are set ad hoc with little rationale for selected various components such as number of layers, layer depth, and convolution settings. In this work, we develop a structured approach to explore and select architectures that provide optimal classification performance. This was constructed with an IRB-approved data set containing 10,924 2-D maximum intensity projection (MIP) breast MRI images containing breast cancer lesion present or lesion absent classes. The architecture search method employs a genetic algorithm to generate CNN-based classifiers, representing as strings and mutating them. During architecture updates, each classifier goes through supervised machine learning on the training set. The search method identifies the method with the highest validation accuracy. In initial testing, we built an optimal CNN that classifies lesion present images with 75% accuracy and achieves an AUC score of 83%. This approach offers a rational framework for architecture exploration, potentially leading to more efficient and generalizable CNN-based classifiers.

Adaptation of the ResNet-50 Classification Architecture for the Prediction of Malignancy of Thyroid Nodules
Joseph Cox
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 309
Mentor: Adam Alessio

Ultrasound imaging is commonly performed to both detect and evaluate thyroid nodules for malignancy. Although most nodules are harmless, many patients undergo fine-needle aspiration (FNA) to determine if a nodule is malignant or benign. In order to reduce the number of unnecessary FNAs, radiologists will often score thyroid nodules on the TI-RADS scale and provide a recommendation for whether or not FNA is necessary. This scoring is both subjective and time-consuming, leading to discrepancies between radiologists and recommendations that can be inaccurate. We hypothesize that an automated scoring process using machine learning can produce more accurate and consistent results than manual evaluation. We adapted the ResNet-50 architecture to create both a model for conventional ultrasound images and a model for shear-wave elastography images, then we merged the last layer of these two networks. This produced a network that accepted two inputs, shear-wave and ultrasound, and predicted malignancy of nodules with 80.0% accuracy. Work is ongoing to explore hyperparameter settings to improve the accuracy . These initial performance results suggest that deep learning machine learned models offer a promising strategy for thyroid nodule classification and may promote the increased clinical use of the TI-RADs scoring system.

Biomolecular Sequence Analysis for Forensic Genealogy
Jesus Garcia
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 310
Mentor: Kevin Liu

At nearly 3 billion base pairs long the human genome holds so much data, but only very small specific

sections are used to uniquely identify humans. Recent advancements in DNA sequencing techniques are allowing federal agencies like the FBI to implement technologies like SNP analysis and cross-analyze DNA results with individuals in CODIS (FBI database) to create family trees. This technique has also been able to solve cold case files through public genealogy sites such as GEDmatch, this led to discovering the identity of the infamous golden state killer. Additionally, sites like GEDmatch are public and agencies are able to inquire about obtaining sequenced DNA with barely any obstacles. In this project wee focus on biomolecular sequencing algorithms that utilize sequenced DNA for analysis. With these algorithms we will be able to examine DNA sequences and create software that can compare similarities in the DNA and possibly find past common relatives to link the DNA. The results of the analysis might allow us to create maps of how each DNA strand is related/unrelated to each other. This tool allowed for authorities to find the golden state killer indirectly through family DNA that was already of GEDmatch. More justice departments can implement similar tools to identify unknown criminals and possibly lead to their arrest.

MetaSurvey - Researching a Survey Tool that Automatically Generates Surveys for Research
Lillian Gosser
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 311
Mentor: Dirk Colbry, Astri Briliyanti

The NSF funded CyberAmbassador program provides communication, teamwork and leadership training for technically- proficient Cyberinfrastructure (CI) - Professionals. During the first year, we have focused on curriculum development that use interactive exercises and small- group activities to help build participant's professional skills. After each training, the facilitators will hand out surveys to be filled out by the participants. These surveys evaluate the participants' satisfaction with the curriculum and the overall training, as well as the impacts the training had on each individual participant. Every survey is specially designed for the specific module taught, the audience, and aspects of the venue (ex. online, in-person, hybrid). Since every module, every type of audience, and each training modality are evaluated differently, program evaluators often created survey forms manually. Therefore, a system that automatically generates a survey based on facilitators' needs are necessary to help program evaluation more effective.This project explores the creation of a "meta-survey," where facilitators can fill out a questionnaire and have a specialty survey generated for their specific training. We find several systems that can use logic branching to generate a meta-survey. Testing will be done with each one to ensure the most user-friendly logic branch, which is able to generate every single possibility of a survey. The goal is for facilitators to access this meta-survey, answer a few questions about their workshop plan, and get a customized survey form generatedinstantly.

Automatic Segmentation of Pediatric Chest Radiographs with Deep Learning
Gregory Holste
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 312
Mentor: Adam Alessio

Patients in neonatal and pediatric intensive care units often require catheters and tubes, collectively referred to as "lines," to sustain life. These patients undergo a series of chest radiographs throughout their stay to ensure proper line placement, and each study must be assessed by a radiologist, representing a time-consuming, labor-intensive process. Here we employ deep learning approaches to automate line monitoring by segmenting the chest into medically relevant regions, locating lines, and determining whether each line is appropriately placed relative to those regions. In an IRB-approved study, pediatric chest radiographs were collected and annotated with custom software in which users drew boundaries around seven regions of the chest: left and right lung, left and right subdiaphragm, spine, mediastinum, and carina. We trained a U-Net, a type of fully convolutional neural network for biomedical image segmentation, implemented in Keras on 240 chest radiographs and their binary masks. On a test set of 43 radiographs, our model achieved 92.3% mean pixel accuracy and a mean Dice coefficient of 0.768. Qualitatively, the model produces realistic predictions for large regions like the lungs and spine. However, in some cases, boundaries between regions are unrealistic and, most crucially, the carina – the small point at which the trachea splits into each bronchus – is never correctly classified. Work is ongoing to implement weighted loss functions to overcome these challenges. At present, this approach offers an initial step toward the goal of providing automatic, anatomic context for line placement assessment.

Direct visualization of underwater objects using wireless transducers on sonar vehicle
Shaswat Joshi
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 313
Mentor: Xiaobo Tan

Underwater surveying has become a challenge on the level where sunlight diminishes, and sound becomes the primary source to map geographical features. Sonar vehicles have played a significant role in capturing both minuscule and substantial attributes of objects underwater with the assistance of transducers. Transducers are mounted on the sides of the sonar vehicle to allow for the conversion of sonar waves to digital signals, and vice-versa. This allows for detection of underwater objects via the reflection of incident sonar rays sent out by the transducers. Current technologies of sonar vehicles have several challenges that are discussed in this research paper such as identifying smooth-surface objects and feeding data from wired transducers. To address these issues, we have stepped away from traditional methods of mechanical measurements and developed a wireless transducer system to maximize the number of reflected sonar waves for capture. In order to mimic underwater conditions as closely as possible, we have conducted our tests in pools with various dimensions. Additionally, diverse gain settings were applied to the wireless transducers to suppress weaker echoes in the chamber for image clarity. Higher order of reflections showed lower levels of intensity uniformly in all of our experiments. We have found that an increasing amount of reflections are also flattened by the gain setting when the wave intensity becomes too minuscule. The wireless transducers have proven to be a reliable source of data collection when requiring an immediate change in electronic settings of the side-scan sonar vehicle.

Characterizing the Differences Between Selection Schemes that are used in Genetic Algorithms
Daniel Junghans
Category & Time: Computer Science & Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 314
Mentor: Charles Ofria

Genetic algorithms are tools that use the principles of natural evolution to solve computational or engineering problems. Genetic algorithms start by generating populations of random candidate solutions, evaluating each of them, and selecting the "best" to move on to the next generation. This new generation is then mutated (to create minor variations) and the process is repeated, refining the quality of the solutions. When running genetic algorithms, different selection schemes exist to determine which parents should be selected for the next generation of candidate solutions. Each selection scheme produces different evolutionary outcomes and interacts differently with other configuration parameters. These differences between selection schemes can affect the quality of the final evolved solutions. The goal of my research is to better understand the differences between selection schemes and ideally demonstrate a new way of characterizing them. For my research, I examined the differences among multiple selection schemes including both traditional choices (Tournament and Roulette Selection) and newer techniques intended to explore many distinct solutions at once (Lexicase selection and its variants). I focused on the differences in performance on challenging problems, as well as the diversity of the solutions produced. I measured selection probabilities using both randomly generated and hand-crafted data. I measured the differences in diversity and performance on challenging problems after each new parent population is generated. We are now examining these results and expect to see Lexicase selection schemes maintain higher levels of diversity than traditional selection schemes, leading to higher-quality solutions.

Trajectory Privacy in Autonomous Vehicles' Communications and Applications
Sophia Khan, Chelsea Osei Mensah
Category & Time: Computer Science & Engineering, Section 3, 2:30 PM - 3:45 PM
Poster: 315
Mentor: Huirong Fu

Despite extensive research efforts over the last decade, security and privacy concerns for self-driving cars and other autonomous vehicles are still prevalent. The proposed research would evaluate protections against "tracing" vehicles, i.e. deanonymizing vehicles based on historical records of their entire trajectories. The trajectory privacy attack on autonomous driving [T-PAAD] suggests there may exist previously unrealized trajectory privacy methods unique to autonomous cars, and there may even be a need to update privacy metrics to better evaluate these new privacy methods. This work evaluates T-PAAD impacts on traditional privacy-preserving techniques, in particular the mix-zone technique, wherein an adversary aims to deanonymize trajectories by exploiting the relation between autonomous vehicles' path planning algorithms and trajectories.

Replay Attack Detection in Multimedia of Things (MoT)
Anderson Kim
Category & Time: Computer Science & Engineering, Section 3, 2:30 PM - 3:45 PM
Poster: 316
Mentor: Khalid Malik

Fake audio detection is expected to become an important research area in the field of multimedia of things (MoT). This paper aims to propose a countermeasure to detect replay spoofing attacks. More specifically, using controlled data sets prepared by SMILES (Semantic Modeling and Intelligent Learning in Engineering Systems) Lab and ASVspoof 2019, we compared the performance of several machine learning algorithms. Detailed evaluation shows that the SVM classifier performed the best among other algorithms by achieving a precision of 97.9%, recall of 97.7%, f-measure of 97.8%, and accuracy of 98%. Additionally, detailed analyses of feature importance show that MFCC, GTCC, and Spectral Flatness are the most reliable features for differentiating between original, first order replay, and second order replay audio samples.

The HelpMe Web Application: Enhancing Communication within Instructional Lab Settings
Gabrielle Kosiba, Claire Lundy
Category & Time: Computer Science & Engineering, Section 3, 2:30 PM - 3:45 PM
Poster: 317
Mentor: Ryan McFall

Stressful college labs are all too familiar to today's students due to the imbalance of instructional staff (professors and TAs) and the students' need for assistance. Students are often left waiting for help, hindering their ability to utilize lab time effectively. It can also leave instructors stressed and exasperated, especially when the same question is asked repeatedly. We created the HelpMe application to better facilitate communication during labs between students and instructors. As students enter their questions into the system, the instructional staff is alerted. Instructors can then provide detailed information to the student and allow other students to access and benefit from the answer via HelpMe. This allows students to work at their own pace and avoids the pitfall of many students having the same question and needing assistance. Our overarching vision is to better provide students with the support they need by providing access to the necessary information and allowing instructional staff to use their time as effectively as possible. We developed HelpMe over a 9 week period using the Angular web-development framework. The front-end utilized HTML, CSS (Bootstrap Library), and TypeScript, while the back-end was implemented using Ruby-on-Rails. Our presentation will describe how HelpMe enhances rather than replaces human interaction by addressing its features and future uses. We performed two beta tests over the course of the summer and will describe what we learned from these two tests. Attendees will have a chance to interact with the HelpMe application as part of the presentation.

Improving FlowDroid's Taint Analysis Using String Information
James Lynott
Category & Time: Computer Science & Engineering, Section 3, 11:30 AM - 12:45 PM

Poster: 318
Mentor: Lunjin Lu

Android offers a popular platform for the creation and use of mobile applications, but with this popularity has come the risk of endemic security issues. Applications that leak sensitive information are a threat to the privacy and security of Android users. This results in a pressing need for the development of precise and comprehensive analysis tools for the Android platform. One such tool is FlowDroid, which uses a taint analysis to track data from sensitive sources to untrusted sinks. Taint analysis is just one static analysis tool of many, however. Other analysis types can report on different types of security information. In particular, a string analysis can not only identify where sensitive strings may appear, but could also help locate safe strings that the taint analysis considers dangerous. We therefore propose refining FlowDroid by incorporating a string analysis to increase the tool's accuracy in identifying harmful flows of information.

A Fixed-Point Architecture for Fully Connected Networks in a CNN
Joseph Muhle, Devon Schleyer
Category & Time: Computer Science & Engineering, Section 3, 2:30 PM - 3:45 PM
Poster: 319
Mentor: Daniel Llamocca

This work presents a custom hardware architecture for fully connected layers of a convolutional neural network (CNN) implemented on a field programmable gate array. This research is being performed because CNNs have proven very effective in areas such as image recognition and classification. Other areas they excel in are identifying faces, objects and traffic signs apart from powering vision in robots and self-driving cars. In addition, CNNs have been effective in several Natural Language Processing tasks (such as sentence classification). A MATLAB model is implemented that performs training and testing the CNN with the MNIST database. The hardware design is described in VHDL in a parametric fashion that allows for the rapid hardware implementation of a variety of neural network configurations. To optimize resource usage, the hardware design is implemented using fixed-point arithmetic. The resulting design is a fully parallel and pipelined architecture that produces results every clock cycle, thereby enabling the design of high-performance dedicated hardware implementations for CNNs. Hardware verification is carried out by integrating the hardware design into a reconfigurable embedded system and comparing the results of the fixed-point architecture with those of a floating-point MATLAB model.

Using Resampling to Generate Multiple Sequence Alignment Support Estimation
Anushka Murthy
Category & Time: Computer Science & Engineering, Section 3, 2:30 PM - 3:45 PM
Poster: 320
Mentor: Kevin Liu

Multiple sequence alignment is a fundamental problem in computational biology, and it is used as an input to many problems within the field (eg. phylogeny estimation, protein structure prediction, etc.). When we estimate an alignment, it is useful to know how much support is associated with each portion

of the alignment—If a particular region has a higher amount of support, we can be sure that the particular region of the alignment is likely to be correct. One way to estimate support is to construct alignments from many resampled replicates and see if they agree. Bootstrapping, based on random sampling with replacement, is one of the most popular methods of non-parametric resampling. Once we have our set of replicates, we obtain a support metric by measuring how often a particular subset of our original alignment occurs in each replicate. Although bootstrapping is useful for resampling, it makes the highly idealized assumption that sites of evolution in a genome are independent and identically distributed. In order to remove this assumption, a new method was introduced called SEQuential RESampling (or SERES), which operates by taking random walks on unaligned sequences. The basis behind SERES comes from the Heads or Tails (HoT) assumption that an alignment can be read from front to back or back to front. Because of this, SERES replicates preserve the neighbors that any given nucleotide has in the original alignment. Among the many applications for the SERES method, we hope to further investigate use for multiple sequence alignment support estimation.

The Keyboard Trap: Making Jupyter Notebooks Accessible to All Students
Abudit Rai
Category & Time: Computer Science & Engineering, Section 4, 2:30 PM - 3:45 PM
Poster: 321
Mentor: Dirk Colbry

Jupyter Notebook is a relatively new environment that incorporates formatted text (using markdown), multimedia (video and pictures using html) and executable code where users can write and execute code within "cells" for languages such as Python, Julia, and R making it a particularly effective means of teaching students concepts that involve programming. Because notebooks help in communication, many instructors prefer to implement class content using Jupyter Notebooks. However, there are currently several accessibility issues with the current Jupyter Notebook software that prevents every user from having an equal opportunity to use this platform. This research investigates one of the largest problems; the issue of keyboard traps where keyboard navigation of a website becomes stuck after a certain point, effectively trapping a user who does not have the ability to use the mouse. By reviewing the Javascript code for Jupyter Notebooks, this project will look at key bindings and commands to see how the interface is set up, find the areas that cause this trap to occur, come up with ways to fix the potential solutions and provide the best fix to the OpenSource Jupyter Software Community Project.

Asymmetric Lightweight Hierarchical Group Key Management Protocol for VANETs
Skyler Robinson, Tom Royce
Category & Time: Computer Science & Engineering, Section 4, 2:30 PM - 3:45 PM
Poster: 323
Mentor: Khalid Malik

A vehicular ad-hoc network (VANET) is a dynamic model designed to provide communication between vehicles, assisting with problems like traffic management and safe transportation. In a VANET, multicast groups are formed when nearby vehicles have the same application requirements. These multicast groups rely on the confidential sharing of cryptographic group keys, and these keys must change

whenever a vehicle joins or leaves the group. An asymmetric lightweight multicast scalable (ALMS) group key management protocol has already been developed by members of the SMILES lab to efficiently manage group keys for VANETs. Our project is to propose a hierarchical version of ALMS in order to improve its scalability for large groups. We will test the effectiveness of this modified protocol via an OMNeT++ simulation, considering the following factors: group key computation time, group key retrieval time, size of encrypted key, and scalability when the number of group members increases.

Characterization and Mapping of Gadolinium Based Contrast Agents
Tom Ruvio
Category & Time: Computer Science & Engineering, Section 4, 2:30 PM - 3:45 PM
Poster: 324
Mentor: Assaf Gilad

In order to find the correct T1 relaxivities of any given contrast agent; We developed a new protocol for the T1 mapping of a known contrast agent, gadolinium. We developed this novel protocol, by constructing a newly developed MATLAB based algorithm and compared the algorithm generated T1 relaxivities, R1, and signal intensities of gadolinium to their respective values produced by the MRI machine. After viewing these results, my data, signal, and generalized image processing algorithm affectively found the correct T1 relaxivities, R1, and signal intensities of gadolinium, especially when compared to its known, MRI generated values at given concentrations. Furthermore, this project displays the development of this T1 relaxation algorithm and the significance of the development in relation to its application and functionality towards finding T1, R1, and intensity values of any given contrast agent. In conclusion, the algorithm we generated not only successfully characterizes the given gadolinium contrast agent, by determining its mean intensity, R1, and T1 relaxation times both precisely and accurately, while simultaneously capitalizing on R^2 dependent thresholding to eliminate signal noise in an efficient manner, which will improve MRI cell tracking.

Searching the Algorithm Space to Automate Scientific Image Analysis workflows.
Noah Stolz
Category & Time: Computer Science & Engineering, Section 4, 2:30 PM - 3:45 PM
Poster: 325
Mentor: Dirk Colbry

Scientific image analysis is the process of pulling specific measurements out of images. Which measures are important depend on the scientific question being asked. For this reason, there is no single image analysis software that scientists can use to analyze their data. For every new problem, a researcher must either manually annotate each of their images or new software needs to be written for their specific problem. In this research we aim to use machine learning to search the "Algorithm Space" of common image analysis workflows and automatically find customized solutions. As an example, and proof of concept, this research will demonstrate the concept using the common workflow of Image Segmentation. We aim to create a tool that helps researchers segment any image based data set and try to find an algorithm that will automate the process for the particular data analysis task. The success of this tool is in reducing the amount of time it takes researchers to segment an image data set manually.

In this prototype, we will use python's skimage.segmentation library which provides a comprehensive set of algorithms. Each algorithm in the skimage.segmentation has multiple parameters which leads to a large search space. We will apply genetic algorithms which are known to effectively evaluate large, non-differentiable search spaces. This tool will be tested against prelabeled datasets and estimate the amount of time the tool could potentially save a researcher to segment the images by hand.

Deep Learning Methods for Automatic Evaluation of Lines in Chest Radiographs
Ryan Sullivan
Category & Time: Computer Science & Engineering, Section 4, 2:30 PM - 3:45 PM
Poster: 326
Mentor: Adam Alessio

Catheters, lines, and tubes are life-supporting devices often inserted into patients undergoing medical procedures. Radiologists examine chest X-ray images immediately after insertion to avoid serious complications from misplaced devices. We seek to develop a machine learned automatic evaluation of these inserted devices to provide faster interpretation and improved patient outcomes. A previous approach to address this challenge with machine learning synthesized lines on radiographs to generate annotated data, then used a U-Net style segmentation network. Separate studies have demonstrated the value of adding residual connections to Fully Convolutional Networks (FCN) used for biomedical image segmentation. Our approach extends this research by incorporating a ResNet50 backbone into U-Net and by proposing a novel transfer learning scheme. First, a ResNet50 model pre-trained on the ImageNet data set is fine tuned for an auxiliary classification task. Second, the full segmentation network, using the ResNet50 backbone, is trained on the primary task performing semantic segmentation of lines. Our approach was developed and tested with two data sets: 1) the publically available Stanford CheXpert data set, and 2) an IRB-approved set of pediatric radiographs, both of which we manually annotated with the line locations. We demonstrate that this transfer learning scheme outperforms learning from scratch and leads to a viable approach for rapid line evaluation in chest radiography.

Lightweight Data Authentication in Information-Centric Based IoT Applications
Andrew Tian, Andrea Koenigsknecht
Category & Time: Computer Science & Engineering, Section 5, 2:30 PM - 3:45 PM
Poster: 327
Mentor: Amartya Sen

The Internet of Things (IoT) domain is typically characterized by a vast array of resource-constrained heterogeneous devices. IoT services facilitated via these devices are in the form of data sensing and sharing which has enabled numerous applications like healthcare, industries 4.0, and smart cities. For data routing and networking purposes in these IoT applications, a new protocol called the Information-Centric Networking (ICN) has been proposed as an alternative to the traditional IP based networking. ICN protocol implements data routing and networking by leveraging a publish-subscribe approach between users, focusing on the contents of generated data packets and in-network caching strategies. Even though ICN improves performance metrics like network latency, it removes the need for a source-

destination identification model as used in IP-networking. Hence, there is an increased need for effective data authentication schemes for IoT applications utilizing ICN. However, since IoT devices are resource-constrained in terms of available energy, memory, and processing power, any proposed authentication scheme should be optimized in terms of their resource consumption without compromising the obtained security. Along this direction, this work presents the simulation and performance analysis of different lightweight authentication schemes incorporated in an IoT based healthcare application designed using ICN.

Understanding Evolutionary Transitions to Multicellularity
Oscar Vargas
Category & Time: Computer Science & Engineering, Section 5, 2:30 PM - 3:45 PM
Poster: 328
Mentor: Charles Ofria

Perhaps the most monumental shift in our evolutionary history was the transition from single cellular organisms to multicellular organisms. However, because that transition happened about 600 million years ago, it is effectively impossible to study the events leading up to it. Laboratory experiments that attempt to study this major transition must first wait for organisms to reach the point where they begin to evolve multicellularity, and maintaining the experiment for such a long time can be challenging. Even once this transition begins, it can also be difficult to collect the level of data needed to understand what is going on. Furthermore, these challenges are multiplied when we consider that we would need many instances of a major transition if we want to make claims about the cause and effects of evolutionary pressures on evolving populations. One way to overcome these obstacles is to use computer models that instantiate evolutionary pressures on populations of digital organisms and collect perfect data throughout the process. For this project, we use such a computer model with a virtual physics system that was developed to facilitate evolutionary transitions. We have started by designing a virtual world that should allow coexistence of many types of organisms across niches. We will allow each organism to consume anything that is a certain factor smaller than it, including small resources that we seed the population with or, for large organisms, other smaller organisms. We hope to find stable coexistence of many types of organisms at different sizes.

Efficient Algorithms for Predicate Detection with Configurable Accuracy
Alexander Villatora Jr.
Category & Time: Computer Science & Engineering, Section 5, 2:30 PM - 3:45 PM
Poster: 329
Mentor: Eric Torng, Sandeep Kulkarni

In runtime monitoring of distributed systems, we try to detect if the system violates any predefined requirements; we define these requirements with predicates and thus simplify runtime monitoring to predicate detection. Runtime monitoring of distributed systems must balance three conflicting criteria: wait-free execution (the application will not be stopped due to monitoring), efficiency (the monitoring overhead is small), and accuracy (minimizing both the number of false positives [the predicate is detected when it should not have] and false negatives [the predicate is not detected when it should

have been]). Previously, Yingchareonthawornchai et al. proposed a wait-free and efficient hybrid logical clock (HLC) monitoring solution that guaranteed no false positives but could fail to detect predicates that are true for intervals shorter than 휖, the synchronization error bound. In this work, we propose to generalize their HLC monitoring solution so that users can trade off minimizing false positives and false negatives by introducing a parameter Γ between zero and 휖 such that intervals are extended in length by up to Γ. If Γ=휖, we have no false negatives but do have false positives. If Γ=0, this is equivalent to their original solution, which has no false positives but does have false negatives. If 0 < 휂 < 휖 , we will have both false positives and false negatives, but fewer than either extreme. To achieve this generalization, we can only monitor a more restricted set of predicates that allow efficient resolution of overlapping intervals.

HOW CONVOLUTIONAL NETWORKS CAN HELP IDENTIFY CROPS AND WEEDS IN FARMS
Jason Viviano
Category & Time: Computer Science & Engineering, Section 5, 2:30 PM - 3:45 PM
Poster: 330
Mentor: Daniel Morris

In order to combat and help secure the future of farming we've begun looking at integrating software advances with the needs of farmers. By using machine learning techniques like convolutional neural networks, we are trying to detect crops and weeds and soil separately in images. First by creating a binary classification to distinct image pixels belonging to soil and plants. Then using the plant pixels and training them to learn what type of plants they are in order to separate them. There are a lot of challenges revolving analyzing images however when it comes to identifying plants it becomes complicated through how intermingled each plant is with the other and how they share very similar characteristics. It also depends on which angles are used when taking pictures and the amount of resolution used, and how advance we can make the recognition by the computer through the use of multiple deep learning algorithms and a database of crop pictures. We are hoping our results could help farmers analyze their farms better and help develop new techniques to dealing with weeds in the hopes of reducing the rise of resistance towards herbicide.

Gait Recognition via Disentangled Representation Learning
Ziyuan Zhang
Category & Time: Computer Science & Engineering, Section 5, 2:30 PM - 3:45 PM
Poster: 331
Mentor: Xiaoming Liu, Feng Liu

Gait, the walking pattern of individuals, is one of the most important biometrics modalities. Most of the existing gait recognition methods take silhouettes or articulated body models as the gait features. These methods suffer from degraded recognition performance when handling confounding variables, such as clothing, carrying and view angle. To remedy this issue, we propose a novel AutoEncoder framework to explicitly disentangle pose and appearance features from RGB imagery and the LSTM-based integration of pose features over time produces the gait feature. In addition, we collect a Frontal-View Gait (FVG)

dataset to focus on gait recognition from frontal-view walking, which is a challenging problem since it contains minimal gait cues compared to other views. FVG also includes other important variations, e.g., walking speed, carrying, and clothing. With extensive experiments on CASIA-B, USF and FVG datasets, our method demonstrates superior performance to the state of the arts quantitatively, the ability of feature disentanglement qualitatively, and promising computational efficiency.

Fine Mapping Disease-Risk Variants with a Novel Bayesian Model by Integrating Casual Biological Information
Tongyu Yang
Category & Time: Computer Science & Engineering, Section 5, 2:30 PM - 3:45 PM
Poster: 332
Mentor: Jianrong Wang

Predicting casual variants is of vital importance in understanding disease mechanisms. With Genome-Wise Association Study (GWAS), people associated genotype with disease phenotype and identified tens of thousands of single nucleotide variants (SNVs) that are correlated with a certain disease. However, there is a gap between phenotype and genotype and the reason why those genetic variants are correlated with disease is still unknown. Further, among those large number of correlated variants, it is much more challenging to identify the casual variants because of pervasive correlations result from linkage-disequilibrium (LD) block. Recently, booming of personalized disease diagnose and therapy requires a comprehensive map of casual genetic variants. By identifying those casual variants as a reference, people can compare DNA profile of patients with reference and give a personalized prediction. Great efforts have been made to predict those variants by investigate different methods, including Bayesian method, deep learning and so on. To address the challenge, we build a machine learning model to precisely predict causal disease-risk variants by borrowing additional information from DNA sequence. Moreover, our model can simultaneously prioritize important k-mers, which represents transcription factors that are highly involve in human disease. By applying the model to current public available data, we aim to discover disease-risk variants and reveal underlying disease mechanisms.

A Motion Induced Passive Infrared (PIR) Sensor for Real-Time Human Occupancy Detection
Jack Andrews
Category & Time: Electrical & Computer Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 333
Mentor: Jia Li

Passive Infrared (PIR) sensors are able to detect human presence by identifying the change in infrared radiation across the polarity of the sensor; however, PIR sensors are dependent on human movement. As a result, the PIR sensor will not detect stationary human objects resulting in false negatives. In the pursuit of creating a low-cost, low-power, simplified solution to detecting true occupancy in a closed space, a PIR sensor mounted on a moving platform, MI-PIR, was developed for the system to induce the motion that is necessary for human detection. MI-PIR will allow for detection of stationary and moving human occupants, classifying an office space as being occupied or unoccupied. MI-PIR was made possible through extraction of the raw analog output of the PIR sensor. The analog output served as a

means of calibrating a threshold environmental temperature signal and then comparing that to a human occupied office. This development alongside deep learning algorithms allows for real-time occupancy detection in a closed office space. MI-PIR is a real-time, simplified mechanical approach to using a PIR sensor for stationary occupancy detection. Accurate detection of a closed office space will aid in further research of human behavior and presence detection utilizing various sensor modalities.

Investigation of the Process of Converting a C++ Code into an Implementable FPGA File
Ana Borgesdealmeidabarreto
Category & Time: Electrical & Computer Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 334
Mentor: Dirk Colbry

A Field Programmable Gate Arrays (FPGAs) is an integrated circuit that can be "rewired" to become other circuits. This ability makes FPGAs highly configurable and can significantly help speed up large scale computation used in scientific research. While useful, FPGAs are often underutilized because of the complexity of developing circuits using Hardware Descriptive Languages (HDLs). Software compilers exist (ex. OpenCL and Merlin) to make circuit design easier but these compilers require many hours to translate C++ into a variable circuit implementable file and can fail to even find a solution. Compiling a C++ code into an implementable file has three main steps. First, converting the C++ code into an HDL code, running the implementation of that code, and finally mapping the implementation for the specific FPGA. The first two steps are relatively quick to complete. However, the mapping part is what makes the whole process slow. It is difficult for the computer to take an arbitrary HDL circuit diagram and map it to the FPGA framework. The calculations are an optimization problem that requires searching though many different circuit pathways to find one that will work. The premise of this project is to explore methods to more efficiently converting C++ into FPGA applicable file. As this is a big problem to tackle, the first objective is to understand how the mapping is currently done (using Intel FPGA SDK), make a practical guide of installing and using the open source compiler and explore alternatives to the existing FPGA programming workflows.

Increasing Lifespan of Implanted Microdevices by Applying Organic Coatings on Wires
Matthew Brauer
Category & Time: Electrical & Computer Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 335
Mentor: Wen Li

Neural microdevices appear to have more potential for implantations for the future although their lifespan inside the nervous system raises a concern in case of possible replacement of the device. In this study, multiple organic coatings between silicon nitride, perylene-c, and silicon dioxide are tested with tungsten wires to determine which coating is best when the wires are attached to a neural layer. The wires are stored in glass bottles with 1.5 centimeters of three possible solutions, phosphate-buffered saline (PBS), PBS and high concentration hydrogen peroxide (H2O2), or PBS and low concentration H2O2, and placed in a microwave oven at an elevated temperature of 60°C to accelerate the aging of the samples. One week in the microwave oven is equal to eight weeks of the lifespan of the wires.

Impedance measurements and microscopic images are captured daily until clear patterns in the graphs between impedance and phase angle are shown. Measurements are incomplete as of far, high concentrations of H2O2 with PBS have appeared to deteriorate the tungsten wires at quick rates at about the span of two to three weeks, further testing is needed for proof. Silicon dioxide coated wires have shown to have glass-like behavior, the coating is very fragile and difficult to test, different methods to prepare silicon dioxide coatings are needed. Multiple external factors such as temperature and variable concentration of solutions possibly affect the process of measurement due to inconsistency in impedance values. Further testing is necessary to reduce these factors and refining methods for testing will yield precise results.

Human Phantom Development for Mouth pH Monitoring
Nikkoiya Cromwell
Category & Time: Electrical & Computer Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 336
Mentor: Prem Chahal

The goal of this research is to develop a pH sensor that could effectively detect the acidic/alkaline levels present within the oral cavity in order to increase the effectiveness of dental care. To test the sensor, we would design a human head phantom, a model of the human head that mimics the physical and chemical properties and its tissues, thus removing the need of using living creatures as test subjects. To develop our model, it is required to mix various materials at certain proportion to exhibit the properties of the human tissue. The phantom has primarily two objective: 1) to provide a test bed for different pH solutions, and 2) to provide similar dielectric properties of the human tissue. This work will allow us to attain a test bed for measuring pH levels within mouth oral cavity. We also would test the relative permittivity and electrical conductivity within the model and identify possible material variations that could be made to the composition of the human mouth, in order to design antenna to improve the effectiveness of our sensor.

Analyzing Strategies for Safe Multi-robot Motion Planning Algorithms
Kunj Dedhia
Category & Time: Electrical & Computer Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 337
Mentor: Shaunak Bopardikar

In order to deploy technologies in future smart cities, and systems, especially, autonomous vehicles will heavily rely on intra-vehicle sensors and inter-vehicle communication links to make decisions. Such dependence on sensors and communication leaves the system vulnerable to physical and cyber-attacks to manipulate sensor data and take control of the system. In fact, according to a recent article by the Forbes Technology Council, the world would spend $6 trillion dollars by 2021 on cybersecurity to protect data breaches and the amount will only increase with more reliance on technology. Thus, to ensure safety and security of autonomous vehicles, this study focuses on analysing circumstances under which information from attacked sensors could still hold to be of value for autonomous systems. It revolves around mapping and path planning against mobile adversaries compromising sensor data, which

otherwise aid the robot. The setup in the study considers Gazebo simulations of a TurtleBot3 WafflePi evader and pursuer(s) in bounded and unbounded regions with the limitations of an intermittent 2-dimensional laser distance sensor (LDS) as the only functional sources of input data streams with which the robot must make decisions. In such a scenario, the robots could adopt one of two possible strategies – Reactive Pursuit (move one unit step only at every instance it receives a sensor-input) or continue with the last known measurement. This work examines and compares outcomes of each strategy.

Machine Learning Approaches to Predict Learning Outcomes in Online Courses
Charles Green
Category & Time: Electrical & Computer Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 338
Mentor: Jiliang Tang, Jiangtao Huang

Improving the learning experience can be done with the use of Learning Analytics. Based on the Open University Learning Analytics dataset, in 2013 and 2014 47.25% of the people in the selected modules passed while 21.62% failed and 31.13% drop the class. This could be for a multitude of reasons from demographics such as age and gender, location or activity on the online course. Finding which one of the many influences on their grades are the most impactful on the final outcome of the class can help raise the number of people passing and passing with distinction, while also lowering the drop and fail rate of classes. The goal is to test different machine learning algorithms and to compare their performances for this dataset. We will also use the data obtained from machine learning to help find which influences are most important in predicting the final outcome of a class. Demographics about 32,593 students, their assessment results and the logs of their interactions on the online courses will be used to test machine learning algorithms such as Decision Trees, Random Forest and Support Vector Machines, amongst other Machine Learning Algorithms. We anticipate that we will find an algorithm that will be able to predict the final result of the online course around 90% accuracy and show which influences are most important in the final result of the class. Our results will help show which algorithms are best to be used statistical analysis situations such as this.

A Wearable Flex Sensor-Based Approach to Tracking Human Joint Motion
Harrison Lavins
Category & Time: Electrical & Computer Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 339
Mentor: Brian Dean

Accurate methods of human motion tracking which can be effectively attached to the body or integrated into clothing have a wide variety of uses in film, animation, athletic performance analysis, gaming, virtual reality, and biomedical research applications. Current wearable tracking systems which rely solely on the use of inertial measurement unit (IMU) sensors are costly, obtrusive, and prone to inaccurate measurements due to factors such as drift and electromagnetic radiation in the subject's surroundings. The aim of this experimental study is to investigate the potential of using commercially available capacitive bend sensors to improve the accuracy and reliability of current wearable human motion capture systems, and to improve their cost-effectiveness, ease-of-use, and viability by reducing

the total number of sensors required. Preliminary bend angle data was collected using sensors worn on the outside of the knee joint with the use of commercial microcontrollers, processed using Arduino and MATLAB software packages, and then validated against ground-truth digital goniometer measurements. Preliminary results suggest that the Bend Labs One Axis Soft sensor produces joint angle measurements with the high degree of accuracy and repeatability necessary for effective human motion capture, and that these types of flexible capacitive sensors can be easily integrated into clothing and wearable devices so as not to restrict the wearer's movements, however, great care must be taken in their mounting in order to ensure reliable sampling.

A Phase Measurement Based Structured Light Sensor for the Inspection of Internal Corrosion of Metal Pipes
Zonglin Li
Category & Time: Electrical & Computer Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 340
Mentor: Yiming Deng

Internal corrosion in pipes is dangerous due to multiple factors such as gas composition (carbon dioxide, hydrogen sulfide, and oxygen), water and microbial influences contributing to its development. Especially in gas pipelines, the internal corrosion results in material loss that may lead to pinhole leakage, cracks, or even rupture of the pipeline. To reduce the downtime during scheduled maintenance, fast and efficient corrosion detection techniques are required. The proposed method will focus on the development of novel structured-light based imaging for internal corrosion detection, which simplifies the detection process while achieving superior spatial resolution. We will develop an endoscopic structured light scanning tool which will be entirely inserted into the pipe through a main hole and moving along the pipe while projecting a static fringe pattern on the inner pipe wall. The proposed method facilitates the integration of PMP with the moving scanning platforms, which will lead to the generation high density 3D maps of the scanned pipe surfaces and be used to provide the sensor with depth sensing capability. With structured light, a predefined pattern is projected on the scanned surface and the shape is reconstructed through monitoring the projected pattern deformations. The 3D reconstructions will be successfully completed and tested by applying the proposed method to the pipeline samples during the EnSURE program.

Using GPU Computing to Develop a Neural Network Model for Autonomous Driving
John McCartney
Category & Time: Electrical & Computer Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 341
Mentor: Shadi Alawneh

With self-driving cars being the future of the automobile industry, the formulation of more efficient algorithms has been the forefront of the advancement of self-driving technologies. Driving scenarios are becoming increasingly complex – pedestrians, bicycles, road work, etc. – so it is crucial that the models used for self-driving cars are able to respond to these scenarios as quickly as possible to ensure roads are as safe as possible. This research project aims to build an AI model using a deep neural network for

autonomous driving, while using a GPU to increase the speed of the training and inference process. The NVIDIA Jetson TX1 'Jet' robot will be used as the vehicle for autonomous driving, utilizing a camera mounted on the front to collect images in order to build the neural network. The output from the neural network will then be sent from the TX1 to the Arduino in order to communicate to the robot which direction it needs to go to avoid any obstacles in its path. With the data collected, it is hoped to find out what kind of impact (if any) using GPU has on developing a neural network model to help further advance future technologies for autonomous driving.

3D Printed Microfluidics for Thermal Cooling of RF Circuits
Avi Rajendra-Nicolucci
Category & Time: Electrical & Computer Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 342
Mentor: Prem Chahal, Saranraj Karuppuswami

Additive Manufacturing or 3D Printing has become an increasingly popular tool for fabrication of RF and microwave circuits. The advantages of 3D printing such as freedom along the z-axis and rapid customization have been exploited for printing complex geometries which are often difficult to realize using traditional manufacturing techniques. 3D printing has grown into an important tool for low-cost mass commercialization of light-weight, complex electronics. In this work, a microfluidic channel is printed coupled to an integrated circuit and associated passives using 3D printing. A face-up process for embedding the chip along with the associated passives is performed. Initially, a required number of cavities are created on the 3D printed substrate. The printing is stopped to place the different chips into their corresponding cavities. Once placed, the printing is continued to enclose the chips. Vias are created on the top layer of the substrate to allow electrical connectivity. Microfluidics channels are also printed along with the substrate. The fluid inside the microfluidic channels will act as a heat sink to prevent overheating of the chip. The key challenge is optimizing the design of the microfluidic channels to maximize the heat loss from the chip as well as embedding different components onto the substrate. The RF circuit along with the microfluidics will be characterized and studied.

Nonverbal and Verbal Synchronous Communication in Robots for the Enhancement of Message Comprehension
Niya Senn
Category & Time: Electrical & Computer Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 343
Mentor: Wing-Yue Louie

As we continue to make technological advances in AI, we also are working further towards bridging the gap between robot and human interaction. Robots being able to communicate with humans directly through speech is already a huge step in this direction, however we want to continue to enhance this communication and take it a step further. This study focuses on taking that step by understanding how verbal and nonverbal synchrony can be used in socially assistive robots in order to enhance message comprehension from its users. This study aims to do this by programming a Pepper robot to use both speech and movement/gestures to communicate with real people. Since movement and speech are

already features built into Pepper, the verbal and nonverbal synchrony will be implemented on the robot using the GUI programming tool Choregraphe. This communication will be tested on subjects using three different conditions: high synchrony, in which there are far more frequent gestures that align with the robot's speech, minimal synchrony, and finally dyssynchrony. The results of these conditions will be determined by a questionnaire given to the subjects once they have finished interacting with Pepper. Through testing these three conditions the desired outcome is a better understanding of what combination of speech and movement from a robot results in easier message processing.

Developing a Smartphone-Based Application for Remote IoT Sensors Monitoring
Kanishka Wijewardena
Category & Time: Electrical & Computer Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 344
Mentor: Prem Chahal

With the proliferation of Internet of Things (IoT) technology, there is a demand for obtaining uninterrupted information from different sensors using smartphones. This is especially important in healthcare and other sensor-based real-time smart monitoring systems. This work is being developed as a part of a Smart Mouth-placed Health monitoring device, which can provide real-time information from the mouth sensor and visually display the data to the users. The proposed IoT system builds upon the existing batteryless RFID infrastructure. The existing design has two communication layers 1) Sensor to RF reader communication, and 2) Smartphone to RF reader communication. A smartphone application receives and transmits data from an intermediate RF reader, which interacts with the batteryless sensors deployed in the Smart Mouth-placed device. The Sensor to RF reader communication layer uses standard RF backscatter communication to obtain data from the sensor at the intermediate RF reader. After obtaining the sensor data at the RF Reader, the reader communicates the data to the smartphone using standard wireless technology such as Bluetooth or WiFi. In this project, a smartphone application will be developed and demonstrated on the Android platform using Android Studio.

Vortical/Non-Vortical (V/NV) Boundary Identification for a Turbulent Single Stream Shear Layer
Timur Aminov
Category & Time: Mechanical Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 345
Mentor: Junlin Yuan

Turbulent shear slows are often found in axisymmetric and planar jets and wakes, such as the wake of a moving truck or jets generated by vertical take-off aircraft. We aim to identify and characterize the viscous super layer at the boundaries of a single-stream turbulent shear layer, bordered by a high-speed parallel entrainment and a low-speed perpendicular entrainment. The terminology of "turbulent/non-turbulent interface" commonly used in the literature is problematic since there is no universal definition for turbulent. Instead, we use a V/NV interface as a more definitive way of identifying the border of a single stream shear layer. Particle Image Velocimetry data was used to capture instantaneous border of the turbulent flow based on the V/NV interface locations identified using the instantaneous velocity and

vorticity fields. The present study also explores ways to improve the border-identification techniques by, e.g., using a higher-order difference scheme, using a more physics-based approach, and developing a new algorithm to post-process the PIV data.

Quantification of Biventricular Myocardial Strain from Magnetic Resonance Images of Pediatric Pulmonary Hypertensive Patients using Hyperelastic Warping Method
Carson Bronnenberg
Category & Time: Mechanical Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 346
Mentor: Lik-Chuan Lee, Tong Gao

Pulmonary hypertension (PH) is a rare disease where the pulmonary arteries become constricted. This disease is diagnosed clinically when the pulmonary arterial pressure is greater than 25 mmHg at rest (and greater than 30 mmHg during exercise). Without treatment, PH can lead to right heart failure, the most common cause of death in PH patients. The increase in pulmonary arterial pressure impacts the right ventricular (RV) mechanics. Unfortunately, it is not clear how PH affects the ventricular mechanics of pediatric patients. In this study, we seek to use the Hyperelastic Warping method to estimate the circumferential, longitudinal, and radial strains in the left ventricle (LV) and RV. The main goal of this research is to compare the PH patients' strain data to those of normal patients in order to detect abnormalities in the biventricular mechanics. Geometrical surfaces of the RV cavity, LV cavity, and epicardium surfaces were reconstructed from the magnetic resonance images (MRI). Based on the hyperelastic warping method that was implemented using the finite element method, the patient-specific biventricular models were deformed into alignment with the MRIs acquired in a cardiac cycle. Biventricular strains of the PH patients were then computed from the deformation. This study will help better understand PH and its effects on biventricular mechanics.

Developing a Posture Cycle as a Method of Pressure Relief for Wheelchair Users
Paige Cordts
Category & Time: Mechanical Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 347
Mentor: Tamara Bush

Pressure ulcers (PU) are acquired due to prolong periods of pressure on regions of the body, or due to shorter periods of intense pressure. Most PUs form on bony prominences in the body such as the sacrum, heels, and buttocks. PUs are a prominent problem in populations of wheelchair users as they are seated for long periods of time, often without shifting in their seat. As many as 21% of wheelchair users still develop PUs, and once formed they are difficult to heal. The best solution is prevention. A need exists for devices and protocols that reduce PU formation. Thus, the goal of this work was to develop a list of postures that shift pressure to different regions of the thighs, buttocks, and back through the use of an articulating wheelchair. Using pressure data collected from 20 able-bodied participants, optimal positions for unloading the buttocks, distal thighs, and lower back were found. From this, a set of postures was successfully identified that shift pressures from the butt and lower back to the distal thigh and upper back. Using an Arduino Uno, a program is being created to move the chair

through this set of postures. With this program and set of postures the potential exists to reduce the risk of PUs for wheelchair users.

Utilizing a Human Head Surrogate to Study Blunt Impacts and Traumatic Brain Injuries
Bianca Davila Montero
Category & Time: Mechanical Engineering, Section 1, 11:30 AM - 12:45 PM
Poster: 348
Mentor: Thomas Pence

Traumatic Brain Injury (TBI) is a disruption in normal function of the brain caused by an outside force to the head. According to the Center for Disease Control and Prevention, 2.87 million TBI-related emergencies occurred in 2014; increasing medical visits from 2006 to 2014 by a 53%. The impact mechanisms are widely studied; experiments performed on animals or post mortem human subjects. An alternative to these models is to use human head surrogates known as phantoms. This study aims to validate the use of phantoms in the study of blunt force impacts. The phantoms have been developed with materials that match the dynamic and non-linear response of a human brain, while also allowing for optical transparency. The blunt impact will be created using a drop tower experiment, with increasing load drops onto the brain phantom. The data gathered will be from the full spectrum of head impacts; both under and above the average impact energy specified to cause damage. Pressure data from a sensor located at the inside of the phantom will be collected, and it will serve to specify if the intracranial pressure of the phantom behaves as previously reported data in the literature. In addition, ultra-high-speed cameras will be used to image the phantom ultimately allowing us to track internal events. This serves to as a secondary data acquisition source to explore the possible mechanism/s leading to tissue damage. A peak for the intracranial pressure is expected to be obtained, including a negative pressure right after the impact.

Fully 3D-Printable Soft Robotic Glove with Force Sensors
Mia Gilreath
Category & Time: Mechanical Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 349
Mentor: Xiaobo Tan

Stroke is a frequent cause of adult-onset disability. As many as 9 out of 10 stroke survivors suffer some form of mobility impairment, including hand paralysis (National Stroke Association). The cost of paralysis rehabilitation is among the fastest-growing healthcare expenses, with an average cost of over $11,000 in medical fees per year (Godwin). We aim to design an affordable at-home device for hand paralysis rehabilitation for stroke survivors. The device will be fully 3D-printable with force sensors embedded in the structure. The glove will be made of NinjaFlex, a flexible and durable filament. Each part of the glove will be fabricated separately. In order to sense changes in pressure and grip strength, the design will contain microchannels for liquid metal or another conductive material. Throughout this study, we will modify the size and shape of the material to accommodate the sensors. Prototypes of this glove will be tested for pressure strength, conductivity, and durability. By designing and fabricating a 3D-printable glove, this may provide an affordable and at-home solution to physical therapy for hand

paralysis.

Data Acquisition and Model of an Integrated Greenhouse System
Michael González Boehlert
Category & Time: Mechanical Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 350
Mentor: Andre Benard

The overall project aims to develop an advanced greenhouse system with substantially reduced energy and water consumption with a potential for up to a 50% improvement in crop yield compared with state-of-the-art greenhouse systems. As part of this effort, a developed model requires validation from recorded temperature, humidity, light irradiation and air quality data from an actual greenhouse. The project for this summer consists of implementing a low-cost data acquisition system based on an Arduino Board and eventually compare recorded data with model predictions. Temperature, humidity, and irradiation sensors will be located throughout the greenhouse (ground, air, and greenhouse frame) and a computer system acquiring data from the sensors will be demonstrated.

A Novel Synthetic Model of the Breast for Practicing Surgical Techniques
Michael Hernandez Lamberty
Category & Time: Mechanical Engineering, Section 1, 2:30 PM - 3:45 PM
Poster: 351
Mentor: Tamara Bush

The American Society of Plastic Surgeons (ASPS) describes breast reduction (breast mammoplasty) as a surgical procedure that removes glandular tissue, skin and breast fat to obtain a breast size more proportional to the body. Women with excessively large breasts may seek breast reduction surgery to alleviate physical or emotional discomfort. ASPS reports that between 2011-2018 an average of 112,970 breast reduction procedures were done annually, which were divided 62.88% reconstructive and 37.12% aesthetic surgeries. Past literature has shown that 36% of all aesthetic surgery malpractice occurs during breast-related surgeries. A need exists for a simple, inexpensive device for surgeons to practice breast reductions and reconstructions. Thus, the goal of this work was to create a breast biomodel for surgical practice of breast reduction. To accomplish this goal, a computer-aided design (CAD) model of a breast mold was created from literature-based dimensions to achieve an accurate representation of a breast. The prepared CAD model was 3D-printed using polylactic acid (PLA). The materials selected for the biomodel were gelatine and agar agar. The mechanical properties of these materials were analyzed used indentation tests. The model demonstrated to be a good initial prototype on which to practice breast mammoplasty; however, the addition of blood vessels and the use of other gel composites should be conducted to improve the realistic nature of the biomodel. With the creation of a realistic breast phantom, plastic surgeons will be more prepared for breast surgery, which will consequently decrease malpractice in breast-related procedures.

Pulmonary Hypertension Modeling and Simulation
Ailohi Izirein
Category & Time: Mechanical Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 352
Mentor: Seungik Baek

High blood pressure effects every 1 In 3 individuals in the United States and of these only about 54% have their blood pressure under control. Hypertension can cause many problems one of which that arises is the focused area of this research, Pulmonary Hypertension (PH) and how these issues can reduce fatalities. To integrate the Engineering practices with Medical Doctors is going to be our focus, especially on pulmonary hypertension, and we'll use software to render models of the arteriole circulatory system to aid doctors in diagnosis of PH. This will be done by using CRIMSON software along with MIMICS (Materialise Mimics) software to inspect the hemodynamics in an individual's arteries where we will be putting boundary conditions to dissect velocity, flow rate, shear stress, deformable wall and pressure. From doing these series of tests and simulations on CRIMSON and Mimics I will get quantitative data such as flow rate, pressure and figures from the softwares to give visual data along with the quantities gathered. So, the overall impact that this research will provide a service to doctors and patients. From Crimson model it's prevalent to notice that velocity doesn't have much effect on hypertension but it does on shear stress. Also that shear stress is the most important factor analyzed where we can look at the strength of material, thickness and elasticity of that material lining the vessel. The programs will help aid the diagnosis of pulmonary hypertension and reduce the risks from a catheter.

Analysis of Humidification Dehumidification Packing Material Geometries
Jared Koekkoek
Category & Time: Mechanical Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 353
Mentor: James Klausner

While water is critical to human life, it has become increasingly difficult to obtain in remote areas. In recent years, Humidification Dehumidification (HDH) technology has been studied as a method to produce freshwater from low quality water sources, including seawater and brackish water. HDH provides a simple, low-cost water treatment system that uses low temperature solar or waste heat. This simplicity allows decentralized water production by significantly decreasing the specific energy required for water processing. The applications of solar and waste heat to drive the HDH system offer a multitude of intriguing possibilities. A general setup for an HDH evaporator involves liquid being supplied to the top of a high surface area packing material and a non-condensable gas blown at the bottom. The gas and liquid pass through the packing counter-currently which enhances liquid and vapor contact and mass transfer. Heat and mass transfer occurs at the interface between the liquid and gas. The heated brackish water evaporates, humidifying the air. The opposite process takes place in the condenser where the humidified air condenses and freshwater is produced. The literature currently reports freshwater production up to 50L/day for household-sized systems. However, there is currently little understanding of the momentum, heat, and mass exchange at the scale of the pores within the packing. The goal of this study is to design and build an experimental system that will allow modification of

packing geometries under various operating conditions to understand and enhance the performance of such HDH water treatment systems.

Freestanding Silicon Nanocrystal Layers: Optical and Mechanical Properties
Cameron Papson
Category & Time: Mechanical Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 354
Mentor: Rebecca Anthony

Silicon nanocrystals (SiNCs) have many applications in electronic devices due to their efficient and tunable optoelectronic properties. In the many methods for creating SiNCs, they are nearly always either embedded in an inorganic matrix or supported by a substrate. While this has not hindered their use in technologies such as light-emitting devices (LEDs) and solar photovoltaics, it also raises questions about SiNC properties in standalone layers. It is well-known that the local environment of nanocrystals can influence their optical properties, and many of the methods for testing the mechanical behavior of thin layers of SiNCs rely on substrate-supported techniques. The purpose of this research project is to explore the mechanical and optical properties of SiNCs as freestanding layers, moving to fill our knowledge gaps about the behavior of thin films of these materials. Our hypothesis is that we can create these freestanding layers by using inertial impaction of SiNCs onto sacrificial layers such as NaCl. We used thermal evaporation to deposit thin layers of NaCl onto substrates such as glass, silicon wafer, and polydimethylsiloxane (PDMS). Then, we synthesized SiNCs using a flow-through RF plasma reactor and inertially impacted them onto the NaCl-coated substrates. Next, we dissolved the NaCl layer, freeing the SiNC layers and allowing us to test their photoluminescence, shear modulus, and other properties.

Optical Observation of the Flue Gas Recirculation Effect on Methane/Air Flames
Yen-Cheng Wang
Category & Time: Mechanical Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 355
Mentor: Elisa Toulson

With more stringent regulations on power plant emissions and the increasing role of renewable energy sources in power production, the staged combustion concept for gas turbine combustors is gaining in popularity since staged combustors provide higher load flexibility and lower NOx emissions. However, the reintroduction of flue gasses into the combustion environment – corresponding to the second stage for a staged combustor– affects the flame reactivity and stability. For this work, the effect of flue gasses on methane/air flames was experimentally investigated at elevated temperatures and pressures (1-5 bar and 373-473 K). Experiments were performed in a 22.24-liter cylindrical combustion chamber complete with two 20.32-cm-diameter windows for optical access.

Avatars in the Office
Garrett Weidig
Category & Time: Mechanical Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 356

Mentor: Tamara Bush

More than 60% of Americans work at a desk and chair. In recent years, standards have been used for ergonomic seating and standing postures. However, those standards are not widely known and when they are, people rarely maintain that posture for long. Sitting or standing in non-ergonomic positions for long periods of time can lead to back pain, joint pain, and decreased blood flow. There is a need to study what kind of deviations people make from ergonomic postures, how extreme they are, and what immediate effects it has on the body. There also needs to be a way to communicate this information in a meaningful way. The objective of this study was to create an avatar that moves with the participant to show deviations in seated posture and to collect perfusion and force data to show the effects of non-ergonomic postures. The study tested participants in 3 postures: seated, standing, and seated in a stool. 3D kinematic data was collected and linked to a full-body avatar to show deviations in ergonomic posture. Force and perfusion data were used to analyze the effects of transitioning to a non-ergonomic posture. To market this data, an avatar was constructed using the kinematic data to map a participant's body movement. The avatar was used to show posture in a way that people can interact with and understand. Using the avatar's motion, the optimal duration spent in different postures as well as an optimal design for a chair can be determined.

Effective MQL process
Zhengwei Yu
Category & Time: Mechanical Engineering, Section 2, 2:30 PM - 3:45 PM
Poster: 357
Mentor: Patrick Kwon

My summer research main focus on the MQL (Minimum Quantity Lubrication). The function of the MQL is to lubricate the drilling process and make and cut more effective and accurate. My research area is to design a specific nozzle that could inject a mixture of oil and air towards the top of the cutting insert. The goal is to create a layer of oil and cover the surface of the workpiece, so that could reduce the friction between cutting tools and workpiece. At the same time, the heat generated by the cutting process could be absorbed by the liquid drops. So the nozzle I designed should be able to create a uniform layer on the surface of the workpiece. Besides, the channel of the nozzle should form a certain angle to make sure the liquid goes towards the right location. The problem I faced is that, I need to make different types of the nozzles that could fit the tube size, also make the channel shape that fits the inter pressure and velocity of the air. Also, I'm doing some tapping experiences to measure the density of the different mixture of the material so that we are able to choose the correct ratio of the mixture for 3D printing.

Mass Measurements of 27P for Improved X-ray Burst Modeling
Ayman Abdullah-Smoot
Category & Time: Physical & Mathematical Sciences, Section 1, 2:30 PM - 3:45 PM
Poster: 358
Mentor: Ryan Ringle

Neutron stars can form due to iron 56 (56Fe) fusion occurring inside some massive stars during supernovae. A lack of energy opposing the force of gravity causes the star to collapse in on itself creating a neutron star. Neutron stars can orbit in a binary system with a companion star from which the neutron star takes hydrogen and helium particles in a process called accretion. Accreted hydrogen and helium begins building up on the neutron star. This creates another fusion, called thermonuclear runaway, resulting in a thermonuclear explosion, called an X-ray burst, that creates heavier elements. X-ray burst light curves can help study neutrons stars and their companion. Light curves measure the intensity of an X-ray burst's light over the duration which it occurs. For accurate light curve creation, masses of all elements involved in the X-ray burst's reactions must be known and their uncertainties small enough for negligible effect on the plotting of the light curve. Isotopes with well-known mass uncertainties are added to the Atomic Mass Evaluation (AME), a quadrennially updated table listing known masses and uncertainties. In the case of the extremely rare phosphorus 27 (27P) the mass uncertainty is too large, significantly effecting the light curve. In this study, we will measure the mass of 27P using a 27P beam, created in the National Superconducting Cyclotron Laboratory, and a Penning trap mass spectrometer. We hope to find 27P's mass, use it to create accurate light curve simulations and add our findings to the 2020 AME.

Molecular-Driven Computational Approaches to Understanding the PFAS Crisis
Betoul Ali
Category & Time: Physical & Mathematical Sciences, Section 1, 2:30 PM - 3:45 PM
Poster: 359
Mentor: Angela Wilson, Timothe Melin

For the past 60 years, perfluorinated and polyfluorinated alkyl substances, known as PFAS, have been prevalent in the environment due to their high performance and versatility as flame retardants, stain repellents, and non-stick coatings such as Teflon and lining in food packaging. Bioaccumulation of these molecules has been linked to diminished liver, thyroid, and pancreatic function. Although ubiquitous, there have been limited studies of the thermochemical properties of PFAS. This study investigates the thermochemical properties of this class of molecules, and more specifically, those of polyfluorinated compounds with a carbon chain of four carbons or less, using density functional theory. Several density functionals have been utilized with the 6-31G and aug-cc-pVTZ basis sets to predict the Gibbs free energy and other properties including pKas. Additionally, a number of reaction pathways are considered to determine possible degradation mechanisms of PFAS in nature.

Synthesis and Structure-Activity Relationship Study of Novel Nitrodiphenylurea Antibiotics
Helen Bahlbi
Category & Time: Physical & Mathematical Sciences, Section 1, 2:30 PM - 3:45 PM
Poster: 360
Mentor: Matthew Hart

Mycobacterium tuberculosis bacteria causes tuberculosis (TB) infections. With the emergence of multidrug-resistant tuberculosis (MDR-TB) exhibiting resistance to rifampicin and isoniazid, the most

effective antibiotic treatments, new antibiotics are urgently needed. The only antibiotic to recently receive approval for the treatment of MDR-TB has been delamanid, which exhibits nitro functionality. Recently, our lab has discovered a novel family of diphenyl ureas (DPU) that exhibit antimicrobial activity against several bacterial strains including mycobacterium, similar to TB. Based on the previous research and current antibiotics used to treat MDR-TB, several new nitro-substituted DPU derivatives were synthesized and examined for their structure-activity relationship. Each modification to the chemical structure of our lead nitro-DPU allows for the testing of their biological effects and improve upon the lead antibiotic's potency. Herein, we report the synthesis of the nitro-DPUs. Moving forward, the completed ureas will be tested with kill zone assay tests to determine antibiotic activity.

Rotational Diffusion Dynamics of Oxazine 725 in a Binary Solvent System. In Search of Heterogeneity in the Solution Phase
Austin Benedict
Category & Time: Physical & Mathematical Sciences, Section 1, 2:30 PM - 3:45 PM
Poster: 361
Mentor: Gary Blanchard

Oxazine 725 is a laser dye that is used in this work to understand whether or not two liquids mix randomly or exhibit molecular scale heterogeneity. By studying the rotational diffusion behavior of this dye in a binary solvent system, comprised of a polar aprotic solvent (DMSO) which is not capable of hydrogen bonding, and controlled amounts of a polar protic solvent (1-propanol) that is capable of hydrogen bonding, we will determine the uniformity of the solvent system at the molecular scale. The Oxazine 725 rotational dynamics will exhibit a linear dependence on the concentration of 1-propanol if the solution is homogeneous and a non-linear trend if the solution is heterogeneous. The results of this work have implications on chemical processes ranging from chemical separations to the synthesis of complex pharmaceutical compounds.

Modeling a Quantum Engine with Different Theoretical Approaches
John Buhl
Category & Time: Physical & Mathematical Sciences, Section 1, 2:30 PM - 3:45 PM
Poster: 362
Mentor: Katharine Hunt

The probability of a transition between quantum states due to a time-dependent perturbation has typically been calculated with P. A. M. Dirac's perturbation theory, based on the entire coefficient for the excited states of the unperturbed Hamiltonian. Mandal and Hunt have shown that interpreting the probability of transitions with this theory does not work for a "plateau" pulse, which rises from zero to a constant value and later falls off. The Dirac theory shows transitions while the perturbation is constant, which is not physically reasonable. In contrast, the theoretical method developed by Lev Landau and Evgeny Lifshitz splits Dirac's answer into the sum of two terms, adiabatic and and nonadiabatic. Then with the identification of the norm-square of the nonadiabatic term as the transition probability, more reasonable results are found, which meet known physical requirements. Other theoretical results

obtained by Mandal and Hunt strongly support the identification of the norm-square of the nonadiabatic term as the true transition probability between states. With this in mind, our work compares the results of these two theories in the context of a single-molecule quantum thermodynamic engine suggested by R. Kosloff and modeled experimentally in work by Rossnagel et al. The calculated work output of the engine during the power stroke differs between the two approaches, as does the heat transfer to a bath.

Analysis of the Impact of Silanes on the Fluidity of Indium Bisphosphonate Surfaces
Emma Calabrese
Category & Time: Physical & Mathematical Sciences, Section 1, 2:30 PM - 3:45 PM
Poster: 363
Mentor: Gary Blanchard

A fluid surface is one that allows for high diffusional movement and can minimize the frictional force present when materials interact. For this reason, surface fluidity offers a novel solution for systems that are friction limited, such as lubricants that are applicable to a range of areas, automobiles, industrial machinery, and firearms. Fluid surfaces bound to a solid substrate were constructed using metal bisphosphonate chemistry. A self-assembly process allowed for the sequential adsorption of each component to form the monolayer surfaces. Silane compounds were incorporated into the structure of the surfaces based on results from previous studies indicating that silanes contribute to uniformity. Reactive silanes bind covalently to a surface containing the appropriate functionality, and ordering occurs through intermolecular forces. Techniques from these studies were repeated with four different silanes to analyze if they could affect surface fluidity. Ellipsometry and fluorescence recovery after photobleaching (FRAP) were implemented to analyze the structure of the surfaces and the diffusional properties of the surfaces, respectively.

Understanding Energy Transfer in Plasma Turbulence
Aurora Cossairt
Category & Time: Physical & Mathematical Sciences, Section 2, 2:30 PM - 3:45 PM
Poster: 364
Mentor: Philipp Grete, Brian OShea

Plasma turbulence is a pervasive phenomenon throughout our universe and is known to play an important role in many astrophysical processes, including the formation of stars and galaxies and the production of cosmic rays. However, even its simplest form (compressible magnetized turbulence) is not well understood, and the lack of a universal theory of magnetohydrodynamics (MHD) limits our ability to study other interesting astrophysical phenomena. In order to study magnetized turbulence, we must turn to large scale computer simulations which can solve the MHD equations numerically. Using such simulations, we can study energy transfers in turbulent plasma systems, such as how magnetic energy is transferred to kinetic energy and vice versa and whether energy cascades are present. There are multiple ways to formally define the kinetic energy density, and one's choice of this mathematical formalism may impact the conclusions drawn by data analysis. The goal of this project is to understand how the chosen formalism affects the resulting calculation of energy transfer rates and the energy

power spectrum. We test two possible mathematical formalisms against various conditions—focusing on the compressibility but also including multiple magnetic field configurations and forcing patterns—to determine how they affect our analysis of scale-to-scale energy transfer. We compare our results with those given by Grete, et. al. (2017). Our results will improve the accuracy of future simulation analysis, thus advancing efforts to better understand how compressible magnetized turbulence shapes our universe.

Rapid spectral variability in the black hole transient MAXI J1820+070
Megan Davis
Category & Time: Physical & Mathematical Sciences, Section 2, 2:30 PM - 3:45 PM
Poster: 365
Mentor: Abigail Stevens, Jay Strader

One of the best laboratories to study strong-field gravity is the inner 100s of kilometers around stellar-mass black holes in binary systems with low-mass stars like our Sun. The X-ray light curves of these binary systems show variability on timescales from milliseconds to months — the shorter (sub-second) variability can appear as quasi-periodic oscillations (QPOs), which may be produced by general relativistic effects. We will look at types of low-frequency QPOs from an exciting recent black hole transient, MAXI J1820+070. This source was observed in a multi-wavelength campaign that included the NICER mission, a soft X-ray telescope attached to the International Space Station. Our X-ray analysis will be done by applying Fourier-domain analysis and "spectral-timing" techniques. The ultimate goal is to place constraints on the QPO emission mechanism, perhaps precession of the accretion disk and/or relativistic jets.

How does Student Self-Feedback Align with Assigned Focus Areas?
Matthew Dew
Category & Time: Physical & Mathematical Sciences, Section 2, 2:30 PM - 3:45 PM
Poster: 366
Mentor: Paul Irving, Daryl McPadden, Paul Hamerski

Currently at MSU, students have the option of taking either a standard lecture-based physics course or a flipped problem-based learning classroom for their introductory calculus-based physics sequence. In EMP Cubed, the electricity and magnetism version of the flipped classroom, students are given formative feedback by their instructors on their performance every week with the aim of assessing and developing scientific practices. A third of the way into the semester, the feedback switches from teacher-centered to student-centered and the students are required to assess their performance in three categories and write feedback for themselves. The three categories are group collaboration, individual understanding, and process skills. When giving self-feedback, students are prompted to discuss something they did well, something they want to improve on, and strategies to improve on that aspect of their performance. In this study, we investigate how well student responses fit these three categories and highlight self-feedback themes present in students feedback that are focused on alternative categories. This research will inform the iterative development of the feedback process in

EMP-Cubed.

Biocatalytic Production of a Paclitaxel Analogue Precursor
Jennifer Elder
Category & Time: Physical & Mathematical Sciences, Section 2, 2:30 PM - 3:45 PM
Poster: 367
Mentor: Kevin Walker

Drug-resistant bacteria are well known among various human populations, and these microorganisms have adapted to the antibiotic drugs that are used to kill them. Likewise, a serious challenge is drug-resistance to chemotherapeutics in cancer cell lines, and this preventive medicine challenge commands equal attention. Drug-resistant cancer cell lines is an ever-growing concern that requires further research on the mechanism of resistance so new chemotherapy treatments can be developed. Paclitaxel is a microtubule stabilizing drug that is widely used for various cancers, including those of the breasts and ovaries. Drug resistance to paclitaxel has been found in cancer cell lines overexpressing mutant β-tubulin isotypes and the P-glycoprotein (P-gp) drug efflux pump. There are studies seeking to design paclitaxel analogues that will target either β-tubulin mutants or P-gp to render resistant cell lines susceptible to chemotherapy. A paclitaxel analogue SB-T-1214 was found that effectively binds P-gp and βI-tubulin isotype with point mutations near the taxane binding site in paclitaxel-resistant cancer cell sublines. These binding interactions made SB-T-1214 effective against drug-resistance cancer cell lines. SB-T-1214 is currently made through a semisynthetic process over ~9 steps from a natural product 10-deacetylbaccatin III. In this study, we investigated the use an acetyltransferase (DBAT) enzyme to biocatalytically produce a precursor of SB-T-1214 with an ultimate goal to reduce the number of synthesis steps and remove the use of petroleum-based reagents that are used currently in the semisynthesis methodology. This presentation will report on the results of these biocatalytic efforts.

Excited State Dynamics of Anticancer Photodynamic Therapy Dye Indocyanine Green
Benjamin Farris
Category & Time: Physical & Mathematical Sciences, Section 2, 2:30 PM - 3:45 PM
Poster: 368
Mentor: Marcos Dantus, Maryann Laboe

This project examines the excited state dynamics of the fluorescent molecule indocyanine green (ICG) in water. ICG is FDA-approved for use in anticancer photodynamic therapy (PDT). In PDT, laser light is used to excite ICG, which generates free radicals that kill cancer cells. Steady-state and femtosecond time-resolved relaxation dynamics were studied using absorbance/fluorescence spectroscopy and pump-probe spectroscopy, respectively. Single-photon absorption at 800nm excites ICG to the S1 excited state. Absorption at 266nm excites ICG to the little studied S3 state. Interestingly, this state fluoresces at 450nm instead of relaxing to S1 and emitting at ~830nm. ICG can also access the S3 state by three-photon absorption of 800nm light, which could lead to novel PDT applications. Ultimately, this project seeks to understand the role of 266nm and 800nm light in controlling the excitation of ICG.

Physics-Informed Machine Learning: Using Function Learning Networks for Multiscale Modeling
Elijah Sheridan
Category & Time: Physical & Mathematical Sciences, Section 3, 2:30 PM - 3:45 PM
Poster: 369
Mentor: Michael Murillo

Nearly all physical systems have dynamics occurring across wide ranges of length and time scales. Modeling such multiscale systems is challenging when the known macroscopic models are approximate versions of the underlying microscopic dynamics. Hydrodynamics models, for example, assume functional forms for closures that might be inconsistent with the atomistic dynamics. The general problem of multivariate nonlinear regression is often effectively approached with basic neural networks; unfortunately, approximations found this way provide little physical significance and tend to fail to extrapolate. This motivates the development of a model which can learn the macroscopic equations of motion themselves from the microscopic, atomistic dynamics; having functional forms grants more information about the system and promises to allow the inclusion of physical constraints along with improving extrapolation. We have begun exploring existing methods which employ novel, end-to-end differentiable, feed-forward function learning networks to learn analytic solutions and output them symbolically. To date, we have applied these approaches to simple physical models—including coupled pendula and coupled springs—and nonlinear mathematical expressions. Throughout this process we have also examined architectural, hyperparameter, and regularization implications for the accuracy and sparsity of learned functions. Our ultimate goal is to learn the macroscopic equations of motion from molecular dynamics simulations to enable lower cost forecasting in large-scale simulations.

Identification and Quantification of Pyrazines (IPMP and IBMP) in Coffee Samples by Solvent Extraction-GCMS Analysis
Ciara Gillis
Category & Time: Physical & Mathematical Sciences, Section 3, 2:30 PM - 3:45 PM
Poster: 370
Mentor: Kevin Walker

Approximately 75.3% of the Rwandan labor force works in agriculture and coffee is one of their top exports. Of late the Potato Taste Defect (PTD) has caused their brewed coffee to taste and smell like boiled raw potatoes. Farmers may end up losing their market because of the defect, potentially hurting the Rwandan economy and the farmers' livelihoods since quality determines the price. IPMP (2-isopropyl-3-methoxypyrazine) and IBMP (2-isobutyl-3-methoxypyrazine) are the pyrazines that cause PTD. Pyrazines are aromatic organic compounds found in many foods, but there is little knowledge on how the compounds are impacted by coffee roasting. Determining the amount of IPMP and IBMP at multiple temperatures can determine the ideal roasting treatments to reduce the potato taste as much as possible. The goal of our study is to quantify the concentration of pyrazines at different temperature treatments. Green coffee beans were roasted at varying temperatures and the pyrazines were extracted using liquid solvent extraction. We will run the samples through the gas chromatography-mass spectrometer to separate and quantify the compounds and discover their concentrations through calculated peak areas. We anticipate that the concentrations of IPMP and IBMP in the affected green coffee samples will increase as the roasting temperature increases because high temperatures are ideal

for the formation of pyrazines. By discovering the effect of temperature on IPMP and IBMP concentration, farmers can adjust their roasting process accordingly to reduce the amount of PTD in their crops.

Modification of Nitrogen-based Ligands for Ortho-directed, Iridium-catalyzed C-H Borylation
Kameryn Hinton, Kameryn Hinton
Category & Time: Physical & Mathematical Sciences, Section 3, 2:30 PM - 3:45 PM
Poster: 371
Mentor: Milton Smith

Carbon-hydrogen borylation reactions have become a sought-after technique due to their use as intermediates in synthesis and green synthesis methods. Using traditional borylation synthesis, the processes generally involve three steps that are time consuming and utilize hazardous materials. In contrast, the contemporary practice involves a one-pot synthesis to transform substrates, such as arenes, into organoboron compounds by using an iridium-based catalyst and a boron source. This catalytic method transforms C-H bonds into C-B bonds, which are comparatively more reactive, in a single step. This project requires the usage of nitrogen-based ligands in order to create a catalyst that gives high regioselectivity for the ortho-position, rather than steric products. In this presentation, we will be highlighting how these nitrogen-based ligands work and their capabilities in iridium-catalyzed C-H borylation reactions.

Seismic Monitoring of Temporal Change of the Red Cedar River
Tyler Jackson
Category & Time: Physical & Mathematical Sciences, Section 3, 2:30 PM - 3:45 PM
Poster: 372
Mentor: Min Chen

Every year, as the snow melts in Michigan, the Red Cedar River's discharge drastically increases and water spills onto the Michigan State University's campus. This interrupts life on campus, and roadway closures cause mass confusion for commuters. It's important to monitor the temporal change of a river's upstream activity in order to issue flood early warning for its downstream. As a river flows and interacts with its bed and banks, a fraction of the energy of the river can be transferred into the earth media outside the river channel in the form of seismic waves. Previous studies have shown that the change of seismic wave energy content measured outside the river channel is directly related to the temporal variations of discharge rate and bed load of the river. The discharge rate and water level of the Red Cedar River is monitored by USGS (United States Geological Survey) water gauging station on MSU campus. In this study, two palm-sized seismometers (Raspberry Shake 3D) are installed outside and across the Red Cedar River channel to collect continuous seismic waveforms. In order to isolate the river seismic signals from other sources (e.g., anthropogenic noise or earthquakes signals), a series of data analysis methods including Fast Fourier transform, ambient noise interferometry, and power spectra density analysis will be applied on the seismic data set. The goal of this study is to identify the temporal correlation between high seismic energy and drastic increase of water discharge rate of the Red Cedar

River.

Using the Halo Monitor Ring as a Pickup to Measure Beam Bunch Length
Robby Mckay
Category & Time: Physical & Mathematical Sciences, Section 3, 2:30 PM - 3:45 PM
Poster: 373
Mentor: Steven Lidia

Measuring beam bunch structure and length is essential to producing and delivering a high quality beam to the target for experimentation. The Halo Monitor Ring (HMR) which has been shown to detect loss of the beam may also serve as a pickup used to measure bunch length. Using the modeling software LT Spice, a circuit model with passive components was used to gain a simplified understanding of the interaction between the beam, HMR, and coaxial cables. This interaction was also measured using a network analyzer. The circuit model was then replaced by a mathematical expression using the time derivative of the beam current as the image current on the HMR. An expression was found for the image voltage of the HMR over a transmission line as a function of frequency using a Fourier transform. The effects of coaxial cables and a beam position monitor measurement box on the output voltage of the system were observed. The output voltage could then be used to understand beam characteristics.

Measuring 25Si decay with the new GADGET system at NSCL/FRIB
Aaron Kruskie
Category & Time: Physical & Mathematical Sciences, Section 3, 2:30 PM - 3:45 PM
Poster: 374
Mentor: Christopher Wrede

The recently built Gas Amplifier Detector with Germanium Tagging (GADGET) system was built to measure β-delayed particle and γ-ray emissions to study nuclear astrophysics applications. To calibrate the detector, GADGET was commissioned with a Silicon-25 (25Si) beam at the National Superconducting Cyclotron Laboratory (NSCL). Though just a calibration, the system has the sensitivity to detect new transitions in the 25Si decay. 25Si undergoes β-delayed proton emission, which emits γ-rays of distinct energies, corresponding to its two daughter nuclei, 25Al and 24Mg. Using data from GADGET and the Segmented Germanium Array (SeGA), γ-ray spectra of 25Si decay were created. Through gating these spectra to include only γ-rays in coincidence with another emission, peaks caused by background decays can be eliminated from the spectrum. 25Al peaks were gated under β decay and 24Mg peaks were gated under proton decay. The γ-ray peaks corresponding to the 24Mg daughter nucleus were found to be Doppler shifted, requiring additional simulation using a Monte Carlo method. Through analyzing the peaks of these spectra, new information on the β-delayed proton emission decay scheme can be gained, which can be compared to predictions from nuclear models.

X-ray Observations of the Classical Nova V339 Del
Jesse Leahy-Mcgregor
Category & Time: Physical & Mathematical Sciences, Section 4, 2:30 PM - 3:45 PM
Poster: 375

Mentor: Ehab Ahmed

An overview of the x-ray photometry and spectroscopy of the classical nova V339 Del using observations taken by Swift XRT and Chandra.

GAMMA-EM: Emulating Galactic Chemical Evolution Models to Explore the Galactic Origins of the Elements
Carleen Markey
Category & Time: Physical & Mathematical Sciences, Section 4, 2:30 PM - 3:45 PM
Poster: 376
Mentor: Brian OShea

The elements on the surface of stars carry a permanent snapshot of the star formation and chemical evolution history of a galaxy. When modern models of galactic chemical evolution are compared to these snapshots, it should be possible to discern the chemical evolution process in a galaxy. However, current models are too time-intensive to evaluate with proper statistical methods, which require many iterations of the model within its parameter space to produce a probability distribution of starting parameters that best fit the observations. As one proposed solution, we aim to emulate the Galaxy Assembly with Merger Trees for Modeling Abundances (GAMMA) model through the use of Gaussian process regression, then compare the results to newly available observational data with Markov Chain Monte Carlo methods. By training a Gaussian process based emulator with numerous training GAMMA samples generated from a sparsely sampled set of input parameters, we seek to greatly reduce the computational time required to produce chemical evolution predictions from GAMMA. Given this, we expect to use this emulator model (GAMMA-EM) in conjunction with Markov Chain Monte Carlo to obtain a set of GAMMA input parameters that produce the best model fit to newly available observational data. This will likely improve our current understanding of the chemical evolution process in our galaxy and many others.

The VIP (Variations in Progenitor) Suite
Brandon Mcintyre
Category & Time: Physical & Mathematical Sciences, Section 4, 2:30 PM - 3:45 PM
Poster: 377
Mentor: Chelsea Harris, Sean Couch

Massive stars die when their cores collapse to a neutron star or black hole. The collapse triggers an explosion in the rest of the star -- a supernova. The most common core-collapse supernovae are called Type IIP supernovae (SNe IIP) because their luminosity is constant for a hundred or more days, creating a plateau in the "light curve" (plot of luminosity over time). SNe IIP can be used to measure distances in the universe, and are seen farthest away when magnified by gravitational lensing -- gravitational microlensing, however, at the same time changes the light curve to create error in this measurement. On top of this effect, there is uncertainty in how the light curve looks because different progenitors (the stars that explode) create slightly different supernovae. In order to aid in the study of lensed SNe IIP, I created ~200 SNe IIP simulations on the local MSU supercomputers with varying progenitor properties.

These progenitors where evolved through core-collapse and nuclear burning with a code called FLASH, then carried out to ~300 days with the SNEC code, which also provides light curves. I will present on these simulations and how they will be used to study microlensing of glSNe IIP.

Investigating Patterns Between Chemical Properties and Degradation of Perfluoroalkyl and Polyfluoroalkyl Molecules (PFAS)
Quintin Medina
Category & Time: Physical & Mathematical Sciences, Section 4, 2:30 PM - 3:45 PM
Poster: 378
Mentor: Angela Wilson, Timothe Melin

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals used in a wide range of consumer products (e.g., fire suppressants, food packaging, clothing, etc.). Although PFAS have many applications, its presence has led to numerous adverse health effects such as cancer, an increase in birth defects, and compromising the immune system. One of the more daunting challenges of studying PFAS is the vast number of PFAS present – over 4000 compounds – of which only a small subset has been studied concerning environmental impact and thermochemical properties.This work focuses on investigating physiochemical properties and potential trends of PFAS via computational approaches. A library containing ∼200 PFAS molecules and their chemical properties is created to include molecular descriptors (Gibbs free energy, pKa, solubility, etc.) generated via density functional theory calculations. This library will highlight similarities within PFAS and provide insight towards developing and improving methods for PFAS removal from theenvironment.

Winnability for the Group Labeling ?Lights Out? Game.
Christian Miller
Category & Time: Physical & Mathematical Sciences, Section 4, 2:30 PM - 3:45 PM
Poster: 379
Mentor: Darren Parker

The game "Lights Out!" consists of a 5x5 grid of buttons that have two states, on and off. Pushing a button will cause the pushed button and all of the buttons adjacent to it to change their states. We can also represent these states with a number label, either 1 if the button is on or a 0 denoting the button is off. The goal of this game is to be able to "turn off" all the lights, or in other words, to get all of the buttons to have a state of 0. The rules and setup of the game lends itself well to a graph theory representation. For an arbitrary graph, we can play the "Lights Out!" game on it if we let the vertices of the graph represent buttons in our original game, with the edges connecting those vertices representing the buttons that are adjacent to each other. This project is focused on a slightly modified version of the game's original rules, with the labels for the vertices coming from the group Z_n. It is not always possible to win the game. We will be investigating the values of n for which this group labeling "Lights Out!" game is always winnable when played on various families of graphs, including complete bipartite graphs.

Finding Candidate Millisecond Pulsar Binaries
Jessie Miller
Category & Time: Physical & Mathematical Sciences, Section 4, 2:30 PM - 3:45 PM
Poster: 380
Mentor: Samuel Swihart

Multi-wavelength follow-up observations of unidentified gamma-ray sources have led to the discovery of numerous millisecond pulsar (MSP) binaries with non-degenerate companions. When the companion is low-mass and hydrogen-rich, they are classified as redbacks, after the cannibalistic spider. These systems are critical for understanding the physics of the pulsar spin-up process. Our group has pioneered a new method to discover such systems using new and archival datasets spanning across the electromagnetic spectrum. We begin by searching for X-ray sources inside the error regions of carefully selected 4FGL gamma-ray sources, using observations from the Chandra, Swift, and XMM-Newton X-ray missions. If the X-ray source has an optical counterpart, we look for evidence of optical variability, consistent with orbital motion in a compact binary. Using our regular cadence with the SOAR 4m telescope, we quickly follow up these systems with optical spectroscopy, allowing us to fit for the orbital properties of the binary. Together with the inclination (inferred from fitting the optical light curve), these measurements can be used to estimate the mass of the MSP and infer the true counterpart to the gamma-ray source.

Searching for Shocks in Novae from Hard X-ray Emission
Alexa Muethel
Category & Time: Physical & Mathematical Sciences, Section 5, 2:30 PM - 3:45 PM
Poster: 381
Mentor: Laura Chomiuk, Elias Aydi

Novae are thermonuclear runaway events on the surface of accreting white dwarf stars. This event increases the brightness of the binary star system hosting the white dwarf by a factor of 10,000. With the recent detection of gamma-ray emission from novae, it has been discovered that shocks and the accompanying hard X-ray emission play an important role in powering the nova emission. However, the study of shocks in novae is still a new and poorly-explored topic. In order to better understand the mechanisms of shocks and the role of hard X-ray emission, we are conducting a survey of novae that have shown emission in X-ray wavelengths. We present an analysis of 36 X-ray light curves with data taken by the Swift X-Ray satellite from 2004 to 2018. This unprecedentedly large sample size allows us to look for population trends with the goal of understanding the role of hard X-ray emission in novae.

Comparing Supervised Learning Algorithms for Image Classification
Calarina Muslimani
Category & Time: Physical & Mathematical Sciences, Section 5, 2:30 PM - 3:45 PM
Poster: 382
Mentor: Ekaterina Rapinchuk

Image classification is the process of categorizing image pixels into specific classes. It is used across

many fields such as facial recognition in social media apps and monitoring remote areas via drones. This process can be done on several image types such as hyperspectral, RGB, and grayscale images. Hyperspectral images have many channels that span across the electromagnetic spectrum which allows them to convey more information than RGB images, which have only three channels. Hyperspectral imaging results in thorough spectral information which allows for distinguishing between materials. This is useful for military target detection or identifying mineral and wetland properties. Our goal is to apply several supervised learning algorithms to classify hyperspectral images and sets of RGB images. More specifically, support vector machines, random forest, convolutional neural networks, and k-nearest neighbors will be applied. We will then compare the accuracies and computation times of the various methods. Additionally, we will vary the hyperparameters in the algorithms to optimize the accuracies.

Doppler-free Laser Spectroscopy of Iodine Molecule for Laser Frequency Calibration
Ryan Parker
Category & Time: Physical & Mathematical Sciences, Section 5, 2:30 PM - 3:45 PM
Poster: 383
Mentor: Kei Minamisono

Our team is interested in determining the charge radius of radioactive short-lived nucleus. To do this we use laser spectroscopy and measure atomic hyperfine spectra. We need to know the laser light frequency accurately, since the nuclear effect in a hyperfine spectrum is very small. Iodine is a molecule that has thousands of well-known transitions in the visible to near-infrared range of light. These well-known transitions allow us to use iodine as a calibration source to accurately determine laser frequency. We use Doppler-free spectroscopy to measure hyperfine spectra of iodine molecule. The comparison of peak positions in the hyperfine spectrum to the set frequency of our laser system allows for accurate calibration of our laser frequency. This summer, I will test the Doppler-free spectroscopy system: particularly important parameters are the temperature of the iodine cell, and powers and alignment of laser light. Details and results of the test will be discussed.

GADGET System for Nuclear Astrophysics: γ-ray Data Analysis
Molly Janasik
Category & Time: Physical & Mathematical Sciences, Section 5, 2:30 PM - 3:45 PM
Poster: 384
Mentor: Christopher Wrede

We are working to understand scientific questions about nuclear astrophysics, such as nucleosynthesis and energy generation in stars and exploding stars. Nuclear physics experiments are needed in order to answer these questions, so we have developed the Gaseous Detector with Germanium Tagging (GADGET) system, a new experimental device at NSCL/FRIB. GADGET is composed of the Proton Detector and the Segmented Germanium Array (SeGA), which are used to measure protons and gamma rays (respectively) emitted following β-decay. In a recent experiment GADGET was commissioned using two rare-isotope beams: a 25Si beam and a 23Al beam. The system was proven to operate successfully using both beams, and a detailed analysis is currently being done on the 23Al gamma-ray data from SeGA to extract the intensities and energies of gamma-ray transitions in 23Mg. We will use this

information to search for new transitions to improve the decay scheme of 23Al to 23Mg.

Applicability of various coupled cluster and perturbation theory methods in the correlation consistent Composite Approach
Rebecca Tomann
Category & Time: Physical & Mathematical Sciences, Section 5, 2:30 PM - 3:45 PM
Poster: 385
Mentor: Angela Wilson, Prajay Patel

To predict physical properties of molecules computationally, ab initio methods such as coupled cluster and many body perturbation theory have been developed. Due to their high technical requirements (memory, disk space, CPU time), lowering the computational cost while maintaining the same level of accuracy of ab initio methods has been of great interest. One such approach towards this goal is an ab initio composite approach, which approximates a higher level of theory at a fraction of the computational cost through a combination of lower level ab initio calculations. The correlation consistent Composite Approach (ccCA) is one of the more accurate composite methodologies used to calculate thermochemical properties within chemical accuracy (1 kcal/mol) in comparison to experimental data. To determine the efficacy of coupled cluster and perturbation theory variants within the ccCA framework, the enthalpy of formation was predicted for a molecule set of 148 closed-shell, radical, and open-shell species consisting of first-row and second-row main group atoms. All variants were compared against the standard ccCA methodology for performance.

Searching for Ultra Luminous X-Ray Sources in Seven Spiral Galaxies
Noah Vowell
Category & Time: Physical & Mathematical Sciences, Section 5, 2:30 PM - 3:45 PM
Poster: 386
Mentor: Kristen Dage

We provide an analysis of extragalactic X-Ray sources in seven edge-on spiral galaxies with the goal of locating Ultra Luminous X-Ray (ULX) source candidates. ULXs are highly energetic X-Ray binaries thought to be powered by rapidly feeding black holes. We target edge-on spirals so that we can disentangle and compare the population of Low Mass X-Ray Binaries (LMXB) typically associated with the galactic halo with High Mass X-Ray Binaries (HMXB) typically associated with the disk of the galaxy. With data from the Chandra Data Archive, we fit each source to different models using XSPEC in order to identify differences between the two populations. Sources better fit by power law models indicate a hard X-Ray source, while ones better fit by disk models indicate a soft X-Ray source. We also determine which sources are contaminating background galaxies as opposed to ULX candidates within our spiral galaxies of interest. Hence we provide a catalogue of X-Ray sources in these seven edge-on spirals and the surrounding areas including both high and low mass X-Ray binary ULX candidates, as well as newly discovered background galaxies.

Recurrent neural network event reconstruction for the IceCube experiment
Johannes Wagner
Category & Time: Physical & Mathematical Sciences, Section 6, 2:30 PM - 3:45 PM
Poster: 387
Mentor: Claudio Kopper

The "IceCube Neutrino Observatory" is a large neutrino detector located in the deep glacial ice near the south pole. It is made up of a three-dimensional array of photodetectors ("optical modules") contained within a cubic kilometer of ice. These measure the Cherenkov light from secondary particles caused by neutrino interactions. IceCube is primarily concerned with searching for neutrinos from astrophysical sources, making it a powerful tool to study the properties of these elusive particles. As a neutrino experiment, it relies on accurate predictions of the energies and trajectories of measured particles. However, the current software used to perform these reconstructions from measured events takes a long time and has relatively poor resolution. Recurrent Neural Networks present an interesting opportunity to both speed up this process, as well as potentially increase the resolution of the results. These networks try to predict desired parameters from given time-series data by minimizing the error between known true values and predicted values. In our case, this means the network receives a list of detector hits containing timing and charge information for each individual optical module involved in a given particle event and tries to predict the corresponding energy and trajectory. After training on data where these quantities are known, the network can then be applied to real physics events. While there is still a lot of fine tuning required, the most recent results show promising accuracy for particle energy and trajectory and suggest possible uses for this method in the IceCube event reconstruction chain.

Stereoselective Synthesis of MUC1-βTf Glycopeptides for use in Anti-Cancer Vaccines
Darshae Ward
Category & Time: Physical & Mathematical Sciences, Section 6, 2:30 PM - 3:45 PM
Poster: 388
Mentor: Xuefei Huang, Hunter Mcfall-Boegeman

Cancer is the second leading cause of death in the United States with an estimated 1.7 million new cases diagnosed in 2019. Glycoconjugate vaccines have emerged as potential treatment options, by training the immune system to recognize tumor associated carbohydrate antigens (TACA). The carrier protein Qβ has become of interest for glycoconjugate vaccines due to its ability to elicit long lasting immune responses. It has demonstrated enhanced immune response compared to the gold standard for carrier proteins, keynote limpet hemocyanin (KLH). In previous studies using Qβ as the carrier, the non-natural antigen MUC1-βTf elicited a similar immune response to the natural antigen MUC1-αTf, as a vaccine utilizing Qβ-MUC1-αTf. Additionally, the potential benefits, such as increased stability of the vaccine construct, of using the non-natural MUC1-βTF instead of MUC1-αTf are in need of further study. The key issue limiting further study of the MUC1-βTf vaccine is low availability of the antigen. The current synthesis results in the major product being the α-linked glycopeptide. This project focuses on the development of a high yield synthesis of MUC1-βTf. This will be accomplished by using protecting groups that are able to participate in glycosylation, directing the formation of the desired b-linked the major product.

How Electron Capture Affects Core Collapse Supernovae
Sheldon Wasik
Category & Time: Physical & Mathematical Sciences, Section 6, 2:30 PM - 3:45 PM
Poster: 389
Mentor: Sean Couch

Modeling the affect that electron capture has on the CCSN. This is being done in 1-D, due to the restraints when applied to 2-D and 3-D

Improved Methods for Neutrino Astronomy
Michael Zaidel
Category & Time: Physical & Mathematical Sciences, Section 6, 2:30 PM - 3:45 PM
Poster: 390
Mentor: Tyce DeYoung

The evolving field of Neutrino Astronomy has the potential to associate high-energy neutrino detections with point-like sources, thereby identifying astrophysical particle accelerators. Further informing this search with local neutrino flavor ratios allows greater sensitivity in the identification of astrophysical neutrino sources. Even though the neutrinos from an astrophysical source should be a mix of all flavors, no satisfactory method for utilizing all flavors in a single search has been found. Furthermore, expected background flavor ratios differ from astrophysical source flavor ratios so a flavor ratio informed search may shed light on the spatial distributions of sources over background. In practice, these searches involve Log Likelihood Ratio methods, which evaluate signal and background probability distributions against the data, fitting free parameters before calculating the test statistic. We will explore the possibility of encoding event topology ratios (as a proxy for neutrino flavor ratios) into these probability distributions to improve the correlations between locations of astrophysical sources and neutrino data. The goal of this project is to implement a prior probability distribution which makes the likelihood aware of the expected flavor ratio for astrophysical sources. The shape of the prior will ultimately be a function of the cascade/track ratio and spectral index and is non-trivial. The accuracy of priors will be evaluated against each other using Monte Carlo simulations and ultimately real data. This analysis will attempt to include non-starting events to increase the potential data set used for point source searches.

Unsupervised clustering and cluster analysis of earthquakes in Southern California
Brian Zhu
Category & Time: Physical & Mathematical Sciences, Section 6, 2:30 PM - 3:45 PM
Poster: 391
Mentor: Min Chen

Southern California is a region of very high seismic activity. In order to better understand the seismicity of the region, we propose methods to cluster earthquakes using unsupervised machine learning algorithms. We use the k-means algorithm with additional parameters of distance to major fault lines and earthquake density to produce clusters that align more closely to fault zones than those produced with 2D or 3D space as the only parameters. We then analyze clusters where exceptionally large

earthquakes have occurred in the past and where groundwater injections have occurred recently for trends in the b-value (ratio of small to large earthquakes).

Feasibility of a Gas Photo-Multiplier (GPM) based MoNA-LISA Detector
Angel Christopher
Category & Time: Physical & Mathematical Sciences, Section 7, 2:30 PM - 3:45 PM
Poster: 392
Mentor: Paul Gueye

The Modular Neutron Array/Large multi-Institutional Scintillator Array (MoNA-LISA) is a high-energy neutron detector for rare isotope experiments and is located at the National Superconducting Cyclotron Laboratory (NSCL)at Michigan State University. The MoNA-LISA detector detects neutrons produced from the interaction between a beam and a target. The current MoNA-LISA design consists of plastic scintillator bars which are 10cm by 10cm by 2m long. Photomultiplier Tubes (PMTs) are located at both ends of each bar and detect the scintillation light (or photons) emitted from the interactions and give precise information about their time of arrival and point of origin. However, some photons do not make it to the PMTs due to attenuation in the bar or with the wrong emission angle leading to loss of significant data. The proposed design includes partial wrapping of the plastic scintillators in an aluminum mylar with gas electron multiplier detectors placed behind the unwrapped side. These gas photo-multipliers (GPMs) will detect light produced from any position in the plastic scintillator, thus replacing PMTs and thereby increasing the detection efficiency of the photons. The experiment will consists of GEANT4 based Monte Carlo simulations to be compared to measurements of the light collection.

Comparing Machine Learning Methods for Hyperspectral Image Classification
Daria Garkavtseva
Category & Time: Physical & Mathematical Sciences, Section 7, 2:30 PM - 3:45 PM
Poster: 393
Mentor: Ekaterina Rapinchuk

Hyperspectral images are images with hundreds of channels with values spanning the electromagnetic spectrum, unlike regular RGB images which have only three channels. These images can provide spatial and spectral information of a scanned area, such as surfaces and mineral elements, which can be used for identifying elements in satellite images or object detection of minerals. Our goal is to classify and identify different components of these images by applying both supervised and unsupervised machine learning algorithms. Supervised learning methods use training data in order to fit a model to predict values for the test data, whereas unsupervised methods attempt to cluster similar pixels together to produce categories, without the use of training data. We will apply methods including k-means, hierarchical clustering, and neural networks and then compare the accuracies and computation time of these methods and supervised vs. unsupervised learning methods in general. We will optimize the hyperparameters of the algorithms for various data sets to achieve the most accurate results possible. These same algorithms, in addition to recurrent neural networks, will be applied to text data in order to classify sentences or groups of words into categories based on topic. We will examine how the accuracy

for text data compares with the accuracy obtained using the hyperspectral image data.

Energy partition of active galactic nuclei interaction with the intra-cluster medium
Sebastian Lacayo
Category & Time: Physical & Mathematical Sciences, Section 7, 2:30 PM - 3:45 PM
Poster: 394
Mentor: Brian OShea

Most of the baryonic mass in a galaxy cluster is in the form of hot, diffuse plasma that fills the space between the member galaxies. This hot diffuse plasma, also known as the intra-cluster medium (ICM), undergoes radiative cooling that leads to the precipitation of cold gas from the ICM into the cluster core. The precipitating cold gas in-falls and accretes onto the supermassive black hole that is located in the cluster's central galaxy, fueling outbursts of powerful jets that are known as active galactic nuclei (AGN). The AGN outbursts compensates for the radiative cooling losses of the ICM by transferring the energy back into the ICM through shocks, turbulence, and cavities. In my project work, I will analyze the data of 3D hydrodynamic AGN feedback simulations with the intent of understanding how AGN outburst energy is partitioned between shocks, turbulence, and cavities. Specifically, I'll be using a software called yt in order to analyze simulation data in hopes of better understanding AGN feedback.

Computational Screening of Potential Molecules for Charge Storage in Redox Flow Batteries
Andrew LaDuca
Category & Time: Physical & Mathematical Sciences, Section 7, 2:30 PM - 3:45 PM
Poster: 395
Mentor: Benjamin Levine

In large systems of graphitic carbon nitrides(gCN), a conformational change in the material causes a charge localization. This charge localization only occurs at a specific structural site. When two N-containing heterocycles are connected through an amine, the removal of two electrons from the system results in a bond forming between the two nitrogens in the rings. Utilizing this structural motif, the Levine group has designed a set of synthetically feasible molecules in order to run computations on their thermo- and electrochemical properties. A key electrochemical property determined is the standard reduction potential. Calculations were performed using a variety of Density Functional Theory(DFT) and Post Hartree-Fock(HF) methods, with implicit solvent modelling done using acetonitrile and water. The results and analysis of these computations will be presented.

Detection of Contamination in Ion Beams
Sean Dziubinski
Category & Time: Physical & Mathematical Sciences, Section 7, 2:30 PM - 3:45 PM
Poster: 396
Mentor: Steven Lidia

Measuring contaminants in an ion beam is very important to the lifetime of FRIB. Unwanted ions when accelerated can damage parts of the accelerator because they are not expected to be there, so they can

stray from the focused beam of wanted ions. The goal of this research is to help design a detector that will be able to measure the amount of contamination in a beam. To date, there are three different scenarios that I have researched and will continue to research. There is the beam hitting a wire and backscattering into a detector scenario, the beam traveling straight into a detector that has a thin absorber that works as a filter, and lastly, the beam traveling straight into a detector without a filter. These scenarios have been looked at 12keV/u and 500keV/u. There are positives and negatives to each scenario at each energy, which will be discussed in the poster.

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