July 22, 2015

# Mid-SURE

Mid-Michigan Symposium for
Undergraduate Research Experiences

MICHIGAN STATE
UNIVERSITY

# WELCOME

Thank you for attending the 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. Approximately 343 students from 117 different institutions are participating in today's event. These students are mentored by 351 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

Megan A. Shannahan
Assistant Director, Undergraduate Research

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Diversity Director, BEACON

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Cover image designed by Victoria Spady '16, who is pursuing a Bachelor of Fine Arts in graphic design.

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# 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 or contact Dr. Korine Wawrzynski at steinke7@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 Summer Undergraduate Research Experience** (EnSURE) is designed to engage high achieving students in faculty-mentored research. Students are paired with faculty in one of six engineering departments, and engage in 10 weeks of full-time research activities, ranging from "bench science" in a laboratory to on-site field work 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 EnSURE Coordinator, 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 undergraduate students who pursue graduate study and careers in teaching and research at colleges and universities. The program helps to prepare undergraduate students for graduate study through intensive research experiences with faculty mentors and academic enrichment activities that give students a competitive advantage. For more information, contact Steven D. Thomas, Program Manager at the Graduate School, at msusrop@grd.msu.edu.

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# SCHEDULE OF EVENTS

All events occur in the Breslin Center.

| TIME | EVENT | LOCATION |
|---|---|---|
| 11:00 AM – 1:00 PM | Presenter registration | Ticket office lobby |
| 1:00 – 2:00 PM | Session 1 presentations | Concourse level |
| 2:00 – 3:00 PM | Session 2 presentations | Concourse level |
| 3:00 – 4:00 PM | Session 3 presentations | Concourse level |
| 1:00 – 4:00 PM | Graduate school fair | Concourse level |

## POSTER PRESENTATION SCHEDULE

All posters will be displayed during the entire event, but students will only be present during the following assigned times:

| CATEGORY | SESSION 1 SECTIONS 1:00 – 2:00 PM | SESSION 2 SECTIONS 2:00 – 3:00 PM | SESSION 3 SECTIONS 3:00 – 4:00 PM |
|---|---|---|---|
| Agriculture & Animal Science | 1 | 2 | 3 |
| Biochemistry & Microbiology | 1 & 2 | 3 & 4 | 5, 6, & 7 |
| Biosystems & Agricultural Engineering | 1 & 2 | 3 & 4 | - |
| Cell Biology, Genetics, & Genomics | 1 & 2 | 3 & 4 | 5, 6, & 7 |
| Chemical Engineering & Materials Sciences | 1 & 2 | 3 & 4 | 5 & 6 |
| Civil & Environmental Engineering | 1 | 2 | - |
| Computer Science & Engineering | 1 | 2 | 3 |
| Electrical & Computer Engineering | 1 | 2 | 3 & 4 |
| Epidemiology & Public Health | 1 | 2 | - |
| Integrative Biology | 1 & 2 | 3 & 4 | 5, 6, & 7 |
| Mechanical Engineering | 1 | 2 & 3 | 4 & 5 |
| Physical & Mathematical Sciences | 1 | 2 | - |
| Social, Behavioral, & Economic Sciences | 1 & 2 | 3 | 4 & 5 |

## SROP & REPID ORAL PRESENTATIONS

Students in the MSU SROP and REPID programs will be giving a special session of oral presentations prior to the official start of Mid-SURE. The presentations are open to the public to attend and will take place in Meeting Rooms A-D, located on the Mezzanine level, and the Green Room, located on the Arena level.

| | MEETING ROOM A | MEETING ROOM B | MEETING ROOM C | MEETING ROOM D | GREEN ROOM |
|---|---|---|---|---|---|
| 8:00-8:15 AM | Laila Abdallah | Crystal Holley | Stephanie Price | Miguel Labrador | - |
| 8:15-8:30 AM | Akua Acheampong | Maseray Kamara | Isaac Arthur | Sebastian Muniz | - |
| 8:30-8:45 AM | Ugo Agbakwuru | Amanda Laryea | Stephanie Bonilla | Nelson Sepulveda-Ramos | - |
| 8:45-9:00 AM | Ali Ghorbanpour | Crystal Nance-Panek | Cary Junior | Hines Croshon | - |
| **9:00-9:10 AM** | **BREAK** | | | | |
| 9:10-9:25 AM | Michael Gomez | Rehnuma Newaz | Johnny Jimenez | Garrett Divens | Ronell Eisma |
| 9:25-9:40 AM | Roya Omari | Sumira Stein | Marven Cantave | Isamar Pastrana-Otero | Amir Alavi |
| 9:40-9:55 AM | Emmanuella Joseph | Wazhma Frotan | Billy Rodriguez | Christian Negron McFarlane | Ugurgan Ozdemir |
| 9:55-10:10 AM | Mazyar Aryanfar | Neco Wilson | Meztli Santamaría | Brandon Harrington | Shabnam Rajaei |
| **10:10-10:20 AM** | **BREAK** | | | | |
| 10:20-10:35 AM | Andie Williams | Courtney Jackson | Daniel Gomez | Olivia Leaven | Sushobhan Sen |
| 10:35-10:50 AM | Najwa Taylor | Zayna King | Christian Bonilla | Israel Figueroa | Heena Dhasmana |
| 10:50-11:05 AM | Jennifer Watts | Aja Green-Walker | J. Monroe Gamble | Tatyona Fields | Punit Singhvi |
| 11:05-11:20 AM | - | - | - | - | Katelyn Freeseman |

# 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 |
|---|---|
| American University of the Caribbean | School of Medicine |
| Michigan School of Professional Psychology | Office of Admissions |
| Michigan State University | Business Analytics |
| Michigan State University | College of Engineering |
| Michigan State University | Psychology |
| Michigan State University | School of Human Resources & Labor Relations |
| Michigan State University | The Graduate School |
| Michigan Technological University | Graduate School |
| Midwestern University | Office of Admissions |
| Northwestern University | McCormick School of Engineering & Applied Science |
| Purdue University | College of Engineering |
| University of Michigan | School of Public Health |
| University of Michigan | Taubman College of Architecture & Urban Planning |
| Van Andel Institute | PhD Graduate Program |
| Wayne State University | The Graduate School |
| Western Michigan University | Graduate College |

# ABSTRACTS

Abstracts are organized by discipline and then by poster number within each category. An index of student presenters is located at the back of the program book.

## AGRICULTURE & ANIMAL SCIENCE

**NEW METHOD TO DETECT THE TRANSLOCATION OF EFFECTOR PROTEINS INTO PLANT CELLS**
**Elizabeth Alger (California State University Monterey Bay)**
**Category & Time:** Agriculture and Animal Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 1
**Mentor(s):** Brad Day (Plant, Soil, and Microbial Sciences), Mieder Palm-Forster (Plant, Soil, and Microbial Sciences)

In order to cause disease in plants, many bacterial plant pathogens use the type III secretion system (T3SS) to inject plants with virulence proteins, termed type-III effectors (T3Es). By developing a deeper understanding of this plant-microbe disease interaction, we can develop plants that can better withstand biotic stressors. This study focused on the interaction between *Pseudomonas syringae* pv. *tomato* strain DC3000, and *Arabidopsis thaliana*. Specifically, we investigated if there is a significant difference between the translocation of the virulence protein AvrRpt2 into wild type and mutant *Arabidopsis* lines. To do so, we are currently working to optimize the calmodulin-dependent adenylate cyclase (Cya) reporter system by collecting *Arabidopsis* samples at various time points. Based on previous results, we hypothesis that *Arabidopsis* mutants lacking or with a nonfunctional NDR1 gene, which is required for the activation of disease resistance to AvrRpt2 in *Arabidopsis*, will have lower rates of AvrRpt2 translocation than the wild type. This project is also working towards a new detection method using a 13-residue amino acid glycogen synthase kinase (GSK) tag. When phosphorylated in plant cells, GSK can be identified using phospho-specific GSK-3 antibodies, the antibody-antigen complex purified, and further analyzed by mass spectrophotometry. The GSK system is faster and cheaper than the current Cya system. At present, we are focused on developing methods to detect the translocation of GSK-tagged proteins into *Nicotiana benthamiana*. Both the GSK and Cya system will allow for better detection of effector protein transduction which will in turn provide new insights into T3SSs.

**MECHANISMS OF GANGLION CELL DEATH IN THE GLAUCOMATOUS CANINE RETINA**
**Edward Brauer (Michigan State University)**
**Category & Time:** Agriculture and Animal Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 2
**Mentor(s):** William Atchison (Pharmacology and Toxicology), Andras Komaromy (Small Animal Sciences)

Glaucoma is a series of diseases that damages the eye's optic nerve and causes blindness in thousands of people each year. The aim of this research was to determine why ganglion cells in the glaucomatous canine retina are dying. Glutamate concentrations within the eye are elevated in glaucoma patients, thus excitotoxicity could play a role in ganglion cell death. Excitatory Amino Acid Transporter-2 (EAAT-2) is the main transporter responsible for regulating glutamate levels within the eye. This lead us to hypothesize that a deficiency of EAAT-2 within the glaucomatous canine retina is responsible for ganglion cell death. An optimization of the immunohistochemistry protocol was done, in order to determine compatibility of the EAAT-2 antibody in canine retina. A positive staining was obtained at the following dilutions of the EAAT-2 antibody: 1:5000, 1:2500, and 1:1000. Our future goal will be to see if there is a differences of EAAT-2 levels between wild type and glaucoma retinas.

**DOES DIETARY SUPPLEMENTATION WITH THE Ω-3 POLYUNSATURATED FATTY ACID, DOCOSAHEXAENOIC ACID, PREVENT CRYSTALLINE SILICA INDUCED HEMOLYSIS OF RED BLOOD CELLS IN LUPUS-PRONE NZBWF1 MICE?**
**Nicole Colon Carrion (University of Puerto Rico at Cayey)**
**Category & Time:** Agriculture and Animal Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 3
**Mentor(s):** Melissa Bates (Food Science and Human Nutrition), James Pestka (Food Science and Human Nutrition)

Cellular membranes form a structural barrier around eukaryotic cells such as the red blood cell (RBC) and membrane-bound organelles such as phagolysosomes. Previous studies have indicated that the toxicity of respirable crystalline silica ($cSiO_2$) is mediated, in part, by disruption of the structural integrity of the phagolysosome cell membrane following phagocytosis by alveolar macrophages (AMφ). Permeabilization of the phagolysosome releases lysosomal enzymes into the cytosol that mediate inflammasome-driven proinflammatory cytokine secretion and apoptosis in AMφ. These effects likely precede $cSiO_2$-triggered autoimmunity in lupus-prone NZBWF1 mice; therefore, stabilizing cellular membranes during phagocytosis of $cSiO_2$ particles may be a novel approach to mitigate $cSiO_2$-potentiated lupus. The purpose of this study will be to employ an *ex vivo* RBC hemolysis assay to test the hypothesis that *dietary docosahexaenoic acid (DHA), an ω-3 polyunsaturated fatty acid, will reduce the cytotoxicity of $cSiO_2$ particles*. At 4 wks of age, female NZBWF1 mice will be fed either control diet (0% DHA) or diet containing DHA-enriched algal oil (3% DHA). At 8 wks of age, mice will be sacrificed and RBCs isolated by centrifugation. RBCs obtained will be subjected to an *ex vivo* hemolysis assay that simulates the extracellular, early endosomal, late endosomal, and phagolysosome environments. We expect minimal hemolysis following $cSiO_2$ treatment in RBCs from NZBWF1 mice supplemented with 3% DHA relative to mice fed 0% DHA. These results will serve as foundational studies for future investigations that address the effect of DHA on the stability of cellular membranes following $cSiO_2$ exposure.

**EFFECTS OF CEREBRAL HYPOPERFUSION ON MARKERS OF NEURONAL FUNCTION**
**Kelsey Downs (Michigan State University)**
**Category & Time:** Agriculture and Animal Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 4
**Mentor(s):** Anne Dorrance (Pharmacology and Toxicology)

Bilateral carotid artery occlusion (BCAO) is an established model of chronic cerebral hypoperfusion that leads to vascular cognitive impairment (VCI). We hypothesized that chronic cerebral hypoperfusion will result in a decrease in expression of certain genes due to the hypoxic conditions. 20-week-old Long Evans rats underwent a staggered BCAO with a one-week delay between the occlusion of the left and right carotid arteries. The BCAO rats were compared to SHAM operated controls. Cognitive function was assessed 5 weeks after the BCAO. VCI was evidenced by a decreased performance in Morris water maze and novel object testing. We used qRT-PCR to assess the fold change in mRNA expression of neuronal and inflammatory markers in brain tissue (SHAM vs BCAO). Synaptophysin (SYN, 1.00±0.00 vs 1.92±0.36), doublecortin (DC, 1.00±0.00 vs 1.88±0.30), and glial derived neurotrophic factor receptor (GFRA-4, 1.01±0.01 vs 2.51±0.64) were significantly increased in BCAO brains compared to the SHAM group ($p<0.05$, Student's t-test). The upregulation of SYN, DC and GFRA-4 could be a recovery mechanism linked to hypoxic insult through the formation of new neurons. Future studies will be required to fully define the nature of these mechanisms.

**BILATERAL COMMON CAROTID ARTERY STENOSIS IMPAIRS SHORT-TERM MEMORY**
**Courtney Fisher (Michigan State University)**
**Category & Time:** Agriculture and Animal Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 5
**Mentor(s):** Anne Dorrance (Pharmacology and Toxicology), Nusrat Matin (Pharmacology and Toxicology)

Chronic cerebral hypoperfusion (CCH) and hypertension are risk factors for vascular cognitive impairment (VCI). Reduced blood flow through the common carotid arteries induced by bilateral carotid artery stenosis (BCAS) is a physiologically relevant model of CCH. We hypothesized that BCAS would cause VCI in stroke prone spontaneously hypertensive rats (SHRSP) and Wistar Kyoto (WKY) rats, and that the cognitive dysfunction would be greater in SHRSP+BCAS when compared to WKY+BCAS. Data are shown as mean ± SEM, WKY vs. WKY+BCAS and SHRSP vs. SHRSP+BCAS. BCAS was induced on 20-week-old male SHRSP and age-matched WKY rats. 5 weeks after BCAS, spatial discrimination abilities, evaluated by Morris water maze testing showed a significant impairment in WKY rats (10.6±5.9 vs 22.5±14.4 secs, Student's t-test $p<0.05$), while there was no impairment in SHRSP (22.8±3.2 vs 22.8±4.0 secs, Student's t-test $p=0.35$). After 7 weeks of BCAS, short-term memory, assessed by novel object recognition testing was impaired in both WKY rats (novel exploration quotient: 0.57 ± 0.04 vs 0.44 ± 0.04, Student's t-test $p<0.05$) and SHRSP (novel exploration quotient: 0.58 ± 0.05 vs 0.46 ± 0.04, Student's t-test $p<0.05$). Cerebrovascular reserve capacity (CVR) was assessed by measuring the change in pial perfusion after the administration of acetazolamide (ACZ), the results are expressed as a percentage of baseline perfusion. BCAS completely abolished CVR in WKY rats (4.5±1.0 vs -6.9±5.3, 2way ANOVA $p<0.05$). SHRSP lacked any CVR; in fact, perfusion was reduced after administration of ACZ. There was no difference in CVR between SHRSP and SHRSP+BCAS (-12.5±3.5 vs -11.4±5.9, 2way ANOVA, $p=0.9$). Contrary to our hypothesis hypertension did not exacerbate cognitive impairment. These data suggest that reduced perfusion after BCAS impairs short-term memory in both normotensive and hypertensive rats.

**IMAGING CHEMICALLY ALTERED LIGNIN THROUGH AFM**
**Zachary Ladwig (Western Michigan University)**
**Category & Time:** Agriculture and Animal Science, Section 2, 2:00 PM - 3:00 PM
**Poster:** 8
**Mentor(s):** Shi-You Ding (Plant Biology)

The demand for efficient biofuel production is on the rise. Current methods for processing biomass to produce carbohydrates used in biofuel production are expensive and time consuming due primarily to the carbohydrates protective sheath known as lignin, a vital component of plant development. By introducing monolignol ferulate conjugates into the plant cell's lignification process, we are able to create a series of ester linkages throughout the backbone of this lignin polymer. This series of chemically labile linkages can provide us with lignin that is more willingly processed using current pre-treatment processes. Therefore, fewer inputs will be required for chemical depolymerization of lignin during processing. Our lab has been provided with several hybrid transgenic poplar tree strains that have implemented this technology. Using a multitude of techniques, it has been shown that these monolignol ferulate conjugates introduced into the gene pool have successfully incorporated into the lignification process without hindering other essential biochemical processes within the plant. These poplar trees show no phenotypic difference from the original wild-type. Using a Bruker Multimode 8 Atomic Force Microscope (AFM) we have been mapping and imaging several of these hybrid poplar lines. The AFM has the ability to form images of the atomic level, while imaging a space up to 20 micrometers, often showing lignin and the microfibers beneath. These tiny magnified sections of the poplar show us how the lignin wall is affected by monolignol ferulates and how it may differ from an image of a wild-type poplar line.

**THE EFFECTS OF MINERALOCORTICOID RECEPTOR ANTAGONISM IN CARDIAC INFLAMMATION AND FIBROSIS POST-STROKE**
**Wesley Lopes (Michigan State University)**
**Category & Time:** Agriculture and Animal Science, Section 2, 2:00 PM - 3:00 PM
**Poster:** 9
**Mentor(s):** Janice M Diaz-Otero (Pharmacology and Toxicology), Anne M Dorrance (Pharmacology and Toxicology)

Hypertension is a primary risk for stroke. Stroke can cause cardiac injury possible due increased catecholamine levels post-stroke. Increased catecholamines could also cause post-stroke hyperaldosteronism mediating cardiac injury. Mineralocorticoid receptor (MR) activation induces cardiac fibrosis and adipocyte dysfunction. Cardiac MR activation can promote apoptosis and inflammation. MR antagonism (MRA) in stroke-prone spontaneously hypertensive rats (SHRSP) reduces cardiac fibrosis and prevents cardiac hypertrophy. MRA reduces macrophage infiltration and myocytes apoptosis post-infarct. We hypothesized that MRA with canrenoic acid (CAN) would decrease cardiac fibrosis and macrophage infiltration after middle cerebral artery (MCA) occlusion (MCAO) in SHRSP. Stroke was induced in 18-week-old male SHRSP by MCAO for 1 hour. After reperfusion SHRSP received vehicle or CAN (20mg/Kg/day I.P.) for two weeks. Results are presented as mean ± SEM. Two weeks post-stroke CAN decreased body weight (324.13 ± 4.78 vs 307.63 ± 7.90, Day 0 vs Day 14, $p<0.05$). However, no significant changes

in body weight in the Sham (304.20 ± 7.02 vs 313.00 ± 5.73, Day 0 vs Day 14, p>0.05) and vehicle (310.63 ± 5.33 vs 304.50 ± 8.51, Day 0 vs Day 14, p>0.05) groups were observed. Post-stroke heart weight remained unchanged in Sham, vehicle and CAN groups (1.42 ± 0.04 vs 1.47 ± 0.11 vs 1.33 ± 0.06, p>0.05). Our preliminary data suggest that hypertension induces morphological changes in the heart and increases cardiac MR expression, which is enhanced by stroke. Stroke induced cardiac MR activation causing macrophage recruitment and fibrosis. CAN treatment will potentially prevent cardiac fibrosis and inflammation.

**INCENTIVE CONTRAST EFFECT AND FEEDING BEHAVIORS IN HONEY BEES**
**John Kochiss (Michigan State University)**
**Category & Time:** Agriculture and Animal Science, Section 2, 2:00 PM - 3:00 PM
**Poster:** 11
**Mentor(s):** Frank Bartlett (Integrative Biology), Fred Dyer (Integrative Biology)

Animals fed low quality rewards have a difficult time re-accepting low quality rewards after even a brief experience with a higher quality reward. This phenomenon has been observed in a variety of taxa ( rodents, avian, and insects ets) and is referred to as the a negative incentive contrast effect. Although a great deal is known about the mechanisms of this behavior, most studies of it have taken place in highly artificial laboratory environments, so we have a poor understanding of how it functions in the context of an organism's natural foraging ecology. Through the study of the species Apis mellifera in a natural experimental environment, a model system could be used to further our understanding of such behavior. In order to do so, we will examine two questions about the negative incentive contrast effect; does reluctance to accept lower quality food true even for novel food locations or only for familiar ones? This will be tested by asking how the energetic needs of the colony influence the response of the forager to changing rewards. We can test this idea by controlling colony state and observing incentive contrast in the field. We plan to use this information and continue to apply it to other species such as bumble bees to explore the mechanisms evolutionary and genetic properties, and serve as a model for this reoccurring phenomenon.

**ANGIOTENSIN II INDUCED HYPERTENSION CAUSES CEREBRAL ARTERY REMODELING AND RAREFACTION IN C57B1/6 MICE**
**Erika Sarno (University of Scranton), Kelsey Downs (Michigan State University)**
**Category & Time:** Agriculture and Animal Science, Section 2, 2:00 PM - 3:00 PM
**Poster:** 12
**Mentor(s):** Janice Diaz-Otero (Pharmacology and Toxicology), Anne Dorrance (Pharmacology and Toxicology)

Artery remodeling refers to changes in artery size and wall structure. More specifically, inward remodeling refers to a decrease in artery lumen diameter. Hypertension causes inward remodeling of the middle cerebral artery in stroke-prone spontaneously hypertensive rats. We do not fully understand the effects of hypertension in the cerebral vasculature. However, hypertension and cerebrovascular impairment increase the risk for stroke and dementia. Angiotensin II (Ang II) stimulates the adrenal glands to secrete aldosterone, a mineralocorticoid that regulates blood pressure. We hypothesize that Ang II will increase systolic and diastolic blood pressure and plasma aldosterone levels, and cause inward cerebral artery remodeling and rarefaction in C57b1/6 mice. Ang II (800ng/kg) was delivered to 16-week-old mice via an osmotic mini-pump for 4 weeks and changes in blood pressure were recorded using tail-cuff plethysmography. Data are presented as mean ± SEM; Sham vs AngII. Ang II infusion increased systolic (148 ± 3.8 vs 176.0 ± 6.1, p<0.05) and diastolic (115.3 ± 4.1 vs 144.3 ± 5.6, p<0.05) blood pressure. Our remaining studies will assess the effects of Ang II-induced hypertension on plasma aldosterone levels. Increases in plasma aldosterone can lead to activation of the mineralcorticoid receptor (MR). We propose that MR activation will cause inward cerebral artery remodeling without changes in the wall thickness. Hypertension will also cause a reduction in total cerebral vessel density. Our findings could help to better understand the effects of hypertension in the cerebral vasculature; therefore improve cerebrovascular health and decrease risk for stroke and dementia.

**METAL-CATALYZED AHP PRETREATMENT OF WOODY BIOMASS**
**Aline Silva (Universidade Estadual de Campinas UNICAMP)**
**Category & Time:** Agriculture and Animal Science, Section 3, 3:00 PM - 4:00 PM
**Poster:** 15
**Mentor(s):** Hegg Eric (Biochemistry & Molecular Biology)

Second generation biofuels derived from the lignocellulose (i.e. non-food plant biomass) have the potential to replace petroleum-derived non-renewable fuels. Lignocellulosic material is mainly composed of cellulose, hemicellulose, and lignin, where cellulose and hemicellulose are the source of sugars. Lignin, which mainly contributes to high recalcitrance, impedes the enzymes' access to the polymeric carbohydrate components for their conversion into momomeric sugars. Therefore, pretreatment of this recalcitrant lignocellulose before enzymatic hydrolysis is an unavoidable step in the biological production of biofuels. An effective pretreatment makes lignocellulose susceptible to the action of cellulases and xylanases to efficiently release fermentable sugars. Woody biomass is a promising bioenergy feedstock due to its high density and biomass yields. This study will investigate the potential of metal-catalyzed AHP pretreatment of woody biomass to improve digestibility and maximize the recovery of fermentable sugars.

**THE EFFECTS OF UNILATERAL COMMON CAROTID ARTERY OCCLUSION ON MICROVESSEL IN STROKE PRONE SPONTANEOUSLY HYPERTENSIVE RATS.**
**Jesica Vicente-Reyes (University of Puerto Rico at Cayey)**
**Category & Time:** Agriculture and Animal Science, Section 3, 3:00 PM - 4:00 PM
**Poster:** 17
**Mentor(s):** Anne Dorrance (Pharmacology and Toxicology), Nusrat Matin (Pharmacology and Toxicology)

The brain needs a constant and controlled supply of blood. Unilateral carotid artery occlusion (UCAO) induces hypoperfusion of the brain and studies have shown that hypoperfusion causes cognitive impairment. Stroke prone spontaneously hypertensive rats (SHRSPs) with UCAO are a novel model of cognitive impairment with pre-existing hypertension. Studies suggest that carnosine (CAR), an antioxidant, may have neuroprotective effects. We hypothesized that UCAO in SHRSPs will cause cognitive impairment, and that CAR treatment will alleviate cognitive dysfunction by increasing microvascular perfusion and levels of astrocytes and by decreasing pro-inflammatory markers. 40-50 week old SHRSP were divided into three groups: SHAM, UCAO, UCAO+CAR. Data is shown as means ± SEM. Short-term memory was assessed using the novel object recognition test. Short-term memory was impaired in UCAO rats (Sham vs UCAO: 0.72 ± 0.05 vs 0.43 ±0.4) and the impairment

improved with CAR administration (UCAO vs UCAO+CAR: 0.43 ± 0.04 vs 0.64 ±0.07). The three groups of rats were injected with fluorescein isothiocyanate (FITC-dextran) to assess microvascular perfusion. Coronal section of the brain will be used to detect glial fibrillary acid protein (GFAP) and Iba-1 to observe changes in astrocytes and microglia respectively. Using PCR, markers for inflammation, neuronal growth factors will be used to elucidate the mechanism behind the neuroprotective role of CAR.

**OPERATION POLLINATOR: ASSESSING THE EFFICACY OF HABITAT RESTORATIONS FOR POLLINATOR FORAGE IN AGRICULTURAL LANDSCAPES OVER TIME.**
**Shaana Way (Western Michigan University)**
**Category & Time:** Agriculture and Animal Science, Section 3, 3:00 PM - 4:00 PM
**Poster:** 18
**Mentor(s):** Rufus Isaacs (Entomology)

Native insects provide pollination services that are critical to the production of food and reproduction of wildflowers in both natural and agricultural ecosystems. To help improve the health of these important insects, Syngenta's research and education program Operation Pollinator is dedicated to cultivating wild bee species on commercial farms by integrating wildflower plantings into crop field margins. By participating in this program, farmers of commercially important crops can promote higher yield by providing additional nectar and pollen sources as well as nesting habitat for native bees. Michigan State University is one of three research universities participating in this study and is focused on the response of native bees to newly established wildflower plantings in blueberry fields. To help us understand if these plantings are effectively boosting native insect populations, we collected all insects pollinating flowers within randomized transects in seeded and control field margin plots in fifteen sites across West Michigan. Vegetation data were also collected to understand which flower species were visited by each collected insect as well as the surface area of flower cover at each site. Based on these data, we will address whether bees are visiting the seeded species of wildflower plantings, and if so, which seeded wildflowers are being visited most frequently by pollinators.

**EFFECT OF MINERALOCORTICOID RECEPTOR BLOCKADE WITH CANRENOIC ACID ON PRO-INFLAMMATORY MARKER LIPOCALIN-2 EXPRESSION FOLLOWING ISCHEMIC STROKE INDUCED BY MIDDLE CEREBRAL ARTERY OCCLUSION**
**Jessica Yen (Okemos High School)**
**Category & Time:** Agriculture and Animal Science, Section 3, 3:00 PM - 4:00 PM
**Poster:** 19
**Mentor(s):** Anne Dorrance (Pharmacology and Toxicology), Sebastien Hayoz (Pharmacology and Toxicology)

Preliminary studies from our lab showed that, post-stroke, plasma aldosterone levels increase dramatically. We also showed that acute administration of the MR antagonist spironolactone decreased the cerebral infarct size. Studies from other labs suggest that MR activation has pro-inflammatory effects. We used Western blotting to quantify the expression of pro-inflammatory marker Lipocalin-2 (LCN2) in the brain post-stroke. We hypothesized that chronic post-stroke mineralocorticoid receptor (MR) blockade with canrenoic acid (CAN) would prevent the aldosterone-induced inflammatory response. 18-week-old male SHRSP underwent 1 hour of middle cerebral artery occlusion followed by 14 days of reperfusion. Rats received CAN (20 mg/kg/day) or vehicle at reperfusion, drug treatments continued daily until the rats were euthanized and brains were collected 14 days post-stroke. The protein concentration in each brain sample was measured using a BSA kit and equal amounts of protein were added to the blots. Data were expressed as fold change from control (beta actin). Surprisingly, there were no significant differences in the expression of LCN2 between the vehicle-treated and CAN group. We conclude that chronic MR blockade does not impact LCN2 production two weeks post-stroke. Further studies are needed to assess more acute affects of MR blockade on the stroke induced inflammatory response.

# BIOCHEMISTRY AND MOLECULAR BIOLOGY

**ELECTROCHEMICAL STUDIES OF DIAMOND MICROELECTRODE ARRAYS AND SCREEN-PRINTED CARBON NANOTUBE ELECTRODES**
**Abneil D Alicea-Pauneto (UPR Cayey)**
**Category & Time:** Biochemistry and Molecular Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 22
**Mentor(s):** Greg Swain (Chemistry)

Microelectrode arrays offer significant advantages in electroanalytical measurements included (i) larger signal-to-background ratios due to enhanced mass transport and lower background currents, and (ii) spatial resolution as compared to single microelectrodes. Additionally, the use of boron-doped diamonds (BDD) electrodes improve electrochemical properties, such as chemical inertness, wide potential windows, very small charging currents, and mechanical durability, qualities that together would improve the microelectrode arrays. To prove these expectations, the BDD microelectrodes arrays will be characterize by using cyclic voltammetry and scanning electron microscopy (may change). Characterization that would generate information regarding the nature of the diamond microelectrode arrays surfaces and the stability of the currents generated. Under those circumstances this investigation could generate applications in the detection of bio-related substances such as pyocyanin molecule and others future biocompatibility works. For comparison, we will also study the electrochemical performance of new inkjet-printed carbon nanotube electrodes (1). The basic electrochemical properties of these electrodes warrant study because the nature of the carbon, the functional groups present, cleaning procedures and remaining surface impurities, storage conditions and aging. These electrodes are being used to develop an electrochemical assay for pyocyanin; a toxin (biomarker) secreted by the bacterium Pseudomonas aeruginosa. The opportunistic pathogen is the cause of many infections. Compromised patients are particularly susceptible, e.g. pulmonary infection in cystic fibrosis patients, surgical wound infections and burns wound infections (2). The ability to detect Ps. Aeruginosa infections early could not only reduce the time spent in hospital and reduce patients' pharmaceutical requirements, but improve patient outcomes.

**REPURPOSING AN AMINOMUTASE FROM *TAXUS* PLANTS: STEREO- AND REGIOSELECTIVE AMINATION OF CINNAMATE EPOXIDES PRODUCES RING-OPENED *ERYTHRO*-PHENYLSERINES**
**Lawrence Allen (Talladega College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 23
**Mentor(s):** Prakash Shee (Chemistry), Kevin Walker (Biochemistry and Molecular Biology)

β-Hydroxy-α-amino acids occur as proteogenic hydroxy amino acids threonine, serine, and 3-hydroxyproline, a component of collagen. These hydroxy amino acids are key building blocks of medically relevant products such as, vancomycin, chloramphenicol, and lysobactin, all of which contain a β-Hydroxy-α-amino acid moiety. There is great interest in producing β-Hydroxy-α-amino acids by stereoselective synthetic and biocatalytic approaches, where enzyme catalysts plays a significant role because of their high stereoselectivity. The enzyme catalyst used for this research was an MIO-dependent aminomutase isolated from *Taxus canadensis* (*Tc*PAM). In addition to being an aminomutase isomerase, *Tc*PAM also has inherent transaminase activity. Therefore, this enzyme was repurposed to transfer $NH_2$ from styrylalanine to cinnamic epoxides. This study specifically focused on evaluating whether substituents on the aromatic ring of the substrates affected the regiochemistry of amination catalyzed by *Tc*PAM. Hypothetically, electron-donating substituents (EDS) should favor $C_\beta$-amination, making isoserines, whereas electron-withdrawing substituents (EWS) should favor $C_\alpha$-amination, producing serines. This is the first instance of using an aminomutase to biocatalyze industrially and pharmaceutically relevant hydroxy amino acids. $^1$H NMR (Proton Nuclear Magnetic Resonance Spectroscopy) was used to characterize and assess purity of synthesized epoxides. LC-ESI-MS/MS (liquid chromatography-electrospray ionization-tandem mass spectrometry) was used to quantify the biosynthetic serine and isoserine products for enzyme kinetic measurements of *Tc*PAM for each substituted epoxide substrate.

**AN INITIAL MUTANT SCREEN FOR LIPID VARIATION IN NANNOCHLOROPSIS OCEANICA CCMP1779.**
**Jonathan Alvaro (Hope College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 24
**Mentor(s):** Christoph Benning (Biochemistry and Molecular Biology), Zhi-Yan Du (Biochemistry and Molecular Biology)

Fossil fuels are quickly disappearing. Under the ever-increasing demand of modern societies for fuel, research into sustainable sources of energy is becoming urgent. Unicellular marine algae have promise for providing sustainable biofuel feedstocks. Unlike traditional biofuel organisms they can be grown in seawater, and do not compete for valuable land area that food production could utilize. Under stressful conditions, microalgae can produce large amounts of storage lipids such as triacylglycerols (TAGs) that can serve as feedstock for the production of biofuels. From a genus of oleaginous marine algae, Nannochloropsis oceanica CCMP1779 offers great promise to biofuel supply because of its attractive characteristics: fast growth and large biomass, high lipid content ability, large scale cultivation using ocean water, and no direct competition with food supply or land requirement. In addition, N. oceanica has a compact genome with approximately 12,000 genes, making it an ideal candidate for genetic studies. The methods of nuclear transformation in N. oceanica have been established recently, facilitating the introduction of foreign DNA and stable integration into the genome of N. oceanica, and easing the insertion of genes and genetic engineering of the oleaginous alga. Currently, hundreds of mutant strains have been generated by insertional mutagenesis. In this project, we performed an initial mutant screen for increased/decreased lipid phenotypes by nitrogen deprivation treatment that can induce lipid accumulation in N. oceanica. Taking advantage of the mutant pool and gas chromatography we performed fatty acid profiling on these mutants to search for strains showing lipid productivity variation.

**ENHANCING STORAGE LIPID SYNTHESIS IN VEGETATIVE TISSUES OF *BRACHYPODIUM DISTACHYON***
**Kira Bartlett (Clemson University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 25
**Mentor(s):** Christoph Benning (Biochemistry and Molecular Biology), Agnieszka Zienkiewicz (Biochemistry and Molecular Biology)

Biodiesel, one prominent form of alternative fuel, is created in part by lipids from biomass. Plants are one available source of biomass, but generally contain the majority of their lipid content in seeds as triacylglycerols (TAGs). Seeds make up a small percentage of the plant's overall biomass and are often used as food sources or other agricultural products. Therefore, modifying the plant to have increased lipid production in the leaves and stems would enhance its viability as a lipid source for biodiesel. Using *Brachypodium distachyon*, a recently emerged model species for temperate grass research, certain genes were overexpressed in an attempt to increase the lipid content of the plant. The transgenic *Brachypodium* plants studied expressed the Brachypodium *Wrinkled1* gene under control of a *BdTIFY 3A-like* promoter as well as DGAT1 (diacylglycerol acetyltransferase 1) and LDSP genes (lipid droplet surface protein) from *Nannochloropsis oceanica*. These plants were examined for improved accumulation of TAGs, especially in the vegetative tissues, as well as for overall growth.

**INVESTIGATING THE ROLE OF DIMETHYL FUMARATE IN ACTIVATING NRF2 PATHWAY ASSOCIATED GENES AND IN THE SURVIVAL OF MOTOR NEURONS FOLLOWING MEHG-TOXICITY**
**Garrett Bazany (Calvin College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 26
**Mentor(s):** William Atchison (Pharmacology and Toxicology)

Pathogenic mechanisms resulting from MeHg toxicity include perturbation of membrane receptor functions, alteration of intracellular calcium homeostasis, mitochondrial functions and neurotransmitter release. This multi-cascade toxicity, in turn, produces reactive oxygen species that lead to oxidative stress, as demonstrated in many neurodegenerative diseases. Nuclear factor erythroid 2-released factor 2 (Nrf2) is a transcription factor that induces the expression of a variety of cytoprotective and antioxidant genes that include quinone oxidoreductase 1 (Nqo1) and thioredoxin reductase1 (Txnrd1). Regulation of the Nfr2 pathway is controlled by kelch-like ECH-associated protein1 (Keapl). Under normal conditions, Keap1 binds Nfr2 in the cytoplasm, preventing Nfr2 translocation to the nucleus. Dimethyl fumerate (DMF) is a well characterized anti-inflammatory and cytoprotective agent that has been used successfully in the treatment of relapsing multiple sclerosis. DMF binds the active site of Keap1 and enables nuclear translocation of Nrf2 and subsequent activation of many anti-oxidative genes. The aim of this

study is to test if DMF treatment is able to prevent MeHg -induced cell death in the motor neuron cell line, NSC34. Quantitative polymerase chain reaction was used to assess Nqo1 and Txnrd1 gene levels in cells treated with DMF and vehicle alone (DMSO). NSC34 cells treated with 0, 7, 21 and 42 uM of DMF for 24 h demonstrated equivalent changes in Nqo1 and Txnrd1 levels relative to control (Gapdh). Furthermore, 42uM DMF (24hr) was unable to provide protection against MeHg-induced cell death. Our present study suggests that DMF at the concentrations used, is not neuroprective against MeHg toxicity.

**CONSTRUCTING A DESIGN TO MAKE THE NODAL GENE**
**Andie Williams (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 27
**Mentor(s):** Erik Martinez-Hackert (Biochemistry & Molecular Biology)

Background: Nodal is a ligand that is a part of the Transforming Growth Factor- Beta (TGF-β) family. The TGF-β family controls cell differentiation and proliferation; and its members play key roles in many diseases including cancer, diabetes, and asthma. Nodal plays a regulatory during embryogenesis. In addition, we now know that nodal plays a role in cancer metastasis. In order to stop nodal from contributing to cancer metastasis, we have to identify its function. Once we understand nodal better we could create a molecule that could inhibit its function. Methods: The purpose of our study is to synthesize nodal in order to be able to clone it into mammalian cells. We designed an expression cassette that has the Luciferase gene (Luci). This helps Nodal secretion and also can be used for tracing nodal during purification. The original Luci expression cassette has an Fc domain. However, the Fc destroys nodal expression. We therefore want to remove the Fc gene from the expression cassette. To do this, we perform a deletion mutagenesis polymerase chain reaction (PCR). We transform the PCR product directly into e. coli cells for cloning. To confirm that the Fc has been removed successfully, we a colony PCR reaction. One colony that is positive for Luci will be amplified and sequenced. Once we have the Fc free cassette, we will insert nodal by restriction cloning. Once we have created this clone we will proceed to isolate nodal. Once we have created this clone we will proceed to isolate nodal. Results: We predict that once nodal is made we will be able to clone it into Chinese hamster ovaries. This will allow us to get a better understanding of how nodal works and find a molecule to inhibit it. Conclusion: Once the Nodal is expressed and purified, we will be able to work more closely with it and determine its role cancer. This work will also allow us to have a better understanding of how the proteins in the TGF-β family work.

**GENETIC ENGINEERING OF RHODOPSINS INTO ANCILLARY BICARBONATE TRANSPORTERS IN CYANOBACTERIA**
**Ana Christine Beiza (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 29
**Mentor(s):** Aparajita Banerjee (MSU-DOE Plant Research Laboratory), Sandeep B Gaudana (MSU-DOE Plant Research Laboratory), Cheryl Kerfeld (MSU-DOE Plant Research Laboratory)

The cyanobacterial carbon concentration mechanism (CCM), including its key step of inorganic carbon transport, is being avidly explored as a means for enhancing photosynthesis in prokaryotic and eukaryotic photoautotrophs. It has been recently reported that overexpression of a bicarbonate ($HCO_3^-$) transporter in a model cyanobacterial strain, *Synechocystis* sp. PCC 6803, leads to enhanced growth rates and biomass production. $HCO_3^-$, unlike $CO_2$, cannot cross the plasma membrane and is hence actively transported into the cytoplasm. Therefore, positioning of a potential $HCO_3^-$ transporter in the plasma membrane of cyanobacteria is a critical prerequisite for successful $HCO_3^-$ transport. We envision that the benefit of enhanced $HCO_3^-$ uptake can be augmented by designing and constructing pumps that are driven by light energy. To this end, we are repurposing bacteriorhodopsin and halorhodopsin, light-driven proton and chloride pumps, respectively, into bicarbonate transporters. Several variants of the rhodopsins, including their fusion to proteins known to localize in plasma membrane as well as signal peptides preceding the rhodopsin candidates, were cloned in cyanobacterial expression systems. Heterologous expression of the engineered constructs was followed by sub-cellular immunolocalization and transmission electron microscopy. Rhodopsins were screened for bicarbonate pumping by assaying if they can enable a high $CO_2$ requiring strain of *E. coli* deficient in carbonic anhydrase, to grow in ambient air. The results have provided key insights for potential engineering of rhodopsins into light driven bicarbonate transporters for use in cyanobacteria and, prospectively, algae and C3 plants.

**THE ROLE OF THE ARYL HYDROCARBON RECEPTOR IN MODULATING MITOCHONDRIAL FUNCTION**
**Alexander Best (Tuskegee University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 30
**Mentor(s):** John LaPres (Biochemistry)

The Aryl hydrocarbon receptor (AHR) is a ligand-activated transcription factor that is responsible for mediating most, if not all, of the toxic effects of a class of planar aromatic hydrocarbon, including 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The last several years, research has shown that TCDD, via the activation of the AHR, can negatively impact the mitochondria. This negative impact includes alterations in electron transport chain (ETC) function, reactive oxygen species generation and perturbation of the nuclear-to-mitochondrial stress signaling axis. In the absence of ligand, the AHR is primarily thought to be located within the cytosol; however, we have recently shown that a portion of the AHR is found within the intermembrane space of the mitochondria. The link between TCDD and metabolic syndrome and mitochondria dysfunction, and our preliminary results have led us to hypothesize that the AhR can influence mitochondrial function via direct protein interactions and transcriptional regulation of key electron transport chain (ETC) genes. To test this hypothesis, we will use a human B lymphoblastoid cell line that was transformed with EBV, called SKW6.4 cells. We will use these cells to determine if TCDD exposure impacts mitochondrial function in an AHR-dependent manner. To measure mitochondrial function, we will use a Seahorse XF24 Extracellular Flux Analyzer. This machine measures the oxygen consumption rate of cells in culture. We hope to determine the impact of long and short-term TCDD exposure has on these two measures of cellular metabolic activity and determine if the AHR plays a role in modulating the observed impact of TCDD.

**INVESTIGATION OF GROWTH AND PHYSIOLOGY IN *ARABIDOPSIS THALIANA* MUTANT LINES WITH REDUCED UBIQUITIN CONJUGATING ENZYME (UBC22) GENE EXPRESSION**
**Madalyn Bryant (Fort Valley State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 31
**Mentor(s):** Thomas Sharkey (Biochemistry and Molecular Biology), Sarathi Wijetilleke (Biochemistry and Molecular Biology)

Studies have shown that a ubiquitin conjugating enzyme (UBC22) is present in peroxisomes of plants and may act as a negative regulator during the conversion of indole butyric acid to indole acetic acid (IAA). IAA is an auxin and is known to inhibit primary root elongation, induce lateral root formation, promote stem elongation, inhibit growth of lateral buds, and regulate plant responses to light and gravity. Two *UBC22* gene knockout mutants (ubc22-1 and ubc22-2) of *Arabidopsis thaliana* were used to investigate the impact of removing the negative regulation of UBC22 on leaf gas exchange, carbon partitioning, and plant growth. A comprehensive growth analysis was carried out to measure leaf area, root and stem length, growth rates, and dry weights throughout the growth cycle. Photosynthesis and respiration rates were measured to determine net carbon gain. Leaf anatomy and thickness measurements were taken to examine leaf cell density and mesophyll structure. Chlorophyll content and total protein extraction and quantification were also carried out. All collected data will be fitted to the *Arabidopsis* Leaf Area Growth Model to analyze the differences in carbon partitioning between the mutant lines and the wild type (Col-0). The role of UBC22 in regulating auxin biosynthesis and subsequently carbon assimilation, partitioning, and growth will be discussed along with its potential for crop improvement.

**THE ROLE OF SIRTUIN-3 IN REGULATION OF OXIDATIVE STRESS IN THE ENTERIC NERVOUS SYSTEM**
**Rebecca Bubenheimer (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 32
**Mentor(s):** Brian Gulbransen (Physiology)

Gut inflammation causes changes to the enteric nervous system (ENS) that contribute to gut motility disorders. High oxidative stress during inflammation is one factor that significantly contributes to ENS dysfunction but the mechanisms that regulate oxidative stress in the ENS are unclear. Sirtuin-3 (SIRT3) was recently identified as a key regulator of oxidative stress in the central nervous system. We hypothesized that SIRT3 plays an important role in the regulation of oxidative stress in the healthy gut and during intestinal inflammation. We tested our hypothesis by assessing in vivo gut function, ENS structure and susceptibility to inflammation in SIRT3 knockout (Sirt3-/-) mice. We used the dinitrobenzenesulfonic acid (DNBS) model of mouse colitis to study inflammation and assessed ENS structure using immunohistochemistry. Data were analyzed using a two-way ANOVA. Our results show that Sirt3-/- mice have similar colonic function as wild type (WT) controls. Likewise, enteric ganglia in Sirt3-/- mice contain similar numbers of HuC/D-immunoreactive neurons and a comparable distribution of inhibitory (neuronal nitric oxide synthase, nNOS) and excitatory (calretinin) subsets. We observed a similar extent of neurodegeneration in the myenteric plexus during DNBS colitis in WT (31% decrease; $p<0.01$) and Sirt3-/- (26% decrease; $p<0.05$) mice. The loss of SIRT3 also did not affect the susceptibility of nNOS and calretinin neurons to inflammation. Our results suggest that while SIRT3 contributes to the control of oxidative stress in enteric neurons, the loss of SIRT3 does not significantly contribute to inflammatory neuropathy in the gut.

**INDUCTION OF ΔFOSB FOLLOWING PHYSICAL AND EMOTIONAL STRESS**
**Darlyn Caraballo (University of Puerto Rico-Arecibo)**
**Category & Time:** Biochemistry and Molecular Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 33
**Mentor(s):** Megan Kechner (Neuroscience), Dr Michelle Mazei-Robison (Physiology)

Depression is a devastating disease and the underlying cellular mechanisms are not well understood. To study this, we have employed physical (PS) and emotional (ES) chronic social defeat stress as mouse models of depression. In ES, mice do not receive any physical stress, but witness physical subordination of another mouse. ES has been shown to produce many of the same depressive-like behaviors as PS. Exposure to PS has been shown to promote differences in ΔFosB induction in multiple brain regions including the nucleus accumbens (NAc); a region known to play a significant role in motivation, pleasure and reward. With this in mind, we sought to investigate if the induction of ΔFosB was similar between PS and ES. Eight-week-old C57BL/6J male mice were exposed to either PS or ES for 5 minutes per day for 10 days. PS mice were placed into the home cage of a CD-1 aggressor mouse, and ES mice were placed into the same cage, but were physically separated from the CD-1 and PS mouse by a perforated plexiglass partition. One-hour following social interaction testing on day 11, mice were perfused and brains were post-fixed and cryoprotected. Brains were then sectioned and immunohistochemistry was performed for ΔFosB. FosB-positive cells were counted in multiple brain regions including NAc, dorsal and ventral hippocampus, prefrontal cortex and ventral tegmental area to assess whether PS and ES induce a similar pattern of induction. This work could identify brain regions important for depressive behaviors to focus on in future studies.

**EFFICIENT THICK LAYER SPECTRO-ELECTROCHEMISTRY**
**Dawei Chen (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 34
**Mentor(s):** Denis Proshlyakov (Chemistry)

Redox reactions are crucial life-sustaining processes. The study of these reactions, especially those that are catalyzed by enzymes, is of interest by revealing key mechanisms of enzymatic activity. Investigating these reactions within enzymes consists of two requirements. The first is a flexible and efficient method of communicating electrons to and from these enzymes. The second is a method of observing the changes within these enzymes during the redox reaction. This study attempts to perform a redox reaction while simultaneously observing optical changes within the analyte using UV-Visible spectroscopy. These reactions are usually limited to molecules with strong optical absorption such as chromophores. The main barrier of efficiently conducting a redox reaction is the rate of diffusion of charge through the solvent. To solve this, the working electrode uses a carbon fiber brush to increase surface area. However, the solution needs to be circulated between the brush hairs, which was accomplished using a micro stir-bar inside the cuvette. Dimensional constraints of a traditional optical cuvette limit the options of properly circulating the analyte through the working electrode. To overcome this barrier, a 3D-printed cuvette was tailored to reduce the

volume of solution and distance between the working electrode and the stir bar without blocking the optical window. An additional benefit is the conical shape of the analyte chamber which further improves diffusion by facilitating vortex flow through the working electrode. We will demonstrate the change in reaction rate of this 3D-printed cell in comparison to a traditional, working cell cuvette.

**PHLOEM-MEDIATED LIPID SIGNALING INVOLVED IN DROUGHT TOLERANCE**
**Henry Csikszentmihalyi (Oberlin College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 37
**Mentor(s):** Allison Barbaglia (Biochemistry and Molecular Biology), Susanne Hoffmann-Benning (Biochemistry and Molecular Biology)

Developing new ways of adapting crops to drought conditions could be critical to feeding a climate change-stricken world. Plants have developed long-distance signaling pathways, most often running through the phloem, to better adapt to changing environments and stressors (an important trait given their sessile nature). Using Arabidopsis and its pre-mapped genome, this lab identified several predicted lipid-binding proteins and lipids that we believe to be critical in plant response to drought conditions. Since hydrophobic lipids were unexpected to exist in the aqueous environment of the phloem, we are investigating the affinity of these phloem proteins for specific lipids as well as their role in phloem-mediated long distance signaling. We have found the proteins to be quite lipid-specific (the precise lipid matters during the binding event). We have also utilized overexpression of the genes that code the proteins of the pathway, finding that hardier, larger, and more drought resistant plants grow from the overexpressing seeds. We are in the process of determining the exact cause of the increase in drought resistance (are the roots bigger which allows the plant to be hardier? Or is the abiotic signaling pathway more sensitive to drought due to an increase in the proteins critical for the signaling?). We have also knocked out the genes, and not surprisingly, the resulting plants experienced a failure to thrive at the same level as the wild type. We will continue our research and characterize the specificity of the protein-lipid interaction to increase our understanding of function and physiological consequences.

**THE ROLE OF DIABETES-INDUCED CHANGES IN EXOSOMAL MIRNA IN THE PATHOGENESIS OF DIABETIC RETINOPATHY.**
**Kiera Fisher (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 38
**Mentor(s):** Julia Busik (Physiology)

Diabetic retinopathy is a leading cause of blindness in working age adults. There are very few effective therapeutic options available to those affected with diabetic retinopathy, presenting a real need for novel research concerning the pathogenesis of the disease. Diabetic retinopathy causes damage by producing chronic low-grade inflammation in the retina, which leads to endothelial cell dysfunction caused by retinal micro-vascular injury. Understanding the mechanisms responsible for this chronic inflammation of the retina is critical to identifying new therapies and therapeutic targets for diabetic retinopathy treatment.Exosomes are very small (40-200nm) cell-derived vesicles that are secreted into the extracellular environment and have a special role in transportation of lipids, proteins, as well as RNA and miRNA. Recent studies demonstrated that diabetic patients have increased amount and modified protein content of exosomes present in serum and vitreous humor. In this study we analyzed the effect of diabetes on exosomal miRNA using STZ diabetic mouse model. Exosomes were isolated from mouse plasma with ExoQuick exosome precipitation, miRNA was isolated using Mirvana reagent and analyzed using miScript miRNA Mouse miRNome PCR Array. Our results demonstrated that the diabetic retina and serum have low levels of anti-angiogenic and anti-inflammatory microRNAs, such as miR-15a, miR-146a and miR-200b. We also demonstrated that these miRNA are expressed in exosomes and further examined the effect of diabetes on exosomal miRNA content. In conclusion, diabetes-induced decrease in anti-inflammatory and anti-angiogenic exosomal miRNA could provide a novel mechanism contributing to the development of diabetic retinopathy.

**TRANSIENT RECEPTOR POTENTIAL A1 CHANNEL (TRPA1) AS A PROBABLE MEDIATOR OF METHYLMERCURY (MEHG)-INDUCED EXTRACELLULAR CALCIUM ($CA^{2+}_E$)-DEPENDENT CYTOTOXICITY IN MOUSE DORSAL ROOT GANGLIA (DRG) PRIMARY CULTURES**
**Erin Formiller (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 39
**Mentor(s):** William Atchison (Pharmacology & Toxicology)

MeHg is an environmental toxicant that disrupts neuronal function, causing distal paresthesia, visual deficits, and ataxia. MeHg increases intracellular calcium ($[Ca^{2+}]_i$) in a biphasic manner; this effect contributes to MeHg-induced cytotoxicity. To examine the extent to which $Ca^{2+}_e$ contributes to decreased viability in MeHg toxicity of DRG, we exposed primary mouse DRG to MeHg in the presence and absence of $Ca^{2+}_e$. Cells were exposed to MeHg (200 nM-2 μM) in Hepes Buffered Saline (HBS) for 30 min; viability was assessed 1or 4 hrs later. For experiments performed in the absence of $Ca^{2+}_e$, $Ca^{2+}$ was excluded from the HBS and EGTA was added to chelate trace amounts of $Ca^{2+}$. DRG viability was both [MeHg]- and time-dependent in standard HBS. With the removal of $Ca^{2+}_e$, [MeHg]-dependence remained at only high [MeHg] and time-dependence was lost. The reduction in DRG viability at 1 hr was $Ca^{2+}_e$-independent, whereas viability at 4 hrs was $Ca^{2+}_e$-dependent. These results suggest $Ca^{2+}$ influx through MeHg-susceptible channels contributes to MeHg-induced cytotoxicity at late timepoints. We examined the role of TRPA1, $Ca^{2+}$-permeable cation channel highly expressed in sensory neurons, in mediating MeHg-induced cytotoxicity; cells were treated with channel blocker A-967079 before MeHg exposure and viability assessment. Blocking TRPA1 markedly improved cell viability at 4 hrs, with viabilities comparable to $Ca^{2+}_e$-free conditions. These results suggest that $Ca^{2+}$ influx through TRPA1 contributes to MeHg-cytotoxicity.
Supported by NIH R01ES03299, NIEHS R25ES025060 and MSU College of Veterinary Medicine.

**REGULATORY EFFECTS OF HYPEROXIA ON ADAM17/TACE IN FETAL HUMAN LUNG FIBROBLASTS**
**Michael Gomez (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 40
**Mentor(s):** Elahé Crockett (Medicine), Bruce Uhal (Physiology)

Angiotensin-Converting-Enzyme-2 (ACE-2) is protective but downregulated in human and experimental fibrosis. It functions to degrade the profibrotic octapeptide Angiotensin II to the heptapeptide Angiotensin 1-7. This conversion has been shown to protect against experimental

lung fibrosis. Hyperoxia is a common cause of chronic fibrotic lung disease in neonates. Past studies in this lab have examined the levels of ACE-2 in IMR90 human fetal lung fibroblasts under hyperoxic conditions. Under these conditions ACE-2 enzymatic activity and immunoreactive protein were decreased. There was a decrease in cellular ACE-2 and an increase in soluble ACE-2. TNF-α-converting enzyme (TACE) is believed to have mediated this increase in soluble ACE-2 and decrease in enzymatic activity by cleavage of the ACE-2 ectodomain. Hypothesis: TACE may be upregulated at the transcriptional level in IMR90 human fetal lung fibroblasts exposed to hyperoxic conditions. Methods/Results: IMR90 cells at the post confluent level will be exposed to hyperoxic conditions. The transcriptional inhibitor Actinomycin D will then be used to determine if TACE regulation within these cells is occurring at the transcriptional level. Conclusion: This experimentation should provide further insight regarding how TACE affects the Angiotensin system under profibrotic hyperoxic conditions. A further understanding of the angiotensin system and its role in the pathogenesis of pulmonary fibrosis could serve to help illuminate new therapeutic methods for combating this disease. Support: M.G. is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**CLONING OF BRG1 SHRNA BY SWITCHING ANTIBIOTIC MARKERS IN MACROPHAGE CELLS**
**Aja Green-Walker (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 41
**Mentor(s):** Mohita Tagore (Biochemistry and Molecular Biology), Monique Floer (Biochemistry and Molecular Biology)

Macrophages are important cells of the immune system that are formed in response to an infection or accumulation of damaged or dead cells. In macrophages DNA is tightly wound around nucleosomes into a complex called chromatin. Through a process called chromatin remodeling, this complex can be "opened" so that specific genes are expressed. But it is not known how chromatin remodelers and transcription factors interact with each other in macrophages. Transcription factors are proteins involved in the process of converting, or transcribing, DNA into RNA. The relevance is to understand how macrophages function when responding to bacterial challenge. This is because little information is known regarding how Brg1, a protein that works to activate or repress transcription, and transcription factors contribute to inducible gene expression in macrophages. To acquire knowledge regarding this we will inhibit Brg1 in macrophages. To achieve stable Brg1 knockdown in macrophage cells, we will be cloning a Brg1 shRNA to the pLKO.1 vector having a blasticidin resistance marker for selection. As a result of this it is anticipated that the transcription factor, Pu.1, will not be able to bind to its target site. With this, we hypothesize that Brg1 mRNA knockdown using Brg1 shRNA will prevent inducible gene expression in macrophages.

**VARIATION OF THE ACYLSUCROSE BIOSYNTHESIS PATHWAY CATALYZED BY ACYLSUCROSE-ACYLTRANSFERASE-2 AND 3 IN WILD TOMATO SPECIES**
**Abigail Miller (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 42
**Mentor(s):** Pengxiang Fan (Biochemistry and Molecular Biology)

The apical cells of glandular trichomes on the leaves and stems of wild tomato plants produce diverse natural pesticides called acylsucroses. These compounds have esterified acyl chains on a sucrose backbone. In the acylsucrose-biosynthesis pathway, there are several steps that contribute to the variety of acylsucroses. The second and third step have functionally different enzymes, Acylsucrose Acyltransferase-2 and 3 (ASAT2 and ASAT3), which introduce the diversity of acyl chains on the sucrose molecule. *S. pennellii* and *S. lycopersicum* have ASAT2 and ASAT3 homologous genes; however, these enzymes have a different function in each species. The evolutionary history behind the functional diversity of ASAT2 and ASAT3 is still unknown. In this research, ASAT2 and ASAT3 were cloned and the activities were tested in multiple wild tomato species to determine the genetic basis for the different function, and to compare this to the geographical location of the accessions. Through site-directed mutagenesis, it was found that there are certain key amino acid residues that can change the substrate specificity of *S. pennellii* ASAT2. These residue changes reflect the regions in South America where the plants originated, outlining the question of where the divergence of this function took place. This indicates that these residues are responsible for the evolutionary story of the acylsucrose-biosynthesis pathway and the diversity of acylsucroses. These findings help elucidate a specialized metabolic pathway, and perform manipulation of key enzymes that help in plant defense.

**THE EFFECTS OF HERBIVORY ON NATIVE VS. INVASIVE M. POLYMORPHA**
**Carla Jones (North Carolina A T State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 43
**Mentor(s):** Chandra Jack (Plant Biology)

Plants are involved in many complex interactions below and above ground, such as with microbes and herbivores. These multitrophic level interactions play a key role in the life of a plant. Native plants have co-evolved with other organisms in their community. When an invasive plant is introduced to a new environment, there is a possibility that the native species will be displaced. Invasive species can be successful in colonizing new ecosystems due to their ability to grow and reproduce rapidly, compete aggressively for resources, and their lack of natural enemies. There are many negative consequences caused by the success of an invasive species such as a changed food web, altered ecosystem conditions, and decreased biodiversity. According to the Enemy Release Hypothesis, exotic plants become invasive by experiencing less regulation than native plants do by enemies in their introduced habitat compared to native plants. Our study addresses food choice, food utilization, survivability, and insect growth in invasive vs. native Medicago polymorpha. We hypothesize that our native herbivore, the Soybean looper, will prefer to feed on the invasive plant and will experience a higher growth rate. Our study may provide valuable support to the Enemy Release Hypothesis.

**FUNCTIONAL STUDIES OF THE MYCOBACTERIUM TUBERCULOSIS DOSS SENSOR KINASE AND ITS INTERACTION WITH ARTEMISININ**
**Katriana Jorgensen-Muga (Sweet Briar College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 44
**Mentor(s):** Rob Abramovitch (Microbiology and Molecular Genetics)

Mycobacterium tuberculosis(TB) is a bacterium causing tuberculosis infection in one third of the world's population. Tuberculosis infections can be classified as either latent or active, with a latent infection being characterized by non-replicating bacteria, and an active infection being characterized by bacterial replication. Previous studies have shown tuberculosis enters the latent phase when the bacteria are isolated in the hypoxic granuloma. Kumar(2007) showed that the DosR regulon contains genes needed for the survival of bacteria in the latent infection mode and this regulon is activated by two sensor kinases, DosS and DosT, that phosphorylate and activate the response regulator DosR. DosS contains a central heme group, to which the reduction of the iron occurs under hypoxic conditions. In a screen for potential drugs that regulate the induction of DosRST, Artemisinin exhibited the ability to inhibit activation of DosR and spectroscopy indicates that binding of Artemisinin to the DosS kinase oxidizes the central heme. Crystallography by Cho(2011)of the DosS protein shows that access to the heme is through a channel and previous studies have confirmed that alteration of the amino acids in the channel can alter the ability of the DosS heme to undergo redox reactions. The goal of this study is to introduce amino acid substitutions in the DosS heme-presenting channel that may prevent interaction artemisinin with to the heme group. We hypothesize that these mutations may generate artemisinin-resistant variants of DosS that will be useful tools to study the impact of artemisinin on M. tuberculosis physiology.

### EFFECTS OF ACID SPHINGOMYELINASE ON VEGF-A AND RETINAL VASCULAR DAMAGE

**Maseray Kamara (Michigan State University)**

**Category & Time:** Biochemistry and Molecular Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 45
**Mentor(s):** Julia Busik (Physiology), Elahé Crockett (Medicine)

Introduction: Diabetic retinopathy (DR) has limited available therapeutic options though it is the most common microvascular complication of diabetes and a leading cause of blindness in adults. A number of hyperglycemia- and dyslipidemia-activated pathways have been identified which promote the increase of pro-inflammatory cytokines, pro-inflammatory lipids, and pro-angiogenic factors. This low-grade chronic inflammation leads to retinal endothelial cell dysfunction and contributes to retinal vascular pathology. We previously demonstrated that the central enzyme in the sphingolipid pathway, acid sphingomyelinase (ASM), is highly upregulated in the diabetic retina. The retinal ischemia-reperfusion (IR) model will be used to determine the role of ASM in retinal vascular damage, and its impact on the important pro-angiogenic factor VEGF-A. Hypothesis: Inhibition of ASM activity is expected to decrease VEGF-A, thus decreasing endothelial differentiation and angiogenesis. Methods/Results: Intra-ocular pressure (IOP) will be increased in one eye using infused normal saline solution. The other eye will serve as control. After the ischemic process, IOP will be normalized and subsequent reperfusion will result in characteristic features of DR retinal damage. Following retina extraction, protein and gene expression profiles will be determined by RT-PCR and Western blot. Additionally, vascular permeability will be measured using fluorescent albumin, and retinal cell apoptosis will be determined by TUNEL assay. Conclusion: A relationship between inhibition of ASM and VEGF-A may indicate that anti-ASM therapy could treat the undesirable angiogenesis and vascular leakage seen in diabetic retinopathy. Support: M.K is a REPID scholar, supported by NIH-5-R25-HL108864 award to Elahé Crockett, REPID Program Director.

### ASSESSMENT OF DIFFERENT PERMEABILIZATION METHODS OF MINIMIZING DAMAGE TO THE NATURAL KILLER CELLS FOR DETECTION OF EAT-2 AND IRS-2 BY FLOW CYTOMETRY

**Minjae Kim (Michigan State University)**

**Category & Time:** Biochemistry and Molecular Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 46
**Mentor(s):** Sungjin Kim (MMG)

Various fixation and permeabilization techniques have already been developed for detection of intracellular antigens by flow cytometry; however, there are few studies using flow cytometry to detect the frequency of intracellular signaling molecules in natural killer cells, particularly IRS2 and SH2D1B. This research investigates the effect of several permeabilization methods on detection of IRS2 and SH2D1B in peripheral blood. Detecting molecules of interest while maintaining intracellular components intact were the main considerations of the study. The suggested method would be applicable for intracellular detection of IRS2 and SH2D1B by flow cytometry in NK cells.

### THE STEREOCHEMICAL AND MECHANISTIC STUDIES OF TYROSINE AMINOMUTASE IN *ORYZA SATIVA*

**Zayna King (Medgar Evers College of the City University of New York)**

**Category & Time:** Biochemistry and Molecular Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 47
**Mentor(s):** Kevin Walker (Department of Chemistry and Department of Biochemistry & Molecular Biology), Tyler Walter (Department of Chemistry)

β-Amino acids serve as building blocks for biologically active compounds and important metabolites. A unique family of aminomutase enzymes contain a methylideneimidazol-4-one (MIO) prosthetic group that helps isomerize α- to β-amino acids. Recently, an MIO-dependent tyrosine aminomutase (*Os*TAM) isolated from Japanese rice *Oryza sativa* was discovered. This is the first aminomutase from a cash crop and the first TAM isolated from a plant. The β-tyrosine product catalyzed by *Os*TAM was derivatized as the *N*-(2-(*S*)-methylbutyramide) methyl ester to assess the stereochemistry as (3*R*) by gas chromatography/mass spectrometry (GC/EIMS). Deuterium-labeled α-tyrosines were incubated with *Os*TAM to assess the stereochemistry of the hydrogen abstraction at $C_\beta$ and rebound at $C_\alpha$. The β-tyrosines from the deuterium labeling studies were derivatized as ethyl formamide methyl esters and analyzed by GC/EIMS. *Os*TAM removed the *pro*-(*S*) hydrogen and moved it to $C_\alpha$ with retention of configuration (R.O.C.). The R.O.C. pathway was assessed by $^2$H-NMR analysis of a [$^2$H]-labeled β-tyrosine product. Overall, the *Os*TAM retains the configuration each migration terminus. Further, like other TAMs, *Os*TAM makes a mixture of 3*R*- and 3*S*-β-tyrosine with a $K_M$ = 600 μM and a $k_{cat} \simeq 4\ s^{-1}$. However, by contrast, long incubation time (24 h) and changes in pH did not affect the stereoselectivity of *Os*TAM like other bacterial TAMs.

### USING MOLECULAR DIFFUSION AS A DIAGNOSTIC OF DISEASE STATE

**Cameron Meyer (Michigan State University)**

**Category & Time:** Biochemistry and Molecular Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 48
**Mentor(s):** Gary Blanchard (Chemistry), Julia Busik (Physiology)

Plasma membrane fluidity and structure are involved in cellular functions including proliferation, migration, cell signaling, and cell metabolism. We focus here on Retinal Pigment Epithelium (RPEs) cells because of their sensitivity to diabetic conditions. The composition of the plasma membrane and the distribution of constituents within it are determining factors for membrane fluidity, but the contribution of specific lipids to plasma membrane fluidity and structure are not known due to the lack of ability to evaluate these properties in real time and over multiple length scales.The methodology we use combines established technologies; fluorescence anisotropy decay imaging (FADI) and fluorescence recovery after photobleaching (FRAP). The innovation of this approach lies in the ability to obtain complementary dynamic information (rotational and translational diffusion dynamics) on very different length scales for the same plasma membrane and to use this information to evaluate the structure and fluidity of the membrane as a function of exposure to disease state conditions. Evaluating plasma membrane structure is not readily achievable by other means. Changes in membrane structure as a function of conditions to which the cell is exposed form the basis for the diagnosis of disease state. The high sensitivity and imaging capabilities of the state-of-the-art fluorescence instrumentation enables the direct evaluation of plasma membrane fluidity and structure at the single cell level. We demonstrate the sensitivity of this diagnostic to have a factor of two change in plasma membrane dynamics upon exposure of RPEs to high levels of glucose.

### PROTEIN-PROTEIN INTERACTION OF HIGH-AFFINITY SULFATE TRANSPORTERS FACILITATING SULFATE UPTAKE IN ARABIDOPSIS THALIANA

**Jocelyn Olvera (California State University San Marcos)**
**Category & Time:** Biochemistry and Molecular Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 51
**Mentor(s):** Anne-Sophie Bohrer (Biochemistry & Molecular Biology), Hideki Takahashi (Biochemistry & Molecular Biology)

Sulfur is an essential macronutrient for plant growth and development. It is found in a number of cellular constituents, such as sulfur-containing amino acids, cysteine and methionine. In Arabidopsis thaliana, sulfate is taken up from the soil via two high-affinity sulfate transporters, SULTR1;1 and SULTR1;2, expressed in root hairs, epidermal and cortical cells of roots. Both SULTR1;1 and SULTR1;2 are induced under low sulfate conditions, increasing the number of transporters expressed at the plasma membranes of root cells to facilitate the uptake of sulfate from the soil. Preliminary studies using yeast sulfate transporter mutant strain showed that, under sulfate starvation, when SULTR1;1 and SULTR1;2 were co-expressed, sulfate uptake was restored and was more than additive of the function of two separate transporters. In addition, SULTR1;1 and SULTR1;2 interacted to form heterodimers, or independently homodimers. Thus, it is hypothesized that, SULTR1;1 and SULTR1;2 form a complex to facilitate sulfate uptake in the roots under sulfate-starved conditions. To investigate this hypothesis, four transgenic lines of Arabidopsis thaliana expressing SULTR fused to either the N-terminal or C-terminal part of YFP were created in the sultr1;1 sultr1;2 double mutant background. Our results show that the root growth defect of the sultr1;1 sultr1;2 mutants was restored in all four transgenic lines, indicating that nYFP- and cYFP-tagged SULTR proteins are functional as sulfate transporters. Furthermore, the interaction between SULTR1;1 and SULTR1;2 was observed in roots of seedlings grown under sulfate-deficient conditions.

### NEOADJUVANT THERAPY WITH ANTI-TELOMERASE POTENTIATES THE EFFECTS OF ANTHRACYCLINE BASED CHEMOTHERAPY

**Luke Pardy (Grand Valley State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 52
**Mentor(s):** Osman Patel (Grand Valley State University: Cell and Molecular Biology)

Breast cancer is the second leading cause of cancer related death in women in the US. In addition, 20% of all breast cancer cases in the US are from the subtype known to be the most aggressive and invasive form of the disease, called Triple-Negative Breast Cancer (TNBC). This type of breast cancer has the worst prognosis, a decreased survival rate, and no targeted therapy. Over the decades, interest in pre- (Neoadjuvant) and post-chemotherapy (Adjuvant) treatments, in the management of TNBC has increased. Therefore, we evaluated the Adjuvant and Neoadjuvant effects of anti-telomerases (BIBR 1532 and GV6) with anthracycline-based chemotherapy (Doxorubicin). In the initial (Neoadjuvant) experiment, MDA-MB-231 (TNBC) cells were supplemented with BIBR 1532 (n=4) or GV6 (n=4) for 14 days, then exposed to Doxorubicin (n=4) for 7 days. In the second (Adjuvant) experiment, cells were primed with Doxorubicin for 7 days (n=4) prior to 14 days of BIBR 1532 (n=4) or GV6 (n=4) therapy. Trypan Blue (Gibco) exclusion test was used to assess the viability of the cells. After 14 days of Neoadjuvant treatment with BIBR1532 or GV6, the cell densities decreased by 55% ($p<0.05$) and 21% ($p=0.06$), respectively. In contrast, adjuvant treatment with BIBR 1532 or GV6 had limited effect on the proliferation rate of MDA-MB-231 cells. A higher ($p<0.05$) percent of dead cells were observed in BIBR1532 adjuvant therapy. These data indicates that neoadjuvant therapy with anti-telomerase does have beneficial effects and warrants further investigation.

### EFFECTS OF CAMTA3 MUTATIONS ON COLD-INDUCED GENE EXPRESSION AND SALICYLIC ACID BIOSYNTHESIS

**Amber Peabody (Michigan Technological University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 54
**Mentor(s):** Sarah Gilmour (Plant Biology)

The *Arabidopsis thaliana* Calmodulin Binding Transcription Activators (CAMTA) have been shown to rapidly induce the CRT/DRE Binding Factor (CBF) genes in plants exposed to low temperature. These binding factors activate the CBF regulatory pathway, leading to an increase in plant freezing tolerance. In addition, CAMTA proteins repress biosynthesis of salicylic acid (SA) in plants grown at warm temperature. This repression is impaired in plants exposed to low temperature for more than one week, resulting in an accumulation of SA and induction of SA-regulated genes involved in plant defense against pathogens. The goal of this project was to identify regions of the CAMTA proteins that are required for induction of the *CBF* genes and repression of SA biosynthesis. Plants carrying *camta2/camta3* double knockout mutations have been transformed with versions of CAMTA3 containing mutations in areas of the protein thought to be sites of posttranslational modifications that could potentially affect CAMTA activity. In the current experiments, induction of *CBF* genes in response to short-term cold treatment will be compared in wild-type and mutant plants using qRT-PCR. Also, accumulation of SA in response to long-term cold treatment will be determined using a bioassay and by monitoring the induction of *PR1*, a plant defense gene that is highly induced in response to SA. The results should provide important new information on CAMTA structure-function relationships and potentially identify regions of the CAMTA proteins required for sensing cold temperatures.

**CHARACTERIZATION OF PHOTOSYNTHETIC PRODUCTIVITY AND GROWTH IN ARABIDOPSIS MUTANTS**
**Linh Pham (Humboldt State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 55
**Mentor(s):** David Kramer (DOE-PRL), Stefanie Tietz (DOE-PRL)

Changes in environmental conditions, such as water content, CO2 concentration, and light intensities, can trigger many different regulatory mechanisms in plants' photosynthesis. High light intensities, for example, can activate a variety of cyclic electron pathways that control the ratio of ATP/NADPH. The type of pathway triggered is dependent upon factors such as the amount of CO2 available for the Calvin Cycle and amount of water that has been oxidized for the light reaction. Faulty activation of these cycles can lead to accumulation of energy in photosystem-II and high concentration of electrons in the thylakoid membrane, allowing formation of reactive oxygen species (ROS) and destruction of photosystem-II. Therefore, a plant's ability to control these mechanisms and express this control in its high photosynthetic productivity under varying environmental conditions is capable of adapting to and repairing damages from environmental stresses very well. In the rapidly changing climate, plants with high photosynthetic productivity in varying conditions can possibly be the key to increasing food and biofuel production. The purpose of this study is to examine ten mutants of Arabidopsis with interesting photosynthetic phenotypes for their photosynthetic productivities and correlation between their productivity and growth. To achieve this purpose, imaging chambers that can capture Arabidopsis' fluorescence under flat and fluctuating light, spectroscopy, PhotosynQ, confocal microscopy, and biomass measurements are used.

**GLYCOPEPTIDE SYNTHESIS AS A BIOMARKER FOR ALZHEIMER'S DISEASE**
**Kathleen Russell (Kalamazoo College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 56
**Mentor(s):** Xeufei Huang (Chemistry), Sherif Ramadan (Chemistry)

Currently, the most prevalent form of dementia found in elderly patients is a neurodegenerative disorder that causes loss of memory called Alzheimer's disease. A certain glycopeptide, given the name Amyloid-β, has been located in the brains of the patients with the disease and is thought to be the reason behind the synapse failure and neuronal dysfunction. In our lab we will synthesize Amyloid-β through the individual attachment of each amino acid in the exact sequence of the glycopeptide chain. Subsequently, we will attach it to a Q- β protein with a linker, and inject it into mice with a particular cancer cell. We hypothesize that the dose of Amyloid-β will exhibit anticancer properties that ultimately will rid the mice of the tumor. Should this be the outcome of the experiment we will create a new method of treatment for cancer patients.

**USING CELL SIGNALING PATHWAYS TO TARGET ER-POSITIVE BREAST CANCER**
**Genevieve Pourzan (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 58
**Mentor(s):** Susan Conrad (Microbiology), Sonia Kumar (Physiology)

According to the NIH, each year over 200,000 women are newly diagnosed with breast cancer- making it the second most common cancer for women in the US. Estrogen, a female hormone, acts to stimulate breast cell growth by signaling the cell to undergo division. Estrogen-positive breast cancer (ER+) is a type of breast cancer where estrogen receptors promote cancerous growth along with normal tissues. Treatment for this type of breast cancer includes endocrine therapy, but resistance among cancer cells can make these treatments ineffective. Our lab investigates how a drug called CEP-1347, a pan mixed-linage kinase inhibitor, can block breast cancer growth. In vitro studies demonstrated that CEP-1347 decreases the viability of ER+ breast cancer cells, including cells with acquired resistance to endocrine therapy (Wang et al. 2013). To evaluate the potential of this compound as a breast cancer therapeutic, an in vivo study was carried out. Mice were injected with breast cancer cells tagged with fluorescent markers, then tumor growth was monitored during a trial of drug therapy using an imaging system called IVIS Spectrum that detects fluorescence and hence growth. Afterwards, tumors were analyzed with immunohistochemistry staining to quantify the efficacy of the treatments which included the control, current endocrine therapy, and CEP-1347.

**LOCALIZING TACHYKININ RECEPTORS IN MOUSE COLON**
**Gretchen Rivera (Universidad de Puerto Rico en Humacao)**
**Category & Time:** Biochemistry and Molecular Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 59
**Mentor(s):** Ninotshka Del Valle (Neuroscience)

The Enteric Nervous System (ENS) is comprised of neurons that are surrounded by glial cells. Recent evidence has illustrated the functional role of glial cells in a myriad of aspects of gastrointestinal physiology and pathophysiology. Irritable Bowel Syndrome (IBS) is a multifactorial gastrointestinal disease caused by alterations in the ENS. However, the role of enteric glial cells (EGC) in this disease state is still unknown. As such, we wanted to see if tachykinins (TKs) are involved in glial changes during IBS. TKs act as neurotransmitters in the central and peripheral nervous system to provide a link for bi-directional interactions between EGC and neurons. The binding of neurokinin receptors (NKR) is responsible for the regulation of motility in the ENS. The purpose of this study was to localize NKR to EGC a to better understand the role of NKR activation on glial cells. NKR are responsible for various effects such as smooth muscle contraction, inflammatory processes, hypotensive effects, and stimulation of gland secretion. To localize expression on EGC, we used fixed mouse colon preparations and performed immunohistochemistry to identify different NKR subtypes. Our preliminary data suggests that NK2R, a specific NKR subtype, is expressed on EGC, suggesting a role of TKs in neuron-glial communication. Furthermore, the data suggest that NK1R and NK3R subtypes are not expressed in EGC.

**COMPARISON OF CARBON ELECTRODE PERFORMANCE FOR THE DETECTION OF AMINO ACIDS IN FLOW INJECTION ANALYSIS**
**Joy Rutherford (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 60
**Mentor(s):** Gregory Swain (Chemistry)

Background: There are many diseases that can be identified by specific biological elements appearing in the blood, urine, or other bodily fluids. A very useful tool in detection of these biological elements is a method called flow injection analysis (FIA). This technique involves injecting analytes into a flowing carrier solution, which then passes through a detector. Amperometric detection was used in this work. In this detection mode, an analyte is detected as an oxidation current. The electrodes being used include: boron-doped diamond (BDD), glassy carbon (GC) and nitrogen-containing tetrahedral amorphous carbon (ta-C:N) thin-film electrodes. The objective of this project is to compare the performance of these three carbon electrodes for detection of bioanalytes (e.g., amino acids) in terms of the detection figures of merit (sensitivity, limit of detection and response precision). The ta-C:N and diamond electrodes should offer the best performance.Methods: The carrier solution used is 0.1 M phosphate buffer solution of pH 7.4. The analytes, tyrosine and tryptophan, are injected into the system. Hydrodynamic voltammetry is then performed to determine the optimum potential to apply for detection of that analyte. Lastly, 30 consecutive injections are made and the relative standard deviation is calculated to determine response precision. Results/Conclusions: Most the electrodes will be able to withstand the potentials used in this experiment. Other factors such as resistance to fouling, response precision, and limits of detection will determine which electrode is best suited for detection of this class of analytes.

**SUBSTRATE PREFERENCES IN CYCLIZATION BY POPB**
**Miranda Smith (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 61
**Mentor(s):** Mike Sgambelluri (Biochemistry and Molecular Biology), Jonathan Walton (Plant Research Laboratory)

Properties such as stability, rigidity, and high membrane permeability make cyclic peptides promising pharmaceutical tools. The Walton Lab has identified prolyl oligopeptidase B (GmPOPB) as the enzyme responsible for macrocyclization of α-amanitin from the linear propeptide GmAMA1. α -Amanitin, a bicyclic octapeptide found in *Galerina marginata*, is a member of a class of compounds known as amatoxins, which are responsible for most fatal human mushroom poisonings. In order to produce novel cyclic peptides, variations of linear peptide GmAMA1 have been produced in E. coli and screened for cyclization by GmPOPB. LC-MS analysis of the reaction products showed that GmPOPB is capable of producing a wide array of cyclic octapeptides, but there was decreased efficiency when certain residues were altered. This analysis will serve as a guide in producing combinatorial libraries of novel cyclic peptides to be screened for useful activities.

**IMPROVING ENZYMES FOR CELLULOSE DECONSTRUCTION**
**Sara Smith (University of Nebraska at Omaha)**
**Category & Time:** Biochemistry and Molecular Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 62
**Mentor(s):** Jonathan Walton (Plant Biology)

Sustainable bioenergy is a promising alternative energy source. From the deconstruction of plant biomass, fermentable sugars from the cell wall can be converted into cellulosic ethanol. Cellulose is difficult to deconstruct because of its crystalline structure. Common ways to hydrolyze cellulose are chemical and enzymatic. Chemical treatment is unpopular due to toxic byproducts. Enzymatic treatment utilizes secreted enzymes from bacteria or fungi. However, enzymes are too expensive to be economical and must be improved. One improvement to enzymes is to increase their pH range. Enzymes currently used in industry function at pH 5, but enzymes with a broader pH range would offer benefits including: compatibility with alkaline pretreatments, less need to monitor pH carefully, greater resistance to contamination, and less lignin binding. The fungus *Cladorrhinum bulbilosum* has been found to grow on biomass at pH 9-10, and its enzymes work at high pH. RNASeq analysis of *C. bulbilosum* will provide information about genes expressed under high pH that contribute to growth and cellulose deconstruction. Another approach to improving enzymes is to find better examples of known important enzymes. Cellobiohydrolase (CBH1) is an exo-beta-1,4-glucanase that converts crystalline cellulose to cellobiose and is one of the most important enzymes for making ethanol from biomass. In order to find a better CBH, we are expressing different CBHs from different fungi in the host *Trichoderma reesei*. We are analyzing their expression at the transcriptional level using reverse transcriptase PCR.

**BRANCHED-CHAIN AMINO ACID BIOSYNTHESIS IN ARABIDOPSIS THALIANA**
**Sarah Sprenger (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 63
**Mentor(s):** Anqi Xing (BMB)

Unlike animals, plants are able to produce Branched-Chain Amino Acids (BCAAs) isoleucine, leucine and valine. Because plant-based diets may lack sufficient BCAAs, it is important to understand the regulation of their biosynthesis. The committing enzymes Isopropylmalate Synthase(IPMS), Acetohydroxy Acid Synthase(AHAS) and Threonine Deaminase(TD) that catalyze BCAA biosynthesis are feedback inhibited by one or more end products. In a previous study, we identified Arabidopsis thaliana feedback insensitive mutants of IPMS1 and AHAS_S1. Mutants showed significant changes in Leu and Val, however Ile levels was only marginally affected. This is consistent with the hypothesis that Ile biosynthesis is regulated separately by TD. In this study, the Ile toxic analog O-methyl-threonine (OMT) was used to select TD feedback-insensitive mutants. Screening identified four mutations on TD, one on AHAS_SI, and three mutants with unkown mutations. Progenies of mutants were sowed on plates containing different OMT concentrations and all mutants showed OMT resistance. Two TD mutants which showed strong OMT resistance, OMTr6 and OMTr11, were selected for further characterization. Segregation analysis with mutant (Col-0)/Ler F2 populations genetically validated the TD mutations in OMTr6 and OMTr11 as causal mutations. Amino acid profiling was performed on OMTr6 and OMTr11 seedlings, which were found to have an average of 102-fold and 30-fold increase in Ile respectively. OMTr6 also had a 3.68-fold increase in Leu, while OMTr11 had no significant changes in other BCAAs. Eventually, the TD mutants will be crossed with previously identified IPMS1 and AHAS_S1 mutants to further understand the regulation of BCAA biosynthesis.

**CHARACTERIZATION OF MEMBRANE PROTEIN TSPO FROM THE CYANOBACTERIUM FREMYELLA DIPLOSIPHON**
**Zachary WareJoncas (St Olaf College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 66
**Mentor(s):** Andrea Busch (Biochemistry)

The tryptophan rich sensory protein TSPO is membrane protein found in many species across all kingdoms. TSPO appears to be involved in early stress responses for many species and is implicated in the binding of steroid compounds and tetrapyrroles. In the oxygenic photosynthetic cyanobacterium Fremyella diplosiphon TSPO (i.e. FdTSPO) is regulated by light quality, becoming upregulated in green light conditions. FdTSPO functions in early responses to abiotic stress and binds tetrapyrroles. Here, we aim to determine the molecular function of FdTSPO through assessment of its ligand binding characteristics.Heterologous expression of FdTSPO in E. Coli has been undertaken. Optimization of protein expression and purification conditions/methods and protein analyses are engaged to ensure isolation of native state protein for binding assays. In addition to examining the natural FdTSPO protein variant, the protein is being mutated to isolate variants with conserved motifs in mammalian TSPO which are known to be involved in ligand binding. Once the expression and stability of both the natural protein and mutant variants have been maximized, ligand binding assessment will be performed using tryptophan fluorescence assays.These efforts are anticipated to contribute to a more complete understanding of the function of the FdTSPO protein, specifically in terms of ligand binding capability. Additionally through comparisons of natural vs. mutated Fremyella TSPO variants we seek to determine key structural features required for ligand binding. Ultimately, we hope to contribute to an understanding of the evolution and divergence of the TSPO protein across kingdoms.

**FLUORESCENCE DECAY PROFILES OF PROBE MOLECULES IN ROOM TEMPERATURE IONIC LIQUIDS**
**Mianna Webber (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 67
**Mentor(s):** Gary Blanchard (Chemistry)

Ionic liquids (ILs) are ionic compounds (salts) which are liquid below 100°C, and are synthesized by either metathesis reactions and/or acid-base neutralization reactions. They also have low volatility, relatively high electrical conductivity and good chemical stability. From an electrochemical standpoint, ILs are of interest because they contain no solvent per se like an aqueous electrolyte solution. This means the interfacial structure at an electrode surface and the environment around a soluble redox probe molecule (chromophore) are necessarily distinct from the condition in an aqueous electrolyte solution. Since little is known about the organization of IL molecules around a redox probe molecule, fluorescence lifetime and anisotropy decay measurements will be used to learn more about the chemical environment of a probe molecule near and far from an electrode (i.e., charged surface). The chromophores used are resorufin sodium salt, oxazine 725, and phenoxazone 660 (nile red). Baseline ethylene glycol solutions with concentrations of $10^{-6}$M of each chromophore have been made and fluorescence and absorbance measurements made. Fluorescence lifetime and anisotropy decay measurements were made using time correlated single photon counting (TCSPC) measurements. With these results the next step is the examination of the same chromophores in selected ionic liquids using the same techniques. Evaluation of the IL systems at and near an electrode surface will provide insight into the short range molecular organization of interest.

**TROPANE ALKALOID DIVERSITY: EXPLORING ALIPHATIC TROPANE ESTER FORMATION WITHIN SOLANACEAE**
**Rebecca Wilkes (Washington and Jefferson College)**
**Category & Time:** Biochemistry and Molecular Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 68
**Mentor(s):** Cornelius Barry (Horticulture), Matthew Bedewitz (Horticulture)

Tropane alkaloids (TAs) are plant specialized metabolites whose medicinal properties have been utilized for centuries for conditions such as nausea, arrhythmia, and tremors. The biosynthesis of TAs is not fully understood but elucidating the pathways involved in their formation could lead to the development of novel therapeutic agents as well as strategies to engineer the synthesis of specific compounds. This project focuses on the Solanaceae family where TA biosynthesis occurs in the roots. Tropinone is a key intermediate in TA biosynthesis and its reduction to tropine by tropinone reductase I (TRI) or pseudotropine by tropinone reductase II (TRII) represents a bifurcation of the TA pathway. Tropine and pseudotropine can be acylated to form aliphatic tropane esters. Atropa belladonna pseudotropine acyltransferase (AbPTR-AT) catalyzes the formation of aliphatic tropane esters and putative orthologs of this gene were identified in several Solanaceae species including tomato, petunia, and potato that are not known to synthesize tropane esters. This project aims to test the activity of putative PTR-AT orthologs from tomato, petunia, potato, and Datura stramonium orthologs using combinations of pseudotropine or tropine with aliphatic CoA esters as substrates. In addition, the expression of putative orthologs of TA biosynthesis genes, including PTR-AT, will be examined in tomato and petunia to determine whether, like in A. belladonna, they are preferentially root expressed. Finally, Solanaceae species from across the phylogeny will be screened for the presence of aliphatic tropane esters.

**ACUTE METHYLMERCURY EXPOSURE EFFECTS ON MRNA EXPRESSION OF GLUTAMATE RECEPTORS IN NSC34 CELLS**
**Neco Wilson (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 69
**Mentor(s):** William Atchison (Pharmacology and Toxicology), Alexandra Colon-Rodriguez (Pharmacology and Toxicology)

Methylmercury (MeHg) is an environmental toxicant that targets the central nervous system. MeHg neurotoxicity has cell specificity and motor neurons are an identified target. Acute exposure to MeHg can lead to disturbances in sensation, hearing, speech, balance and movement. MeHg toxicity in motor neurons leads to dysregulation of Ca2+ concentrations that contribute to cell death. The observed Ca2+ alterations are mediated in part by alpha-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid (AMPAR) receptor. The objective of our study was to evaluate effects of acute MeHg exposure on mRNA levels of glutamate receptor AMPAR in a motor neuron cell line (NSC34). Identifying effects of MeHg on expression of this receptor could contribute to the understanding of its toxicity on this cell line. NSC34 cells were cultured in 1:1 DMEM/F12+1%FBS+1%Anti Anti media for 48 hours then exposed to 0, 1, 2, or 5 µM MeHg for 24 hours. Then RNA was isolated from 500µL

NSC34 cells and reverse transcribed. Real time qPCR was used to determine the mRNA expression levels of the AMPAR subunits GluR1, 2, 3, and 4. Based on the literature our expected results are that mRNA levels of all AMPAR subunits studied will be increased.

**DEVELOPMENT OF A DOSE-DEPENDENT GENE INDUCIBLE SYSTEM IN MYXOCOCCUS XATHUS FOR ANALYSIS OF GENE EXPRESSION UNDER STARVATION CONDITIONS**
**Clayton Wolin (Michigan State University)**
**Category & Time:** Biochemistry and Molecular Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 70
**Mentor(s):** Lee Kroos (Biochemistry)

The purpose of this study is to introduce a dose-depended gene inducible system in Myxococcus xanthus, specifically the laboratory strain DK1622. The gene inducible system will be based off of the tetR receptor, which has been used in E. Coli for the same purposes. The tetRA circuit uses tetR as a repressor of the open reading frame, when in the presence of anhydrotetracycline (ATc) the repressor releases from the system, allowing gene transcription to proceed. The circuit has mCherry in its open reading frame which will allow for fluorescent detection, and if the hypothesis is correct the concentration of ATc and the amount of fluorescence will have a linear relationship. Once an effective system is obtained it will be used to study the effects of genes in the regulation of fruiting body and sporulation production in DK1622. Genes that have been known to help the process will be inserted where mCherry was present; by using varying concentrations of ATc the effects of varying gene expression will be observed.

# BIOSYSTEMS AND AGRICULTURAL ENGINEERING

**OPPORTUNITIES TO UTILIZE SOLID ORGANIC WASTE AT MICHIGAN STATE UNIVERSITY**
**Alexis Baxter (Michigan State University), Aubrey Proctor (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 73
**Mentor(s):** Dana Kirk (Biosystems Engineering)

Michigan State University's T.B. Simon Power Plant is currently converting their fuel source from coal to natural gas. One advantage of coal burning furnaces is the ability to co-fire with solid organic waste. By eliminating coal burning furnaces the power plant cannot use organic waste as a fuel source. Landfilling this organic waste forces anaerobic decomposition that produces methane, which negatively impacts the atmosphere when released. Landfilling also produces a harmful leachate that can affect groundwater. Other hazards include fires, explosions, vegetation damage, settlement, and unpleasant odors. Organic waste also has the potential to become fertilizer but not when landfilled. In order to avoid harmful environmental impacts, it is important to consider alternative methods of disposal. Composting organic matter is an example of these alternative methods. Michigan State University has its own composting facilities; three of which were evaluated. These facilities are University Farms, the Student Organic Farm, and Beaumont Landscape Supply. Another option is to pelletize the solid organic waste, which takes sawdust or pulp size dry organic waste and compresses it into pellets to be burned for fuel. Controlled burning or combustion is also another option. This burns organic waste at high temperatures to create steam to be used for heating, air conditioning, or in steam-powered turbines to convert thermal energy to electrical energy. These alternative options for the reuse of dry solid organic waste on Michigan State University's campus were investigated and analyzed to determine the best overall solution.

**EXTRACTION OF SALMONELLA ENTERICA SEROVAR ENTERITIDIS FROM SEMI-SOLID FOOD ASSOCIATED WITH RECENT FOODBORNE ILLNESS OUTBREAKS**
**Octavio Augusto Costa Almeida (Universidade Federal de Uberlandia), Breno Goncalves Pinheiro (Universidade Federal do Piaul)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 74
**Mentor(s):** Evangelyn Alocilja (Biosystems Engineering), Kasey Pryg

The bacteria Salmonella Enteritidis is known to cause more than one million foodborne illnesses in the United States every year. Salmonellosis is mainly caused by ingestion of contaminated food, such as poultry and poultry derivatives. Current methods to detect contamination with Salmonella in food samples require lengthy testing times, sophisticated equipment and trained personnel. However, biosensors are able to detect and quantify the presence of pathogens in contaminated products faster, cheaper, with less training and equipment. The use of biosensors allows for mobile, rapid, accurate testing to empower and protect both the manufacturer and consumer from contamination. This project proposes to evaluate the efficiency of functionalized magnetic nanoparticles (MNP) in capturing Salmonella Enteritidis in mayonnaise, egg yolk and chicken breast before detection. Salmonella extraction was performed by inoculating samples of food with bacterial cultures of Salmonella Enteritidis and adding MNP. Capture efficiency was evaluated by comparing bacterial growth on plates containing MNP and without MNP. The results are hypothesized to be between 85 and 95 percent, which means that high loads of bacteria can be extracted for biosensor detection or other downstream processing. If successful, the MNP could be an excellent nanomaterial for pathogen extraction and subsequent detection, and could be a tool to prevent foodborne disease outbreaks.

**TRANSPORT AND FATE OF NUTRIENTS FROM WINTER MANURE APPLICATION**
**Natsuki Ikeda (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 75
**Mentor(s):** Steven Safferman (Biosystems & Agricultural Engineering), Jason Smith (Biosystems & Agricultural Engineering), Oya Tekesin (Biosystems & Agricultural Engineering)

Manure application on soil is an important practice for farmers to dispose of agricultural residuals, such as manure. Applications must prevent the discharge of a significant amount of nutrients from the agricultural wastewater into rivers, lakes and other water sources. Winter manure application has recently been receiving attention due to its presumed link to the occurrence of algae blooms in the Midwest, some of which lead to temporary interruption of the water supply in Toledo. Previous research does not provide clear insight on if or how winter manure application

contributes to algae infestation. This project examines the effect of manure application timing and the presence of snow on the amount and proportion of bioavailable phosphorus and nitrogen release to ground and surface waters. Soil columns were built in the laboratory, coiled with cooling tubes that is capable of simulating a spring thaw event by controlling the temperature of multiple zones across the soil profile. Manure is applied on the soil with or without snow, at different timings in the soil's freeze-thaw cycle. The levels of total phosphate, dissolved phosphate, total nitrogen and pH of the effluent and surface water are recorded. The hypotheses are that the manure application on unfrozen or lightly frozen soil has no adverse effect on the runoff of nutrients but the application on frozen ground encourages nutrient release.

**DETECTION OF MYCOBACTERIA USING MAGNETIC NANOPARTICLES IN ARTIFICIAL SPUTUM MATRIX**
**Linda Lay (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 76
**Mentor(s):** Evangelyn Alocilja (Biosystems Engineering), Kasey Pryg (Biosystems and Agricultural Engineering)

Tuberculosis affects millions of people worldwide, with 9 million new cases reported annually. The bacteria responsible for tuberculosis, *Mycobacterium tuberculosis*, can infect any organ of the body but is most often found in the lungs. Tuberculosis aggregates in the lung wall's protective mucus, also known as sputum. As tuberculosis is highly prevalent in developing countries, a simple, inexpensive, and effective diagnosis procedure is needed in order to detect tuberculosis infection. Current diagnostic methods involve expensive equipment and lengthy lab processing, which come at too great an expense to poorer regions in which TB is more widespread. Biosensors using magnetic nanoparticles (MNP) are cheap and can performed directly in the field. The technology works by using functional groups to latch onto the bacteria and magnetic nanoparticles to attract the bacteria to a magnet. This study determined the efficiency of magnetic nanoparticles in capturing *Mycobacterium smegmatis* in artificial sputum. Because of the highly infectious nature of *Mycobacterium tuberculosis*, benign *M. smegmatis* is often used as a model organism for studies involving *M. tuberculosis*. To test capture rate, magnetic nanoparticles were added to stock cultures of *M. smegmatis* and supernatant extracted using magnetic columns. Capture efficiency was calculated from the stock and nanoparticle solutions using plate counts. Overall, the magnetic nanoparticles showed anywhere from 80-90 percent efficiency in detecting the mycobacteria. These results show promise in further developing a novel biosensor for tuberculosis detection.

**THE OPERATION AND OPTIMIZATION OF TROPICAL WETLANDS**
**Olivia Leaven (Bennett College)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 77
**Mentor(s):** Dawn Reinhold (Biosystems & Agricultural Engineering)

BACKGROUND: Wetlands are known to be natural filters and natural buffers to stormwater. According to the United Nations and the EPA, water quality has become an issue due to the growing human population and pollution of natural resources by stormwater. Flooding has also increased. These phenomena are attributed to destruction of over half the nation's wetlands. Biosystems engineers have been working to replace lost wetlands with ecologically engineered ones. Different plants and their effect on wetland treatment have been analyzed; however, there are differences on whether root structure affects nutrient removal. Our goal is to see if the root structure, saturation, and loading rate of wetland plants have any influence on water retention and nutrient removal. METHODS: Chemical Oxygen Demand (COD), Total Nitrate, Total Phosphate, and Total Solids (TS) tests will be compared between a control (column filled with sandy soil media), Juncus plant (sandy soil media column and Juncus plant), and Canna plant (sandy soil media column and Canna plant). Each set of columns are divided into three treatment parts, each part to be watered with COD of 15 mg/L, 30 mg/L, 45 mg/L respectively. RESULTS: We predict the Juncus plant will yield the best results in the COD and TS tests due to its fibrous root structure and therefore prove to be more effective in wetland treatment practices. CONCLUSION: With this information, we will be better equipped to create the most effective wetland with proper loading rates and plant selections.

**A FEASIBILITY STUDY OF UTILIZING THE DETOXIFIED BIO-OIL AQUEOUS PHASE AS SUBSTRATES FOR ANAEROBIC DIGESTION**
**John Blackhurst (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 78
**Mentor(s):** Wei Liao (Biosystems and Agricultural Engineering), Yuan Zhong (Biosystems and Agricultural Engineering), Yan Liu (Biosystems and Agricultural Engineering)

With the environmental concerns and unsustainability of non-renewable fossil fuels, researchers are looking for alternative sources of clean energy. Bio-oil, originated from biomass such as agricultural wastes and bio-energy crops, is created from pyrolysis. The pyrolysis is a thermochemical process that decomposes biomass in the absence of oxygen, to produce an energy rich liquid (bio-oils) and a carbon rich solid (bio-char). The bio-oil containing organic acids can be utilized by anaerobic microbes to produce biogas. However, the inhibitors produced during the pyrolysis, including phenolic compounds and furfurals, obstructs the performance of anaerobes. In this study, the crude bio-oil was first mixed with deionized water and centrifuged to separate the liquid and solid. In order to minimize the inhibition to the anaerobic digestion, the liquid was detoxified with Calcium Hydroxide (lime) and then centrifuged. The inhibitors in the liquid were absorbed by lime and settled in the bottom, while the remaining liquid was used as substrates for anaerobic digestion. A biochemical methane potential (BMP) test was conducted to evaluate the feasibility with a complete random design of 2 anaerobic seed inoculation sizes and 4 different dilution rates.

**DETECTION OF NEW INTERMEDIATES IN NATURE'S MOST POWERFUL OXIDIZING ENZYME**
**Yegor Proshlyakov (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 2, 1:00 PM - 2:00 PM
**Poster:** 80
**Mentor(s):** Denis Proshlyakov (Chemistry)

Methane is responsible for 9% of greenhouse gas emissions in the US. Containing one of the strongest bonds known in organic chemistry, the C-H bond, it is very hard to utilize or convert into a less harmful form. Methane monooxygenase (MMO) is an enzyme able to break this C-H bond and convert methane into methanol. Understanding the mechanism of this catalysis could help decrease pollution while creating greener fuel in

the process. Converting methane to methanol, a far less environmentally hazardous liquid, would greatly cut methane emissions. The produced methanol could then be used to generate electricity, create biodiesel, provide a far cleaner alternative to gasoline, among other uses. Following the vibrational signature of the active site of MMO during the reaction with methane, an unexpected transient mode was observed at the end of the reaction. This mode, showing sensitivity to substrate presence, is proposed to be involved in the catalysis cycle. In an attempt to replicate and study the nature of this mode, a static resonance Raman (rR) experiment utilized various methods of substituting water in the active site for isotopically labeled water. These methods included backflow of water from the bulk into the active site and generation of water in the active site from molecular oxygen. By utilizing these methods and observing the isotopic differences in rR, we are able to detect and characterize a new state of the active site of the enzyme.

**FUNGAL LIPID EXTRACTION**
**Austin Mashburn (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 2, 1:00 PM - 2:00 PM
**Poster:** 81
**Mentor(s):** Wei Liao (Biosystems and Agricultural Engineering), Susie Liu (Biosystems and Agricultural Engineering), Tony Zhong (Biosystems and Agricultural Engineering)

*Mortierella isabellina* ATCC 42613 is a fungal strain that has demonstrated superior capability to accumulate microbial lipids for biofuel production. Extraction of fungal lipids from the fungal biomass is a critical step regarding establishment of a high-efficiency fungal lipid based biorefining. Extraction can be done in a variety of ways such as soxhlet extraction, bligh and Dyer method, and hexane/isopropanol method. However, high toxicity of the solvents and complicated extraction processes limit their application in the biodiesel production. Therefore, a new extraction approach using less toxic chemical (hexane) with simple agitation is developed in this study. The factors of the ratio of biomass to hexane, the agitation speed, temperature, the number of extraction stages, and the time of extraction have been investigated by a completely randomized design (CRD). Consequently the most efficient extraction is concluded and the extraction kinetics is also determined. With continued research in this area, a streamlined extraction process could be developed on larger scales in order to make the lipid extraction more efficient and more cost effective.

**USING TORREFACTION AS A PRETREATMENT TO FORM AROMATIC CHEMICALS UNDER CATALYTIC PYROLYSIS**
**Robert Munro (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 2, 1:00 PM - 2:00 PM
**Poster:** 82
**Mentor(s):** Li Chai (Biosystems Engineering), Chris Saffron (Biosystems Engineering), Yi Yang (Biosystems Engineering), Zhongyu Zhang (Biosystems Engineering)

Production of aromatic chemicals from biomass can further relinquish dependency from non-renewable resources. There are many uses for aromatic chemicals including fuel additives and plastic production. This study was conducted to see if torrefaction, as a pretreatment before catalytic pyrolysis, is a suitable practice to gain higher yields of aromatic chemicals from raw biomass. The effects of torrefaction time and temperature were varied along three different biomass types—poplar, spent coffee grounds, and corn stover. A microscale pyrolysis unit (CDS Pyroprobe 5250, CDS Analytical Inc., Oxford, PA) was used with torrefied biomass mixed with H-ZSM-5 catalyst—23:1 silicon to aluminum ratio—to create aromatic chemicals. The volatiles were collected and identified using a gas-chromatograph mass-spectrometer (Shimadzu Corp., Columbia, MD). Future work may include testing with different catalysts such as red mud and MSU-MFI infused with various metals—Pd, Zn, and Ga. Testing with different torrefaction methods may also be explored such as using a fluidized bed reactor. Scale up to a screw-conveyor reactor will be performed to produce larger amounts of product and collect mass and energy balance information.

**EXTRACTION OF PATHOGENIC BACTERIA FROM LARGE VOLUMES OF RIVER WATER USING MAGNETIC NANOPARTICLES**
**Isamar Pastrana-Otero (University of Puerto Rico at Mayagez)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 2, 1:00 PM - 2:00 PM
**Poster:** 83
**Mentor(s):** Evangelyn C Alocilja (Biosystem Engineering), Kasey Pryg (Biosystems and Agricultural Engineering)

Many developing countries lack access to clean water, which makes their populations susceptible to waterborne diseases like diarrhea and other intestinal illnesses. Membrane filtration is a widely used method to extract bacteria in water either for bacterial count, detection, or clean-up. In this research, our hypothesis is that functionalized magnetic nanoparticles (MNP) could also be used to effectively, rapidly, simply, and inexpensively extract bacteria in water sources for human consumption or use. This paper presents our functionalized magnetite ($Fe_3O_4$) nanoparticles, with a diameter range of 250-450 nanometer, that demonstrate superparamagnetism. Superparamagnetism means that the particles have net magnetization of zero but they can be magnetized by an external magnetic force. With our MNP and a magnetic separator, extraction of bacteria from water samples is simple. This new extraction method will be tested using drinking water and river water intentionally contaminated with *E. coli*. As per protocol established by the Environmental Protection Agency (EPA), 100 ml of water will be used as a sample volume to be seeded with 1 ml of bacterial culture and 1 ml of the MNP. The effectiveness of the extraction method will be measured and reported as capture efficiency. The expected results include a capture efficiency of at least 90% and accuracy comparable to membrane filtration. Preliminary results indicate that the MNP has a capture efficiency between 99.0-103.1% for *E. coli.* Given our preliminary data, MNP has the potential to be an excellent alternative to membrane filtration extraction for clean-up, detection, or downstream processing.

**PYROLYTIC AND ELECTROCATALYTIC UPGRADING OF LIGNIN**
**Ha Phan (Western Michigan University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 2, 1:00 PM - 2:00 PM
**Poster:** 84
**Mentor(s):** Mahlet Garedew (Biosystems & Agricultural Engineering), James Jackson (Chemistry), Christopher Saffron (Biosystems & Agricultural Engineering)

Biomass has three main components; cellulose, hemicellulose, and lignin. While cellulose and hemicellulose are used for ethanol production, lignin is often a byproduct that is burnt for heat. As lignin accounts for 35% of the weight and 40% of the energy of biomass, conversion of

lignin to a viable liquid fuel can be beneficial. This study focuses on using fast pyrolysis as a lignin depolymerization method. Fast pyrolysis is a process where whole biomass or lignin is heated rapidly under high temperature in the absence of oxygen to produce bio-oil (70%), bio-char (15%) and gas (15%). Bio-oil has potential to be used as a liquid fuel. However, bio-oil is acidic, unstable, has high moisture content, and low heating value as compared to petroleum. Therefore, upgrading bio-oil is essential to make it commercially viable. Electrocatalytic hydrogenation (ECH) is a process that helps in upgrading bio-oil under mild conditions by stabilizing components of bio-oil into saturated alcohols and polyols. In this study, ruthenium on activated carbon cloth (Ru/ACC) is used as a catalytic cathode to help hydrogenate and deoxygenate model compounds representative of lignin depolymerization products found in bio-oil. Experiments were carried out to determine the effectiveness of Ru/ACC under mild conditions to reduce lignin monomers found in bio-oil. Moreover, desorption studies of different lignin-derived monomers and their ECH products were conducted to test the effectiveness for compound recovery as well as recovery of the catalyst.

**TREATMENT OF SMALL-SCALE MEAT PROCESSING WASTEWATER USING ANAEROBIC DIGESTION**
**Aubrey Proctor (Michigan State University), Alexis Baxter (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 87
**Mentor(s):** Dana Kirk (Biosystems and Agriculture Engineering)

Recent movements encouraging people to buy local-foods and support smaller companies have increased public interest in small-scale meat processors. The majority of these small meat processors are located in rural areas that lack access to reliable central waste and wastewater treatment facilities. Current wastewater treatment practices that solely focus on waste treatment and disregard waste utilization are designed for large-scale processing plants. These specific practices are not economically feasible for small-scale applications and put little consideration towards the environmental impacts of such techniques. Development of a scalable waste utilization system is crucial for the sustainability of smaller businesses. Anaerobic digestion is a viable solution for small-scale businesses because it is a simple system with the capability of treating meat processing wastewater that is dense with organic material, as well as utilizing this waste for energy production and water reclamation. Digesting meat processing waste through the use of anaerobic microorganisms successfully treats the relatively high concentrations of chemical oxygen demand (COD), suspended solids and grease that are present in waste produces at these facilities. Designing a system that utilizes anaerobic digestion will create a self-sustainable and cost-effective system that will treat waste produced at these smaller meat processing facilities, meet MDEQ and EPA standards, and generate renewable energy and fertilizer as useable byproducts.

**MECHANISMS OF INTERACTION BETWEEN DIFFERENT FUNCTIONALIZED MAGNETIC NANOPARTICLES AND PATHOGENIC BACTERIA**
**Breno Goncalves Pinheiro (Universidade Federal do Piaui), Octavio Augusto Costa Almeida (Universidade Federal de Uberlandia)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 88
**Mentor(s):** Evangelyn Alocilja (Biosystems Engineering), Kasey Pryg

Magnetic Nanoparticles (MNPs) have been largely used as biosensors to detect pathogens and other molecules in many types of samples such as blood, food and water. Besides detection of human diseases such as cancer and sexual transmitted diseases, their use play an important role as for detection of food and water contaminations thus preventing possible disease outbreaks. The performance of the functionalized MNPs depends on the nanoparticle properties as well as the functional groups attached to them. Understanding their mechanisms is important to have a good efficiency in capturing the antigen of interest. The goal of this project is to study some mechanisms of interaction of different types of MNPs. Tests to determine whether the MNPs affect bacterial growth or not were performed using four different kinds of MNPs in cultures of Salmonella Enteritidis and E. coli O157:H7. The interaction of the MNPs with the bacteria was evaluated observing plated colonies under microscopy.

**EVALUATION OF A SOLAR RECEIVER FOR A HYBRID POWER GENERATION PLANT**
**Charles Sanders (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 89
**Mentor(s):** Mauricio Bustamante (BAE), Wei Liao (BAE)

To fulfill the world's increasing energy demands, electric power plants consume a large amount of fossil fuels, which makes an adverse environment impact through the greenhouse gas emission. In addition, the high demand for these fuels has made them more expensive and therefore a commodity to conserve. A solution to reduce the consumption of fossil fuels in energy generation is to integrate solar energy into active power plants that burn natural gas or coal for energy input. Solar radiation is a free source of energy and readily available around the world and thus would be a good alternative to fossil fuels. In this study, a solar receiver is used to transmit the solar energy from the sun into heat-transfer fluid (HTF) as thermal energy. The transmission of energy from the solar receiver to the HTF needs to be tuned in aspects of phase change within the HTF, thermal energy transfer efficiency, as well as the temperatures the HTF can reach. The optimizations of the fluid types and flow rates are thus the objectives of this study to address issues mentioned above. This study facilitates establishing solar-facilitated power plant, and thus benefits energy efficiency and alleviates environmental liability from fossil fuels.

**THE USE OF BIOMASS FOR ALTERNATIVE ENERGY AND PRODUCTS**
**Fred Smith (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 90
**Mentor(s):** Chai Li (Biosystems Engineering), Robert Munro (Biosystems Engineering), Christopher Saffron (Biosystems and Agricultural Engineering), Rachael Sak (Biosystems Engineering), Thomas Stuecken (Mechanical Engineering), Yi Yang (Biosystems Engineering), Zhong

Fossil fuels are constantly being used, mainly for gas, oil, chemicals, and plastics. With the world's natural resources dwindling down and the amount of pollution increasing, the world is in dire need of alternatives. Research has shown promising results for alternative fuel through the processes of torrefying and pyrolyzing biomass. Torrefaction is a slow roasting method used to increase the energy yield of biomass to create a coal-like substance. Torrefied materials can then be pyrolyzed or rapidly heated to extreme temperatures. Pyrolysis produces volatile gases which are condensed into high energy bio-oil. The energy level and selectivity (gases sought after) of the bio-oil vary depending on many

different components; the main components are temperature, time, the type of biomass used, and the catalyst used. Bio-oil composed of many aromatics display potential as some aromatics can be manipulated to create fuel with characteristics similar to fossil fuels.

### FACTORS AFFECTING X-RAY INACTIVATION OF *SALMONELLA* IN LOW-MOISTURE FOODS

**Philip Steinbrunner (Michigan State University)**

**Category & Time:** Biosystems and Agricultural Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 91
**Mentor(s):** Sanghyup Jeong (Biosystems Engineering)

Microbial safety of low-moisture foods is an important goal in the food processing industry. Ionizing irradiation, like x-rays, electron beams, or gamma-rays, can inactivate bacteria within the product without significant impact on the quality of the food. However, it is necessary to identify the factors affecting inactivation of pathogens in low-moisture food products, for improved process modeling, design, and validation. The objective was to quantify the effect of X-ray dose, dose rate, and food structure on *Salmonella* inactivation in wheat products. Wheat kernels, meal, and flour were inoculated with *Salmonella* Enteritidis PT30, conditioned to 0.4 aw, and irradiated at three dose levels with high (6.17 Gy/s) or low (0.617 Gy/s, only for flour sample) dose rate using a 70 kV X-ray food irradiator. Treated samples (~1 g) were plated on modified tryptic soy agar, incubated, and enumerated. Dose rate (high/low) did not affect *Salmonella* inactivation in wheat flour at 0.4 aw ($P > 0.05$) However, D10-values were 321, 241, and 171 Gy for wheat kernel, meal, and flour, respectively, which implies that structural differences can affect X-ray inactivation of *Salmonella* in low-moisture products. Considering the fact that low-moisture raw materials are processed to various particle sizes, the parameters of X-ray irradiation should be validated for each product type, even if the chemical compositions are identical.

### FUNCTIONALIZED MAGNETIC NANOPARTICLE FOR BACTERIAL EXTRACTION IN CONTAMINATED VEGETABLES AND SURFACES

**Najwa Taylor (Rochester Institute of Technology)**

**Category & Time:** Biosystems and Agricultural Engineering, Section 4, 2:00 PM - 3:00 PM
**Poster:** 94
**Mentor(s):** Evangelyn Alocilja (Biosystems and Agricultural Engineering), Kasey Pryg (Biosystems and Agricultural Engineering)

Pathogens are essentially everywhere in the environment. This includes food and surfaces. According to the Centers for Disease Control and Prevention (CDC), more than 48 million individuals are affected by both food-borne illness and healthcare-associated illness (HAI). The most common disease-causing bacteria in both cases include *Escherichia coli*, *Staphylococcus aureus* and *Salmonella species*. To make identification of solid food and surface contamination easier, faster, and cheaper for both consumers and producers, this research looked into the use of biosensors that utilize functionalized magnetic nanoparticles (MNP). To determine the optimal methodical process to identify bacterial contamination, spinach and synthetically inoculated surfaces will be used. Variables such as the type of MNP and bacteria present will be taken into account, as well as standards set by the Food and Drug Administration (FDA) and the CDC which will serve as a baseline for the research. The expected results are a capture efficiency of greater than 85% which will identify and confirm extraction of the bacteria with the use of nanoparticles. The outcomes of this research will allow for further analyses to be made in the future use and development of MNP, in terms of optimal capture efficiency as well as in biosensors as bacterial contaminant detectors in all matrices.

### PERFORMANCE EFFECTS OF MYCELIUM IN STORMWATER BIORETENTION SYSTEMS AND GREEN ROOFS

**Katerina Tsou (Michigan State University)**

**Category & Time:** Biosystems and Agricultural Engineering, Section 4, 2:00 PM - 3:00 PM
**Poster:** 95
**Mentor(s):** Rebecca Bender (Biosystems and Agricultural engineering), Dawn Reinhold (Biosystems and Agricultural engineering)

Fungal mycelium grows into a moist, web-like structure which may reduce soil erosion and nutrient export. This research will be testing the hypothesis that mycelium decreases transport and increase the deposition of particles during erosion in stormwater management systems. A total of eight treatments will be prepared; four tubs representing bioretention systems and four trays representing green roofs. Four scenarios will be presented in each system; including no treatment control, grass with hyphae, grass alone and hyphae alone. To quantify the impact of mycelium on the success of stormwater management systems, researchers will be testing turbidity and chemical oxygen demand (COD) by collecting the first flush from the systems. Low turbidity and improved water quality for the samples are expected with grass and hyphae, due to higher water holding capacity and the presence of grass. Initial results indicate that there are no significant statistical differences ($p>0.05$) to support the reduced export hypothesis, perhaps because the treatments were in a laboratory setting. The current experiment will be placing the series outdoors to observe any impact of rainfall energy to soil erosion and nutrient export in stormwater systems colonized by mycelium.

### SUSTAINABLE UTILIZATION OF ANAEROBIC DIGESTION EFFLUENT

**Marc VandenBerg (Michigan State University)**

**Category & Time:** Biosystems and Agricultural Engineering, Section 4, 2:00 PM - 3:00 PM
**Poster:** 96
**Mentor(s):** Wei Liao (Biosystems & Agricultural Engineering), Zhiguo Liu (Biosystems & Agricultural Engineering)

The purpose of this project is to research the use of electrocoagulation (EC) based treatment of anaerobically digested (AD) effluent and the utilization for the value-added product. Anaerobic digestion is an efficient waste treatment that uses microbes to break down organic compounds into biogas ($CH_4$, $CO_2$, etc.) for energy generation. Despite the high efficiency of AD process, its further applications are hampered by the waste products: the liquid effluent, solid fiber residues, and the impurities in biogas. To address these challenges, this project aims to develop a comprehensive process to fully utilize AD effluent. Electrocoagulation is an electrolysis-based technology that has been used to cause the wastewater to coagulate with electricity applied. It is a chemical-free and highly efficient wastewater treatment, and previous study showed that EC is effective in treating diluted AD effluent to get clean solution. Preliminary results indicate that purification of raw biogas could be mutually beneficial in the EC procedure, making the EC-based treatment not only efficient, but also economically sustainable. After treatment, EC water could be used to facilitate bio-refining process of AD fiber, and produce value-added fuel and chemical products. The significance of this research is that by integrating AD and EC processes, organic wastes can be completely recycled and their negative environmental impacts can be greatly alleviated.

**AGE AND RATE AFFECTS THE FRACTURE PATTERNS OF IMMATURE PORCINE FEMURS UNDER TORSIONAL LOADING**
**Patrick Vaughan (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 4, 2:00 PM - 3:00 PM
**Poster:** 97
**Mentor(s):** Roger Haut (Radiology)

In forensics, determining accidental trauma (AT) from non-accidental trauma (NAT) is often a source of debate, as torsion-induced spiral fractures are typically produced in both AT and NAT (or cases of abuse). A study recently proposed a method to help distinguish NAT from AT based on fracture ratio (length of a spiral fracture in a lateral radiograph with respect to bone diameter). The claim is that NAT fractures occur at fracture ratios of approx. 1.6, while AT fractures have a fracture ratio of approx. 2.8 (Murphy et al., 2015). Since NAT fractures are known to more often occur in young victims 1-3 months of age, the objective of the current study is to determine the effect of age on the fracture ratio of long bones under torsional loads. Using infant porcine femurs, results for a low rate of twist(3°s^(-1)) indicate a linear increase from approx. 1.4 at 1 day to approx. 2.3 at 9 days, before leveling off at approx. 1.85 at 10 days of age, from the anterior-posterior view. Increasing the torsional rate(90°s^(-1)) resulted in a linear increase from approx. 2.1 at 1 day to 2.75 at 8 days. Interestingly, the shear modulus and shear strength of the bone directly correlates with this change in fracture ratio, suggesting bone fracture ratios during early stages of infant life, may depend on the degree of bone development/density. Preliminary data suggests that AT may be distinguished from NAT, through age/rate dependent effects of the fracture ratio in pediatric forensic cases.

**PREDICTIVE MICROBIAL PERSISTENCE MODELING AND ANALYSIS OF GROUND WATER AND WELL WATER PATHOGENS**
**Austin Wissler (Michigan State University)**
**Category & Time:** Biosystems and Agricultural Engineering, Section 4, 2:00 PM - 3:00 PM
**Poster:** 98
**Mentor(s):** Jade Mitchell (Biosystems Engineering)

Persistence modeling of microbial pathogens in water is an important tool in human risk analysis. It can help forecast major outbreaks of disease, predict when a water source is safe for human contact, and quantify the natural and human impact on water quality. The data modeled and analyzed is from samples of well-water and ground-water. Samples were tested and concentrations of Poliovirus, Echovirus, and MS-2 Phage were quantified over time. The decay occurred under natural conditions. Using a Maximum Likelihood Estimation, a statistical modeling program in R (The R Foundation; Vienna, Austria), was used to fit and optimize 17 different mathematical models. The models varied by the number of parameters, so Bayesian Information Criterion (BIC) was used to compare the model fits. It was determined that the Juneja and Marks 1, Gamma, and Juneja and Marks 2 models most frequently resulted in a best fit. Most data sets could not be defined by just one model due to a lack of statistical significance; in this case more than one model defined a best fit. Fecal Indicator Bacteria (FIB) are often used to assess water quality, where specific pathogen data is unavailable. Further research will be done to compare these findings to data gathered on FIB and in different environmental conditions to identify parallels between data gathered by different methods.

# CELL BIOLOGY, GENETICS AND GENOMICS

**BARIUM AND ML133 DO NOT SHOW IDENTICAL PHARMACOLOGY IN MURINE EPIGASTRIC ARTERIES**
**Jessica Pettis (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 1, 1:00 PM - 2:00 PM
**Poster:** 101
**Mentor(s):** William Jackson (Pharmacology and Toxicology)

Smooth muscle cells express inward rectifier $K^+$ channels (KIR) that contribute to the regulation of blood flow in skeletal muscle. However, the KIR isoforms that function in murine skeletal muscle feed arteries are not known. Studies in other vessels suggest that KIR 2.1 is the dominant isoform, therefore we hypothesize that the pharmacology of ML133, a selective KIR 2 inhibitor, and $Ba^{2+}$, which blocks KIR 2 as well as other KIR channels, should be similar. SEAs were isolated from the abdominal muscles of >3 months old male C57BL/6 mice and were cannulated and studied by pressure myography (37 °C, 80 cm $H_2O$). We tested our hypothesis by performing cumulative concentration-response experiments for ML133, and $BaCl_2$. Exposure of cannulated SEAs to the KIR 2 inhibitor ML133 caused a maximal constriction of only 13.8±2% (n=6, $p<0.05$) at 30 μM with an approximate $LogEC_{50}$ of -5. However, at higher concentrations (> 30 μM), ML133 caused vasodilation, rather than the expected constriction. In contrast, application of the general KIR blocker, $Ba^{2+}$, produced concentration-dependent constriction with a maximal effect at 1 mM (92.5±5.7% constriction; $LogEC_{50}$=-4.2± 0.07; n=6, $p<0.05$) as expected. Our results show that ML133 is less effective than $Ba^{2+}$ in producing vasoconstriction of SEAs. This lack of efficacy indicates that either ML133 does not effectively block KIR 2 channels in murine SEAs, or that the vasodilator effects of this drug reduce its vasoconstrictor efficacy. Alternatively, $Ba^{2+}$ may be more effective because it is blocking other channels in addition to KIR. Supported by R01 HL086483.

**THE ROLE OF RHO ASSOCIATED PROTEIN KINASE IN 5-HYDROXYTRYPTAMINE STIMULATION OF CACO-2 CELL MIGRATION**
**Akua Acheampong (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 1, 1:00 PM - 2:00 PM
**Poster:** 102
**Mentor(s):** Elahé Crockett (Medicine), Mark Kadrofske (Pediatrics and Human Development), Lizbeth Lockwood (Pediatrics and Human Development)

Background: 5-hydroxytryptamine (5-HT, serotonin) is an important paracrine signaling molecule in the intestine and may regulate epithelial barrier integrity. Recent evidence demonstrates that 5-HT stimulates in-vitro intestinal cell migration by altering Rho-GTPase activity and inducing changes in the actin cytoskeleton. In many cell types, Rho-associated protein kinase (ROCK) is a kinase that acts downstream of Rho-GTPases and regulates movement and morphology through interactions with the actin cytoskeleton. Objective: To determine if ROCK activation is important in the 5-HT stimulation of in-vitro cell migration. Methods: An in-vitro cell migration assay was performed on cultured Caco-2 enterocyte-like cells. Caco-2 cells were cultured in dishes containing a biofilm barrier. The barrier was removed and cells were allowed to migrate for 24-hr. Migration was determined in the presence and absence of 5-HT (100 nM) with and without the ROCK inhibitor Y-27632 (10

nM-10 μM).The cells were imaged and migration area was quantified using NIH Image-J-software. Results: Caco-2 cells have been cultured. In vitro migration assays demonstrate successful cell migration under positive (10% fetal-bovine serum) and negative (serum-free media) control conditions. Further, the optimal concentration of Y-27632 (10μM) has been determined. Conclusions: Data from upcoming experiments should determine whether ROCK activation is part of a signaling cascade linking 5-HT to actin cytoskeleton changes and stimulation of Caco-2 migration. The findings will be valuable in therapeutic development. Support: A.A. is an NHLBI scholar with training and support from an NIH award (5-R25-HL108864-04) to EC, REPID-Program Director.

**ERYTHROPOIETIN AS A BIOMARKER OF EMOTIONAL STRESS**
**Mazyar Aryanfar (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 1, 1:00 PM - 2:00 PM
**Poster:** 103
**Mentor(s):** Elahé Crockett (Medicine), Houria I Hassouna (Medicine)

Introduction: Erythropoietin (EPO) is a 34-kilodalton glycoprotein hormone and a potent regulator of erythropoiesis, which is secreted mainly from the endothelium and interstitial fibroblast of renal tubules. EPO has been known to respond to low oxygen levels in the blood via up-regulation of hypoxic inducible factor-1. Medical students represent a demographic that experiences a significant amount of chronic stress. Gainsbock syndrome is a finding in apparently normal medical students of red packed cell volumes of 54% or greater attributed to emotional stress. From a previous study in our laboratory in 2012, we identified that erythropoietin was elevated and concluded that it functioned outside of erythropoiesis and unrelated to hypoxia. We intend to measure the hormones, known to be elevated in chronic emotional stress, in medical students. Objective: We seek to verify whether EPO is a marker of emotional stress and to investigate the mechanism by which EPO concentrations are elevated in the blood of chronically stressed medical students by comparing levels of hormones known respond to stress with EPO levels. Method: We aim to recruit 50 nonsmoker MSU-medical students to collect blood samples. Cortisol, epinephrine and norepinephrine will be measured and compared to EPO concentration in blood samples. Data will be analyzed by using the SPSS (Version 9.0) statistical software package. Conclusion: The resulting data of this study will verify a role for EPO as a biomarker of emotional stress. Support: M.A. is a REPID scholar, supported by NIH-5-R25-HL108864 award to Elahé Crockett, REPID-Program Director.

**THE EVOLUTIONARY IMPACT OF A PACK-MULE ELEMENT IN TOMATO AND ITS WILD RELATIVES**
**Timothy Batz (California State Polytechnic University Pomona)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 1, 1:00 PM - 2:00 PM
**Poster:** 104
**Mentor(s):** Stefan Cerbin (Horticulture), Ning Jiang (Horticulture)

Transposable elements are an integral and dynamic part of plant genomes. Mutator-like transposable elements called Pack-MULEs are a special group of transposable elements that are capable of duplicating, amplifying and recombining "parental" host gene and gene fragments within the genome. Although Pack-Mules have been identified in most plant species, they are not significantly amplified. However, a Pack-MULE with 50 copies (SlMP37) has been found in the tomato genome, suggesting possible benefits to Solanum lycopersicum and its relatives. SlMP37 contains captured fragments of two parental genes: Argonaute 1(AGO1) and Cytochrome P450 (CYP51). AGO1 codes for an RNA Slicer protein that is an essential component of the RNA-induced silencing complex (RISC) and its function in RNA silencing. CYP51 is an enzyme which is required for sterol biosynthesis in plants and other organisms. To test the effects of SlMP37, several DNA constructs were transformed into S. lycopersium containing a marker gene under the control of the promoter of the parental genes. The portion of the parental genes that has been duplicated by the Pack-MULE was concatenated to the marker gene to test its impact, with the non-duplicated regions as a control. Confirmation of the construct will be determined through Southern blot tests and the expression level of the transgene will be measured via Northern blot tests. A kanamycin probe was used to detect the presence of DNA and RNA complimentary to the constructs. Characterization of the plants was done through phenotyping of tomato fruit yield, weight, and plant height.

**IDENTIFYING NEUROTENSIN RECEPTOR EXPRESSING NEURONS IN THE BRAIN THAT ARE REGULATED VIA LATERAL HYPOTHALAMIC NEUROTENSIN NEURONS**
**Bethany Beekly (Gonzaga University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 1, 1:00 PM - 2:00 PM
**Poster:** 105
**Mentor(s):** Gina Leinninger (Physiology)

Lateral hypothalamic area (LHA) neurons express the neuropeptide neurotensin (Nts) and regulate motivated behaviors via undetermined mechanisms. Nts neurons synapse onto LHA orexin neurons and dopamine-containing neurons in the ventral tegmental area (VTA). We therefore hypothesized that orexin and/or dopamine neurons express Neurotensin Receptor-1 (NtsR1) and/or -2 (NtsR2) and hence can be regulated by Nts. To examine this we studied mice expressing Cre-inducible GFP in NtsR1 or NtsR2 cells, therefore any cells that express NtsR1 and/or NtsR2 during development will express GFP (*NtsR1*$^{Dev\text{-}GFP}$ and *NtsR2*$^{Dev\text{-}GFP}$ mice). Neurons expressing GFP were identified via immunofluorescent microscopy. Additionally the co-expression of orexin and dopamine was determined. Sparse NtsR2 neurons were observed, including some in the VTA that co-expressed dopamine. NtsR1 neurons, however, were numerous and observed in nearly every brain region, including LHA orexin neurons and VTA dopamine neurons. The extensive NtsR1 expression pattern contrasted from previous reports of limited NtsR1 expression in adult mice. A possible explanation for this discrepancy is that NtsR1 is highly expressed during development but is down-regulated in adulthood. To investigate this we studied mice in which Cre expression is blocked until adulthood (*NtsR1*$^{Adult\text{-}GFP}$ and *NtsR2*$^{Adult\text{-}GFP}$ mice). Indeed, *NtsR1*$^{Adult\text{-}GFP}$ mice revealed a limited distribution of NtsR1 neurons similar to that observed in adult brains via *in situ* hybridization. Furthermore, *NtsR1*$^{Adult\text{-}GFP}$ mice revealed that VTA dopamine neurons co-express NtsR1 but LHA orexin neurons do not. Collectively these data suggest that adult VTA dopamine neurons predominantly express NtsR1 and can be regulated via Nts released from LHA Nts neurons.

**FIBRINOGEN ENHANCES IL-4 INDUCTION OF MMP12 GENE EXPRESSION IN MACROPHAGES**
**Marie Brake (Miami University OH)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 1, 1:00 PM - 2:00 PM
**Poster:** 106
**Mentor(s):** James Luyendyk (Pathobiology and Diagnostic Investigation)

Macrophages can heighten inflammatory liver damage or promote liver regeneration and repair after injury has occurred. Polarization of macrophage functions towards a regenerative (i.e., M2) phenotype is caused by extracellular signals such as the cytokine interleukin-4 (IL-4). In tissue injury, macrophages also receive signals from coagulation factors such as fibrin(ogen), which is deposited in clot formation. We tested the hypothesis that a fibrin(ogen) surface modifies M2 gene expression in macrophages treated with IL-4. Bone marrow-derived macrophages were isolated from wild-type C57BL/6J mice and cultured on plates coated with 10 μg/mL fibrin(ogen) or BSA. Cells were treated with 10 ng/mL IL-4 or sterile PBS 2 hours later. IL-4 treatment increased matrix metalloproteinase 12 (MMP-12) mRNA expression, indicating M2 polarization of the macrophages. Fibrin(ogen) alone did not cause any modifications in MMP-12 expression; however, fibrin(ogen) significantly increased MMP-12 mRNA expression in macrophages treated with IL-4. The results indicate that a fibrin(ogen)-coated surface increases the MMP-12 mRNA expression in IL-4 stimulated macrophages. The results suggest that fibrin(ogen) can modify the effects of cytokine signals for macrophage polarization.

### CHARACTERIZATION OF METHYLMERCURY EFFECTS ON GLUTAMATE RECEPTORS IN NSC34 CELLS

**Ninoshka M Caballero Coln (University of Puerto Rico at Humacao)**

**Category & Time:** Cell Biology, Genetics and Genomics, Section 2, 1:00 PM - 2:00 PM
**Poster:** 109
**Mentor(s):** William D Atchison (Pharmacology and Toxicology), Alexandra Coln Rodriguez (Pharmacology and Toxicology)

Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease that ultimately leads to motor neuron degeneration in the central nervous system (CNS). There are two different forms of ALS, familial and sporadic. The latter is the most common form of the disease and makes up more than 90% of the cases. For the majority of ALS cases there is no genetic link, and evidence suggest that a gene-environment interaction may contribute to its development. One factor thought to contribute to the development of ALS is Methylmercury (MeHg), and it is particularly relevant due to its abundance in the environment. This heavy metal leads to motor neuron loss through calcium mediated pathways. Additionally, there is a strong correlation between the mechanisms of toxicity of ALS and MeHg. Previous experiments suggest that ionotropic-glutamate receptors AMPA and NMDA might play a role in Methylmercury's neurotoxicity. The objective of this study is to better understand the effects of MeHg in AMPA and NMDA receptors, specifically how MeHg leads to changes in calcium permeability in motor neurons utilizing mouse neuroblastoma-motor neuron (NCS34) cell line. In order to determine the optimum MeHg concentration for these experiments, NSC34 cells were grown for 48hrs, followed by a 24hr MeHg exposure at different concentrations. After accessing cell viability RNA was isolated and processed by Reverse Transcription PCR and Quantitative Real Time PCR in order to analyze expression of these receptors. We expect to observe an increase in the expression of AMPA and NMDA receptors on cells exposed to MeHg.

### THE EFFECT OF THE NRF2 ACTIVATOR TBHQ ON CD8 T CELL FUNCTION

**Diana Cervantes (Michigan State University)**

**Category & Time:** Cell Biology, Genetics and Genomics, Section 2, 1:00 PM - 2:00 PM
**Poster:** 110
**Mentor(s):** Cheryl Rockwell (Pharmacology and Toxicology)

The transcription factor nuclear factor erythroid 2-related factor 2 (Nrf2) regulates a battery of antioxidant and cell stress genes. It is activated by oxidative stress and various xenobiotics, one of which is tert-butylhydroquinone (tBHQ), a food preservative widely used in foods. Nrf2 has been shown to modulate immune function in several models. Nrf2-null mice have been shown to be more susceptible to sepsis and inflammatory lung injury. Our lab has shown that tBHQ inhibits T cell activation in Jurkat CD4 T-cells and in primary human CD4 T-cells. The purpose of these studies is to determine the effects of tBHQ on mouse CD8 T-cell activation. We hypothesize that tBHQ will inhibit CD8 T-cell function. Splenocytes were isolated from wild-type and Nrf2-null mice, treated with various concentrations of tBHQ (0.001-1 μM) or vehicle (0.001% ethanol), and 30min later activated with antibodies against the T cell receptor and a co-stimulatory receptor. After 24h of incubation, cells were labeled with anti-CD8/FITC and stained with propidium iodide to quantify cell viability by flow cytometry. In addition, expression of CD25 and CD69, markers of T-cell activation, was also measured. We found that higher tBHQ concentrations caused a decrease in cell viability at low cell density, but not at high cell density. A decrease in CD25 and CD69 expression on CD8 T-cells correlated with the decrease in viability. These findings indicate that cell density affects the cell survival of CD8 T cells upon tBHQ exposure. (Work supported by NIH grants ES018885 and R25HL103156-05).

### *DE NOVO* ASSEMBLY AND ANNOTATION OF THE *PLASMOPARA OBDUCENS* GENOME

**Julie Chow (Georgia Institute of Technology)**

**Category & Time:** Cell Biology, Genetics and Genomics, Section 2, 1:00 PM - 2:00 PM
**Poster:** 111
**Mentor(s):** Megan Bowman (Plant Biology), Kevin Childs (Plant Biology)

Downy mildew, a disease caused by oomycete biotroph infection, is characterized by leaf drop and chlorosis in plants such as hops, cucurbits, grapes, and cruciferous vegetables. Oomycetes and pathogenic fungi infect their hosts similarly by developing mycelium to penetrate and absorb nutrients from host tissue. Oomycetes are phylogenetically related to brown algae and diatoms. Unlike fungi, oomycetes are diploid rather than haploid in their vegetative state, have cells walls composed of cellulose rather than chitin, and produce motile zoospores that target particular zones of the host. Decreased agricultural yield associated with downy mildew has promoted interest in the identification of effector genes that aid in oomycete pathogenesis. The oomycete *Plasmopara obducens* infects the genus *Impatiens*, which consists of flowering ornamentals that accounted for more than $75 million in wholesale sales in 2011. We assembled the *P. obducens* genome and transcriptome using the programs Velvet and Trinity and determined the genome size to be approximately 155 Mbp. The N50 of our genome assembly was 18469 bp. We assessed the quality of our assembly by mapping transcriptome reads to our genome assembly, screened for contamination, and quantified genome completeness using the programs BUSCO, CEGMA, and REAPR prior to genome annotation. We used the gene prediction programs SNAP and AUGUSTUS within the MAKER gene annotation pipeline to create high quality annotations supported by transcript and protein evidence.

**OM CELLS IN VITRO: CELL CHARACTERIZATION BEHAVIOR AND CELL MIGRATION OF DIFFERENT CELL LINES IN DISTINCT ECM COMPONENTS**
**Hillary Domenech (University of Puerto Rico at Aguadilla)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 2, 1:00 PM - 2:00 PM
**Poster:** 112
**Mentor(s):** Ethan Dawson-Baglien (Veterinary Teaching Hospital(Ophthalmology Lab)), Simon Petersen-Jones (Small Animal Clinical Sciences)

Ocular melanosis is an autosomal dominant eye condition seen almost exclusively in Cain Terrier dogs. It is characterized by a thickening of the iris root and migration of large, pigment-laden uveal melanocytes to abnormal areas of the eye, such as the sclera and episclera. Despite the novel phenotype, there is no observable difference in behavior between affected melanocytes and unaffected control melanocytes under standard culture conditions. Our hypothesis is that the differences in cell behavior observed in vivo occur as the result of environmental conditions. The experiment attempts to recover the in vivo phenotype by culturing cells in plates treated with different extracellular matrix (ECM) components present in the uvea in order to more closely approximate in vivo conditions. Cells behavior was tested with five different ECM components in both doubling time and scratch assays. The ECM components used in this study were laminin, fibronectin, and collagens type I, III, and IV. Doubling time assays were performed to determine the proliferation rate of cell populations in the presence of different ECM components. We anticipate seeing an increase in the proliferation rate of affected cell lines relative to unaffected cell lines in the presence of ECM components. Scratch assays were performed to measure cell migration by determining the speed with which confluent cell populations move into an empty space. We anticipate increased migration rates in affected cell lines for distinct ECM component.

**CHARACTERIZATION OF PROTEINS LOCALIZED TO PLASMA MEMBRANE-ENDOPLASMIC RETICULUM CONTACT SITES IN ARABIDOPSIS THALIANA**
**Zachary Engfer (The College of Wooster)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 2, 1:00 PM - 2:00 PM
**Poster:** 113
**Mentor(s):** Federica Brandizzi (Plant Research Laboratory Nat Science), Giovanni Stefano (Plant Biology Cns)

Endomembrane systems within eukaryotic cells are diverse in both structure and function, occupying vast roles in a wide variety of physiological pathways. Though interactions between endomembrane organelles are well explored in animal cells, much has yet to be learned about endomembrane organelle interactions within plant cells. Within recent years, researchers have begun analysis on specific proteins that localize to endomembrane contact sites in Arabidopsis thaliana. Several of these proteins have been identified as localizing to plasma membrane-endoplasmic reticulum contact sites. VAP27 and NET3c, for example, have been proposed to play a role in PM-ER anchorage. We have identified two additional proteins that we believe to localize to static PM-ER contact sites (coined immobile punctae): PMER1 and PMER2. As the functions of these proteins in A. thaliana are currently unknown, we have chosen to isolate and identify proteins that have significant interactions with them. This search is currently being conducted by employing two different methods: the first consisting of pull down experiments utilizing the proteins of interest and the second consisting of yeast two hybrid (Y2H) screening. By identifying new proteins that interact with our candidate proteins of interest we hope to gain valuable insight into the factors that influence the formation and function of PM-ER contact sites during plant cell development. This study could help to shed light on the role of PM-ER contact sites in the regulation of cell signaling, ER architecture and function, and PM domain organization.

**ERYTHROPOIETIN ROLE IN EMOTIONAL STRESS**
**Wazhma Frotan (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 3, 2:00 PM - 3:00 PM
**Poster:** 115
**Mentor(s):** Elahé Crockett (Medicine), Houria I Hassouna (Medicine)

Background: Gainsbock syndrome is a finding in apparently normal medical students of red packed cell volumes of 54% or greater attributed to emotional stress. After informed consent we evaluated in male and female medical students the mechanism for the previously reported elevation in red cell counts. EPO, the crucial regulator and primary effector of erythrocyte synthesis responds to low oxygen levels in the blood by up regulation of hypoxic inducible factor-1. We elucidated whether elevations in red cell count are attributable to erythropoietin (EPO) induced erythropoiesis, or to contracted plasma volume. Our results showed EPO to be paradoxically elevated independent from its normal function suggesting that in at least a portion of chronically stressed medical students mechanisms outside of hypoxia induce the expression of EPO. Objective: Investigate the mechanism by which EPO concentrations are elevated in the blood of chronically stressed medical students by comparing levels of hormones known respond to stress with erythropoietin levels. Methods and Results: After IRB approval we recruit 50 medical students from CHM. Concentrations of cortisol, epinephrine and norepinephrine, hormones are elevated in chronic emotional stress and results will be compared to erythropoietin and to results of a metabolic panel, complete blood count and soluble transferrin receptors. Increasing evidence suggests several biological roles for EPO outside of erythropoiesis including possible alterations to the renin-angiotensin-aldosterone system. Additionally EPO can have protective effects on tissue immunity as well as enhance recovery from cellular injury. We expect to confirm a role for erythropoietin in emotional stress. Support: W.F. is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**IDENTIFYING NEUROTENSIN-CONTAINING NEURONS IN THE HYPOTHALAMUS THAT REGULATE BODY WEIGHT**
**Ryan Furdock (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 3, 2:00 PM - 3:00 PM
**Poster:** 116
**Mentor(s):** Raluca Bugescu (Physiology), Gizem Kurt (Cell and Molecular Biology), Gina Leinninger (Physiology)

The hypothalamus is essential for regulating body weight, but it remains unclear how specific populations of hypothalamic neurons modify weight. In this study we examined the distribution of neurotensin (Nts)-containing neurons throughout the hypothalamus and their response to the weight-reducing hormone leptin. Nts is a neuropeptide implicated in control of body weight, and previous studies suggest that leptin regulates Nts neurons to suppress feeding and promote weight loss. We therefore hypothesized that there are Nts neurons within the hypothalamus that are leptin-responsive. To examine this, we utilized mice that express green fluorescent protein (GFP) selectively within Nts-

containing cells, permitting their detection via immunofluorescent microscopy. Analysis of brains from these mice revealed a large population of Nts neurons in the lateral hypothalamic area (LHA), as well as in the adjacent subthalamic nucleus. We also identified smaller populations of Nts neurons within the premammillary nucleus and the arcuate nucleus of the hypothalamus. Minimal Nts neurons were found within the median eminence, ventromedial or dorsomedial hypothalamus. These data suggested that the LHA is the predominant site of Nts neurons within the hypothalamus. Next we examined which populations of hypothalamic Nts neurons are regulated by leptin via co-immunofluorescent microscopy for phosphorylated STAT-3, a marker of leptin-activated cells. The LHA contained many leptin-responsive Nts neurons, but few such neurons were observed in other hypothalamic regions. Collectively, these data reveal that the LHA is the predominant site of hypothalamic Nts neurons, and that they mediate leptin action to modify body weight.

**IDENTIFYING FOREBRAIN NEUROTENSIN NEURONS THAT REGULATE MOTIVATED BEHAVIORS**
**Angela Garcia (St Mary's University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 3, 2:00 PM - 3:00 PM
**Poster:** 117
**Mentor(s):** Juliette Brown (Physiology), Gina Leinninger (Physiology)

The neuropeptide neurotensin (Nts) modulates locomotor activity and reward intake, but the Nts neurons mediating these behaviors have yet to be defined. The forebrain is a likely site for Nts action, since forebrain sub-regions mediate distinct motivated behaviors. For example, the dorsal striatum regulates goal-directed movement, the ventral striatum modulates reward liking and wanting, and the prefrontal cortex governs decision-making. We therefore hypothesized that Nts is expressed in specific forebrain sub-regions, via which Nts modifies motivated behaviors. Visualization of Nts neurons was previously deterred by a lack of reliable immunohistochemical reagents. To overcome this obstacle, we crossed mice that express Cre recombinase in Nts neurons onto a Cre-inducible green fluorescent protein (GFP) reporter strain, so that GFP is expressed in all Nts neurons (*Nts$^{GFP}$* mice). Forebrains from *Nts$^{GFP}$* mice were analyzed via immunofluorescent micrsocopy for GFP, enabling us to map the populations of Nts$^{GFP}$-expressing neurons. Many Nts$^{GFP}$ neurons were observed in the ventral striatum, particularly within the olfactory tubercle and the nucleus accumbens. Nts$^{GFP}$ neurons were also observed in the adjacent interstitial nucleus of the posterior limb of the anterior commissure (IPAC), a structure that bridges the amygdala and striatum, and may thus link emotionality and motivated behavior. Some Nts$^{GFP}$ neurons were also found within the prefrontal cortex. By contrast, few Nts$^{GFP}$ neurons were found within the dorsal striatum. Taken together, these data reveal that there are Nts neurons within the ventral striatum and prefrontal cortex, and suggest neural mechanisms by which Nts could modify motivated behaviors and decision-making.

**CHARACTERIZATION OF LIGHT INDUCED TRANSCRIPTION IN NANNOCHLOROPSIS OCEANICA**
**Sofia Gonzalez Martinez (University of Puerto Rico Mayagez)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 3, 2:00 PM - 3:00 PM
**Poster:** 118
**Mentor(s):** Eric Poliner (Cell and Molecular Biology)

RATIONALE: Nannochloropsis oceanica is a microalgae that contains large quantities of eicosapentaenoic acid (EPA). EPA is a polyunsaturated fatty acid that is synthesized by the desaturation and elongation of fatty acyl chains. Five desaturases are involved in this pathway, each adding a single double bond in the Δ9-, Δ12-, Δ6-, Δ5-, or ω3- positions. Based on RNA-Seq. measurements, the EPA biosynthetic pathway is strongly coexpressed through light:dark cycles and induced by blue light. Nannochloropsis contains four putative blue light photoreceptors: three Aureochromes and one cryptochrome. An aureochrome has been identified as having possible transcriptional activation activity, which leads us to hypothesize that blue light transcriptionally activates the EPA pathway by the action of an aureochrome receptor. METHODS: Wild type Nannochloropsis cultures were induced with different light qualities (blue, red, and white light) of equal intensity and the relative gene expression of the EPA biosynthetic pathway genes (RT-qPCR) and fatty acid profile measured (Gas Chromatography Flame Ionization Detector). Yeast 1 Hybrid assays will be used to observe the interaction between the aureochromes and the EPA biosynthetic genes' promoter sequences. RESULTS: RT-qPCR preliminary results have shown that the relative gene expression of the desaturases and the aureochromes genes were higher under blue light induction. CONCLUSIONS: Blue light could activate transcription of the EPA pathway in Nannochloropsis by stimulating the blue light photoreceptor, aureochrome. FUNDING: Dr. Eva Farre and Plant Genomics at MSU.

**A SEARCH FOR THE GENE THAT CAUSES INHERITED BLINDNESS IN WHIPPET DOG BREED**
**Courtney Jackson (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 3, 2:00 PM - 3:00 PM
**Poster:** 119
**Mentor(s):** Patrick Venta (Microbiology & Molecular Genetics CVM)

Progressive retinal atrophy (PRA) is a heritable blinding disorder of dogs. The disorder is often inherited as a recessive gene and different genes may underlie PRA in different breeds. Identification of the mutations in a given breed allows the development of a diagnostic test, which a breeder can use to remove the mutation from a kennel by selective breeding. The homologous disorder in humans, a significant health concern, is called retinitis pigmentosa (RP) and dogs serve as a model for the human condition. Recently, DNA samples from PRA affected Whippets have been accumulated by the Peterson-Jones lab. I will test the hypothesis that one of the ten known RP genes underlies Whippet PRA. Genetic markers called microsatellites near each of these genes will be used to test the hypothesis using a process called the exclusion analysis. Genetic exclusion analysis is analogous to exclusion cases of paternity testing, in which alleles from genetic markers do not match expectations for the hypothesized culprit. These markers will be examined simultaneously by multiplex polymerase chain reaction (PCR). Multiplexing requires optimization of the PCR conditions but this results in a net savings on reagent costs and operator time. The multiplexed PCR conditions for the ten genes will then allow these genes to be examined in other breeds with PRA-affected dogs as well. The information discovered by the research will be effective in helping guide gene therapy treatments for blindness in dogs and humans alike.

**DLK1 IDENTIFIES A SPECIFIC SUBSET OF OREXIN NEURONS IN THE BRAIN**
**Jaylyn Kelly (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 4, 2:00 PM - 3:00 PM
**Poster:** 121
**Mentor(s):** Raluca Bugescu (Physiology), Gina Leinninger (Physiology)

Neurons containing the neuropeptide Orexin/Hypocretin (OX) are crucial regulators of feeding and alertness, such that loss of OX neurons causes narcolepsy, obesity and diabetes. Previous studies suggest that there are two distinct subpopulations of OX neurons that separately regulate alertness and feeding. Indeed, some OX neurons are activated during fasting, but other OX neurons are activated to promote waking. Much effort has therefore been devoted to identifying a protein "marker" that could be used to differentiate between the "feeding" and "alertness" OX populations. Recently the protein Delta-like 1 homologue/Preadipocyte Factor-1 (DLK1) was reported in OX neurons, and we hypothesized that DLK-1 might identify a functional subset of OX neurons. To examine this, we used immunofluorescent microscopy to simultaneously identify DLK-1 and OX-containing neurons in the brains of mice. Approximately half of all OX neurons co-express DLK-1: we refer to these the $OX^{DLK-1}$- specific subpopulation of OX neurons. To determine whether $OX^{DLK-1}$-expressing neurons are implicated in feeding control we are examining the activation state of $OX^{DLK-1}$ neurons in fed and fasted mice. Additionally, we are determining whether feeding state regulates gene expression of DLK-1 and OX. To date, our data identify DLK-1 as a protein marker that can be used to distinguish OX subpopulations in the brain. Determining whether feeding status regulates $OX^{DLK-1}$ neurons will establish the framework for how this specific neuronal population contributes to OX-mediated control of alertness and feeding.

**ROLE OF SCHLAFEN-12 AND PSMD-10 PROTEINS IN INTESTINAL MUCOSA DIFFERENTIATION**
**Amanda Laryea (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 4, 2:00 PM - 3:00 PM
**Poster:** 122
**Mentor(s):** Marc Basson (Medicine), Elahé Crockett (Medicine)

The Schlafen superfamily of proteins has been implicated in differentiation, tumorigenesis and apoptosis in hematopoietic and epithelial cells. Preliminary results from our lab have identified human Schlafen-12 as the ortholog of rodent Schlafen-3 and suggest that Schlafen 12 may modulate prostate cancer and enterocytic cell differentiation. Schlafen-12 increases expression of differentiation markers in Caco-2 cells which express several morphological and functional characteristics of mature enterocytes, but its mode of action remains unknown. We hypothesized that Schlafen 12 might act at least in part by modulating proteasomal activity and tested this hypothesis using PSMD-10, a regulatory component of the 26S proteasome, required for ubiquitin-dependent protein degradation. PSMD-10 activates the proteasome. Objectives: In order to eventually determine whether Schlafen-12 and PSMD-10 have opposite effects on Caco2 cell differentiation, we now sought to optimize the effects of viral overexpression of PSMD-10 in Caco-2 cells. Method/Results: Increasing doses of an adenoviral PSMD-10 construct were used to infect Caco-2 cells and PSMD-10 protein levels were assessed by Western blot assay. Conclusion: Adenoviral transient overexpression of PSMD-10 is feasible in Caco-2 cells and may be used as a probe to evaluate the effects of activating the proteasome on Schlafen 12 activity. Support: Amanda Laryea is an NHLBI scholar, supported by NIH-5-R25-HL108864 award to Elahé Crockett, REPID-Program Director.

**THE PHARMACOLOGY OF INWARD RECTIFYING $K^+$ CHANNELS IN MURINE RESISTANCE ARTERY SMOOTH MUSCLE CELLS**
**Brendan Mullan (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 4, 2:00 PM - 3:00 PM
**Poster:** 123
**Mentor(s):** William Jackson (Pharmacology and Toxicology)

Inward rectifier $K^+$ channels (KIR) importantly contribute to the regulation of skeletal muscle blood flow. Barium has been the primary antagonist used to study the function of KIR. Recently ML 133 has been discovered to be a selective inhibitor of KIR 2.X, however, its pharmacology in smooth muscle cells (SMCs) has not been examined. The purpose of the present investigation was to establish a protocol to study the pharmacology of KIR in SMCs. Superior epigastric arteries (SEAs) were dissected from abdominal muscles of male (Y; >3 mo) C57BL/6 mice and enzymatically dissociated to yield SMCs for whole-cell patch clamp recording. Cells were held at -60mV, then stepped to -120mV followed by a 100ms voltage ramp to 0mV and membrane current measured. Elevation of extracellular K+ from 5mM $K^+$ to 60mM $K^+$, to activate KIR, increased holding current from -41.56 ± 6.85pA to -52.45 ± 6.93pA (n=5, $p<0.05$) and subsequent exposure to 100mM $Ba^{2+}$, eliminated this increase, reducing holding current to -37.27 ± 6.161pA (n=5, $p>0.05$ vs. 5mM $K^+$). Similarly, raising extracellular K+ from 5mM $K^+$ to 60mM $K^+$, increased whole cell conductance from 0.6046 ± 0.01pA/mV to 0.8495 ± 0.12pA/mV (n=5, $p<0.01$) and subsequent exposure to 100mM $Ba^{2+}$, eliminated this increase, reducing whole cell conductance to 0.6018 ± 0.01pA/mV (n=5, $p>0.05$ vs. 5mM $K^+$). These data confirm that SEA SMCs express functional KIR that can be inhibited by $Ba^{2+}$ and establish a protocol that will be used to study the pharmacology of ML 133. Supported by R01 HL 086483.

**INTROGRESSED NETWORKS OF GENETIC INTERACTIONS: AN EMPIRICAL STUDY USING NATURAL MOUSE POPULATIONS**
**Giang Nguyen (Grinnell College)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 4, 2:00 PM - 3:00 PM
**Poster:** 124
**Mentor(s):** Kevin Liu (Computer Science and Engineering)

Gene flow between populations can explain many important adaptive phenomena observed across a wide variety of organisms, such as poison resistance in mice and pesticide resistance in weeds. In particular, the *Vkorc1* gene associated with warfarin resistance, as well as genetic regions enriched for olfactory receptor functions, has been shown by Liu et al. (2015) to have been introgressed from *Mus spretus* into some *M. musculus domesticus* populations. Genes also interact in complex networks – the samples from which Liu et al. found introgressed genes also show evidence for introgression from a more ancient hybridization event, which the researchers had hypothesized could include some "driver genes" that maintain introgressed regions. Using a sliding window approach to the D-statistic method, which is sensitive to ancient admixture, we investigate clusters of genes that are related and also introgressed together, including potential hypothesized "driver genes" like *Vkorc1*. Our findings may illuminate important mechanisms of gene flow that are not yet well understood.

**THE EFFECTS OF TRICHLOROETHYLENE ON THE ENTERIC NERVOUS SYSTEM**
**Anne Ojo (St Mary's University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 4, 2:00 PM - 3:00 PM
**Poster:** 125
**Mentor(s):** Brian Gulbransen (Physiology)

Trichloroethylene (TCE) is a nonflammable, colorless liquid commonly used as a solvent to remove grease from metal and textiles. TCE is thought to contribute to health defects such as cancers, hearing and vision loss, liver problems, neurological problems, and more. However, there is a lack of research into the effects of TCE on the Enteric Nervous System (ENS). The ganglionated ENS, primarily composed of neurons and enteric glial cells, controls gut function. We hypothesize that mice treated with TCE will show a decrease in neuronal density, which will be an indicator of inflammation. We also hypothesize that mice with disrupted Transforming Growth Factor Beta II (TGFBII) signaling will have increased inflammation and a worsen response to TCE. 16 Wild Type (WT) mice and 16 Transforming Growth Factor Beta II (TGFBII) dominant negative knockdown mice were used. The TGFBII dominant negative knockdown mice were used as a model of inflammation. In each type, (WT or TGFBII) there was an equal amount of male and female mice. Within each mice type and gender, 4 were treated with an emulsant vehicle and 4 were treated with TCE. An immunohistochemistry was performed on the colons dissected from the animals in each treatment group to assess changes in neuronal density and immune markers. Preliminary findings show that there is a difference in neuronal density between WT and TGFBII mice. Additional analysis will highlight changes in the inflammatory and immune response in WT and TGFBII mice when exposed to the chemical irritant TCE.

**SUSCEPTIBILITY OF MOTOR NEURON CELL LINE NSC34 IN METHYLMERCURY INDUCED TOXICITY**
**Lizbeth Perez-Castro (University of Puerto Rico at Cayey)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 5, 3:00 PM - 4:00 PM
**Poster:** 128
**Mentor(s):** Duanghathai Wiwatratana (Pharmacology and Toxicology)

Methylmercury (MeHg) is an environmental toxicant that can lead to various symptoms including motor dysfunction and peripheral vision loss. Pathological mechanisms by which MeHg induces toxicity include perturbation of membrane receptor functions, intracellular calcium homeostasis, mitochondrial function and synaptic transmission. This multi-cascade pathology leads to an increase in reactive oxygen species (ROS) formation that induces neurodegeneration. In this study NSC34, a cell line of motor neurons, was used to test the susceptibility of MeHg induced toxicity. Cell viability was determined by Trypan Blue and Acridine Orange (AO) & Propiduim Iodine (PI) after 24 hour exposure to 0, 1, 2, and 5μM MeHg. Mitochondrial membrane potential change ($\Delta\psi m$) was determined by 5,5',6,6'-tetrachloro-1,1',3,3'-tetraethylbenzimidazolylcarbocyanine iodide (JC-1) staining with Flow Cytometer. A change in $\Delta\psi m$ serves as an indicator of cell death. The cell viability assay revealed that MeHg induced cytotoxicity is concentration dependent, showing a significant lower percent viability with 2μM and 5μM MeHg treatments compared to controls. $\Delta\psi m$ study demonstrated a significantly compromised mitochondrial membrane potential when exposed to 2μM MeHg, while at 5μM exposure showed an increase in cell death. This study supports the viability data at 2 and 5μM MeHg concentrations demonstrating the induced MeHg toxicity to the motor neuron cell line. The obtained results implicate that motor neuron are susceptible to MeHg induced-toxicity partially due to MeHg impaired mitochondrial membrane potential leading to cell death.

**GLUCOSE CONSUMPTION AND CASPASE-1 ACTIVATION**
**Laila Abdallah (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 5, 3:00 PM - 4:00 PM
**Poster:** 129
**Mentor(s):** Elahé Crockett (Medicine), Susanne Mohr (Physiology)

Caspase-1 activation is known to be a key mediator for inflammatory responses and is involved in cell death. Recent studies show that there is increased caspase-1 activity in the retinas of diabetic mice and diabetic patients and that this caspase-1 activity plays a crucial role in the development of diabetic retinopathy, a major diabetic complication leading to blindness. Therefore, prevention of caspase-1 activation seems to be a possible therapeutic strategy for treatment of diabetic retinopathy. We need to identify the primary activator(s) of caspase-1 in order to prevent caspase-1 activation. A potential strategy would be the inhibition of GLUT 1, a major glucose transporter between blood and the retina. Müller cells are retinal glial cells that have been identified as a source of active caspase-1 in diabetic retinopathy and major glucose utilizing retinal cell type. Therefore, Müller cells were treated with normal (5mM) and high (25mM) glucose media and caspase-1 activity was measured using a caspase-1 specific fluorescent substrate (YVAD-AFC; 2.5μM). Caspase-1 activity significantly increased from 54.59 pmol AFC/ mg/min in normal glucose media to 65.399 pmol AFC/ mg/min when treated in 25 mM high glucose media confirming that hyperglycemia induces caspase-1 activity in Müller cells. Further studies have to identify the role of GLUT1 in this process. Our preliminary data indicate that elevated glucose level drive chronic inflammation seen in diabetic retinopathy. Drugs targeting glucose flux might potentially be beneficial to curb retinal inflammation. Support: L.A. is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**INCREASED GENE EXPRESSION FOR THE INCREASED PRODUCTION OF MIXED LINKAGE GUCANS**
**Donna Pilarski (Calvin College)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 5, 3:00 PM - 4:00 PM
**Poster:** 130
**Mentor(s):** Sang-Jin Kim (Plant Biology)

Mixed linkage glucan (MLG) is a type of hemicellulose only produced in grass. To improve plants for bioenergy production, we are aiming to increase the amount of MLG in plants. CSLF6, an enzyme synthesizing MLG has been identified to be localized at Golgi. An attempt to find protein complexes containing CSLF6 has identified several coat proteins involved in ER to Golgi trafficking as well as sucrose synthase. Accordingly, the putative coat proteins binding domain has been identified in CSLF6. Here, we are testing the interaction between coat proteins and CSLF6 using yeast two hybrid method to investigate whether the coat protein binding domain is essential for the Golgi localization of CSLF6. The genes coding coat proteins and CSLF6 are amplified using PCR and cloned into the vector for yeast two hybrid experiments. Also, three sucrose synthases are also cloned to express in tobacco. We will investigate whether coexpression of sucrose synthase could improve MLG production as well.

**THE EFFECT OF CALCIUM ON THE HOMEOSTASIS OF PURKINJE NEURONS IN A MOUSE MODEL OF SPINOCEREBELLAR ATAXIA TYPE 1**
**Sagar Rathod (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 5, 3:00 PM - 4:00 PM
**Poster:** 131
**Mentor(s):** Ravi Chopra (University of Michigan: Neurology), Vikram Shakkotai (University of Michigan: Neurology)

Spinocerebellar Ataxia Type 1 (SCA1) is one of nine inherited neurodegenerative diseases caused by the expansion of a CAG trinucleotide repeat encoding a polyglutamine tract. The pathogenesis of the disease is not well understood. The expansion of the CAG trinucleotide repeat causes the degeneration of Purkinje Neurons (PN) in the cerebellar cortex within the brainstem. PN send inhibitory projections to the deep cerebellar nuclei, and constitute the sole output of all motor coordination in the cerebellar cortex. The inositol-1,4,5-triphosphate type 1 receptor (Itpr1) and T-type, voltage-gated calcium channel (Cacna1g) are major intracellular Ca2+-release channel in PN. Calcium-activated potassium channel (Kcnma1) is an intracellular K+-release channel in PN. Past research used Northern Blots and Immunohistochemical staining to illustrate the difference in gene expression of certain genes in PN. To determine the precise correlation between the dysfunction of the genes and the degeneration of PN, the expression of Itpr1, Cacna1g, and Kcnma1 in 2-week-old and 6-month-old Wild-Type (A02) and Mutant (B05) SCA1 mice was measured using qRT-PCR and analyzed using T-Tests. There was no significant change in gene expression between 2-week-old A02 and B05 mice. However, there was significant change in gene expression between 6-month-old A02 and B05 mice. In conclusion, Itpr1, Cacna1g, and Kcnma1 expression significantly declines as mice with SCA1 age. The degeneration of Purkinje neurons may be directly related to the decrease expression of genes. Currently, Western Blot analysis is being done to discover significant proteins connected to the genes to gain insight into SCA1 pathogenesis.

**PHENOTYPE EXPRESSION OF THE TRANSCRIPTION FACTOR FLRA IN ESCHERICHIA COLI**
**Christopher Rhoades (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 5, 3:00 PM - 4:00 PM
**Poster:** 132
**Mentor(s):** Geoffrey Severin (Biochemistry and Molecular Biology), Christopher Waters (Microbiology and Molecular Genetics)

The ubiquitous bacterial second messenger cyclic-di-GMP has been linked to biofilms, motility, and virulence of bacteria. While these expressed phenotypes are well observed, it's unknown how on a molecular level these phenotypes are regulated. The transcription factor FlrA regulates Vibrio Cholera flagella expression and its binding to cyclic di-GMP inhibits this expression. However, it remains unknown whether FlrA regulates other phenotypes. We predict that FlrA may regulate some phenotype in the Vibrio Cholera genome, and to search for possible regulated genes, we generated a DNA promoter library from the Vibrio Cholera genome. These promoter sequences are contained in plasmids that have the capability to emit light via the lux operon. Escherichia Coli containing this library are conjugated with a second strain of Escherichia Coli containing an arabinose inducible over expression vector that carries FlrA. The resulting progeny have both plasmids, allowing for individual clones, which theoretically contain unique promoter sequences, to be examined for differential luminescence upon induction of FlrA We hypothesize that if FlrA is strongly interacting with a specific promoter sequence, resulting in greater transcription of the lux operon, then higher levels of light production will be expressed. The emitted light levels are measured via luminosity to determine if there is a significant change in emissions between the induced and un-induced populations. Student's T-test will be conducted to determine if light reading changes are significant. By determining other possible phenotypes associated with FlrA activity, we'll be able to better characterize the molecular pathway of cyclic-di-GMP.

**EFFECT OF MEHG IN CORTICAL ASTROCYTES AFTER 3 HOUR EXPOSURE**
**Joheyrie Rios Arce (University of Puerto Rico-Arecibo)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 6, 3:00 PM - 4:00 PM
**Poster:** 134
**Mentor(s):** Dr William Atchison (Pharmacology and Toxicology)

Methylmercury (MeHg) is a highly potent neurotoxicant, which targets the central nervous system. It has been found that MeHg produces neurotoxicity in astrocytes, an essential cell in charge of neuronal activity modulation. However, the immediate and delayed effects of MeHg induced neurotoxicity in cortical astrocytes still unknown. In order to perform the experiments, primary astrocyte cultures from the cortical layer of mice were exposed for 3hrs to 0μM, 1μM, 2μM, and 5μM MeHg. Cell viability was measured via cytotoxicity assay using ethidium homodimer (EthD)-1 and calcein acetoxymethylester (calcein AM). The mean percentages of cell death immediate after MeHg exposure were 0.21%, 5.66%, 17.35% and 25.56% at 0 μM ,1 μM, 2 μM and 5 μM respectively. The mean percentages of cell death 24hrs after MeHg exposure were 0.76%, 2.51%, 17.71% and 66.30% at each of these concentrations, respectively. There was a significant difference at 5 μM MeHg when immediate and delayed exposure of MeHg were compared. Thus, whereas immediate exposure of MeHg produces significant astrocyte death, the delayed exposure of MeHg produced more severe damage to these cells. The effects of MeHg-toxicity in difference concentrations lead to cell death.

**INITIAL CHARACTERIZATION OF THE INTERLEUKIN-1 RECEPTOR (IL-1R1) KNOCKOUT RAT FOR USE AS A MODEL TO STUDY THE INFLAMMATORY-BASIS OF TCDD-MEDIATED HEPATOTOXICITY**
**Kimberly A. Rivera-Caraballo (University of Puerto Rico Humacao)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 6, 3:00 PM - 4:00 PM
**Poster:** 135
**Mentor(s):** Norbert Kaminski (CIT), Ashwini Phadnis-Moghe (CIT)

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) is a halogenated aromatic hydrocarbon highly resistant to degradation. It is produced primarily as a by-product of incomplete combustion of fossil fuels and solid waste incineration. TCDD is known to cause hepatotoxicity, wherein hepatocellular necrosis leading to liver carcinogenesis is observed. However, the basis of TCDD-mediated hepatotoxicity is less understood. To investigate whether inflammation is the basis of liver toxicity mediated by TCDD, a rat model lacking the receptors for pro-inflammatory cytokines, specifically Interleukin-1 (IL-1R1) and Tumor Necrosis Factor (TNFR-1 and TNFR-2) was designed. Prior to studying the effects of TCDD in the knockout (KO) rats, a systematic characterization of IL-1R1 KO rat will be performed. The first part of this project will confirm the mutation in IL-1R1 using genotyping and sequencing. mRNA and protein measurements will be performed to verify levels of expression of IL-1R1

in Wild Type (WT) and KO rats. In addition, the blockage of the signaling pathway downstream of IL-1R1 in the KO rats in comparison to WT rats will be verified using recombinant rat 1L-1 cytokines. It is expected that IL1-induced signaling will be blocked in the ILIR1 KO rats thus confirming loss of receptor function. Finally, flow cytometry will be used to evaluate differences in the subpopulations of leukocytes such as B- and T-lymphocytes, NK cells, macrophages and dendritic cells within the spleen and liver. Overall, this project will provide an insight of the leukocyte composition of IL-1R1 KO rats and offer an initial characterization of the KO rat model.

**CHARACTERIZATION OF ROOT-ASSOCIATED BACTERIA IN *TRIFOLIUM***
**Nayeli Sanchez (Eastern Michigan University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 6, 3:00 PM - 4:00 PM
**Poster:** 136
**Mentor(s):** Colleen Friel (Plant Biology), Maren Friesen (Plant Biology)

Interactions between plants and beneficial soil microbes are important for plant fitness. One such interaction is the well-studied symbiosis between legumes and *Rhizobia*, proteobacteria that fix atmospheric nitrogen in exchange for photosynthetically fixed carbon. Preliminary research has suggested that soil microbes such as endophytes and root-associated bacteria may influence the colonization process of *Rhizobia* and may help them more effectively form nodules. Bacteria communicate with legumes through chemical exudates that are significant to nutrient acquisition, defense and metabolism. Past studies have demonstrated bacterial isolates that are hypothesized to possess nitrogen fixation ability. To investigate this hypothesis, non-*Rhizobia* microorganisms were isolated from the nodules, root compartments and the surrounding rhizospheres of various *Trifolium* species growing at the Bodega Bay ecological research site in California. Polymerase Chain Reaction (PCR) will be used to test for nitrogen fixation ability and the presence of 1-aminocyclopropane-1-carboxylate (ACC) deaminase. The Salkowski test will be used to explore whether the selected strains produce indole-3-acetic acid (IAA), a compound that regulates factors associated with plant growth and abiotic stress response. Root exudate biochemical data will be collected and analyzed using gas chromatography/mass spectrometry. Additionally, 16S sequencing will be used to identify the isolated strains for future research. This research may provide insight on plant-microbe coevolution in North America and will help us better understand the microbial community of the rhizosphere of legumes.

**NRF2 TRANSCRIPTION FACTOR SUPPRESSIVE EFFECTS ON INFLAMMATORY CYTOKINE EXPRESSION IN PEYER'S PATCH T CELLS**
**Zachary Sokolowski (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 6, 3:00 PM - 4:00 PM
**Poster:** 137
**Mentor(s):** Brian Harvey (Pharmacology/Toxicology), Cheryl Rockwell (Pharmacology/Toxicology)

Peyer's patches are small, organized areas of secondary lymphoid tissue located along the intestines, which play an important role in early detection of ingested pathogens. Nuclear erythroid 2 related factor 2 (Nrf2) is a transcription factor activated by cell stress. Although largely recognized as being anti-inflammatory, the role of Nrf2 in activated T cells is not yet fully characterized. We have recently shown that murine CD4+ T cells treated with tBHQ, a food additive and common Nrf2 activator, skews CD4+ T cell differentiation toward a Th2 phenotype, which may increase susceptibility to allergy. Furthermore, female Nrf2-null mice develop an autoimmune disease similar to lupus, suggesting a role for Nrf2 in regulating immune cell function. The purpose of the current studies was to characterize cytokine induction in activated T cells from Peyer's patches in wild-type and Nrf2-null mice. T Cells, from wild-type or Nrf2-null mice, were isolated, activated with Concanavalin A (ConA), and cultured for 72 hours. Cell supernatants were then collected and the cytokines, IL-2 and IFNγ, were quantified by high sensitivity ELISA. Preliminary data suggest Nrf2 may have a suppressive effect on IFN$_\gamma$ expression in T cells and an activating effect on IL-2 expression, as activated T cells from Peyer's patches from mice lacking Nrf2 showed a greater increase in expression of IFN$_\gamma$ and reduced expression of IL-2 than wild-type. More studies must be done to fully characterize the role of Nrf2 in activation of T cells from Peyer's patches. This work supported by NIH grants ES018885 and ES007255.

**EXPRESSION OF T-TYPE $CA^{2+}$ CHANNELS IN MURINE SUPERIOR EPIGASTRIC ARTERIES (SEAS)**
**Sumira Stein (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 6, 3:00 PM - 4:00 PM
**Poster:** 138
**Mentor(s):** Elahé Crockett (Medicine), William Jackson (Pharmacology & Toxicology Department)

Calcium entry through voltage-gated $Ca^{2+}$ channels importantly contributes to the regulation of myogenic tone. Studies in other resistance arteries suggest that T-type channels may provide a source of activator $Ca^{2+}$ in pressure-induced myogenic tone, while other studies suggest that T-type channels contribute to the negative-feedback regulation of myogenic tone by controlling the activity of $Ca^{2+}$-activated $K^+$ channels. However, the expression and function of T-type $Ca^{2+}$ channels has not been studied in murine superior epigastric arteries (SEAs). Therefore, the purpose of the present study was to test the hypothesis that in addition to L-type $Ca^{2+}$ channels, SEAs express T-type channels. SEAs were isolated from the abdominal muscles of adult male C57BL/6 mice, mRNA was extracted using TRIzol® Reagent and mRNA levels were preamplified for 10 cycles and quantitated using real-time quantitative PCR (RTqPCR) using commercially available TaqMan® primers. We found that SEAs expressed transcripts for CACNA1C ($Ca_v$1.2 L-Type), CACNA1G ($Ca_v$3.1 T-Type), and CACNA1H ($Ca_v$3.2 T-Type) channels. These data support the hypothesis that SEAs express T-Type $Ca^{2+}$ channels that may contribute to the regulation of myogenic tone. Support: Sumira Stein is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**RNAI TARGETED TO THE DROSOPHILA MELANOGASTER GENE MARY SHELLEY RESULTS IN TEMPERATURE DEPENDENT PHENOTYPIC ALTERATIONS**
**Chelsea Watkins (University of Detroit Mercy), Kevin Begic (U of D Jesuit High School), Joseph Samona (University of Detroit Mercy)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 7, 3:00 PM - 4:00 PM
**Poster:** 140
**Mentor(s):** Jacob Kagey (University of Detroit Mercy: Biology)

We have utilized the Gal4/UAS system to target and RNAi construct against the Drosophila melanogaster Mary Shelley (MS). MS is the homolog of the human gene CABLES-1, which has been shown to be frequently down regulated in ovarian and other types of cancer. We observe loss of

viability when using a ubiquitous Gal4 driver to express MS RNAi ($MS^{IR}$). Using a driver for the posterior compartment of the wing results in a temperature dependent alteration of size and wing architecture. Utilizing molecular staining, we have demonstrated that a portion of this change is due to cells dying via apoptosis. In the adult eye, we only observe minor phenotypic changes when driving $MS^{IR}$ in differentiated eye tissue, suggesting that the phenotypes associated with loss of MS may be context dependent. Understanding the molecular changes that company these phenotypes may be helpful to identify pathways altered in human cancers that have CABLES1 down regulation.

**CHRONIC EFFECTS OF TETRAHYDROCANNABINOL ON NEUROGENESIS AND CELL DIFFERENTIATION IN THE DENTATE GYRUS OF ADOLESCENT MICE**
**Sean Watson (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 7, 3:00 PM - 4:00 PM
**Poster:** 141
**Mentor(s):** Colleen C Hegg (Pharmacology Toxicology)

Tetrahydrocannabinol (THC), the psychoactive component in marijuana,induces neurogenesis, the generation of new neurons from progenitor cells, in the embryonic, post-natal and adult nervous systems. However, the effects of endocannabinoids, endogenous ligands that bind to cannabinoid receptors, on neurogenesis in adolescentsis under-studied.Moreover, the long-termeffects of THC on neurogenesis are unknown. I hypothesize that neurogenesis will decrease and gliogenesis will increase in adolescents after chronic administration of THC. To test this hypothesis, tetrahydrocannabinol (THC; 10 mg/kg) or vehicle (5% cremaphor + 5% ethanol),was administered to anesthetized mice (4% isoflurane) aged 1 month (n=6/group) for five days per week for four weeks. At days 26-28, BrdU was given and tissue was collected one, eleven or nineteen days following the last BrdU administration. The paraformaldehyde-fixed tissue was sectioned(forty micrometers). Immunohistochemistry will be performed using markers for proliferated cells (BrdU), neurons (NeuN, PGP9.5), glia (GFAP, s100β) and activated microglia (Iba1). Cell death will be measured with caspase immunoreactivityand the TUNEL assay. The numberofneurons, glia and cells that incorporated BrdU will be counted by a researcher blinded to treatments. Significance will be assessed using two-way analysis of variance and Bonferroni post-hoc test. We anticipate that chronic exposure will negatively affect neurogenesis in adolescent mice, a critical time of brain development. Due to the recent legalization of marijuana, knowingthe long-term effects of THC will allow people to make an educated choice about taking marijuana.

**A SPECIFIC SINGLE NUCLEOTIDE POLYMORPHISM IN NCOA5 GENE REDUCES ITS TUMOR SUPPRESSION FUNCTION**
**Jennifer Watts (University of Texas at San Antonio)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 7, 3:00 PM - 4:00 PM
**Poster:** 142
**Mentor(s):** Madeline Ross (Physiology), Rila Su (Physiology), Mark Williams (Physiology), Hua Xiao (Physiology)

About half a million people were diagnosed with hepatocellular carcinoma (HCC) each year and most of them died within 9 months, making this disease the third leading cause of cancer deaths worldwide. HCC cases in the U.S. are increasing with only a liver transplant procedure as an optimal therapy. Previous studies in our laboratory showed that nuclear receptor co-activator 5 (NCOA5) haploinsufficient male mice developed HCC tumors within 18 months whereas the wild-type mice did not, suggesting that NCOA5 is a haploinsufficient tumor suppressor gene. However, the effects of a single nucleotide polymorphism (SNP) within the NCOA5 gene on the protein's function has not yet been explored. Using an online public cancer database, we have identified a specific SNP (rs35315891) in the NCOA5 gene, which results in the amino acid change Arginine to Histidine at position 335 (R335H). This SNP was found in human stomach cancer specimens. We thus hypothesize that this SNP will impair NCOA5 function to suppress tumor growth. We will construct a DNA vector expressing NCOA5 R335H using site-directed mutagenesis method and transfect it into liver cancer cells. We expect that the wild-type NCOA5 will suppress cancer cell growth while the NCOA5 mutant will allow cancer cells to proliferate. These results will imply that people with this specific SNP on the NCOA5 have an increased susceptibility to HCC development.

**ROLE OF HEMOSTATIC COMPONENTS IN LIVER REPAIR AFTER ACETAMINOPHEN-INDUCED LIVER INJURY**
**Anna Wojcicki (University of Minnesota)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 7, 3:00 PM - 4:00 PM
**Poster:** 143
**Mentor(s):** James P Luyendyk (Pathobiology and Diagnostic Investigation)

Acetaminophen (APAP) is the leading cause of drug-induced liver injury in the United States. APAP-induced liver injury is characterized by hepatocellular necrosis accompanied by activation of the coagulation cascade. The marked hepatotoxic response to APAP in patients and mice is followed by repair and regeneration of damaged liver tissue. However, the connection between coagulation changes and the capacity to support hepatic repair has not been evaluated carefully. Previous studies show a dose-dependent inhibition of liver regeneration in mice after APAP overdose that is seemingly disconnected with the extent of necrosis. We tested the hypothesis that a high dose of APAP in mice leads to depletion of fibrinogen and other hemostatic components, hindering the regenerative process of the liver. Fibrin(ogen), a major component of the coagulation cascade, is one factor which may serve as an interface between the hemostatic and inflammatory systems. C57BL/6J mice were injected with APAP (300 mg/kg, 600 mg/kg) or vehicle (sterile saline) and sacrificed at 2, 6 and 24 h. Thrombin generation, fibrin deposition, fibrinogen consumption and prothrombin time were measured. Both 300mg/kg and 600mg/kg treated mice exhibited significant liver injury. Mice that received 600mg/kg showed impaired liver regeneration and decreased survival at 24 h. APAP treatment caused a dose-dependent decrease in plasma fibrin(ogen) concentration and prolongation of the prothrombin time. Indeed, plasma fibrinogen was not detectable in plasma of mice given 600mg/kg APAP. These results suggest that a high dose of APAP associated with failed liver repair prompts a substantial consumption of available coagulation factors.

**DETERMINING THE CLASSICAL NEUROTRANSMITTER CONTENT OF LATERAL HYPOTHALAMIC AREA NEUROTENSIN NEURONS**
**Anna Wright (Michigan State University)**
**Category & Time:** Cell Biology, Genetics and Genomics, Section 7, 3:00 PM - 4:00 PM
**Poster:** 144
**Mentor(s):** Juliette Brown (Pharmacology and Toxicology), Gina Leinninger (Physiology)

Many neurons in the lateral hypothalamic area (LHA) of the brain contain the neuropeptide neurotensin (Nts) and regulate feeding, drinking and physical activity. It remains unclear, however, how LHA Nts neurons synaptically regulate neural targets to mediate these behaviors. Neurons regulate the activity of synaptically connected neurons via releasing either the classical neurotransmitter GABA (inhibitory) or glutamate (excitatory). We therefore sought to determine whether LHA Nts neurons contain GABA or glutamate, and thus whether they inhibit or excite downstream target neurons to control behavior. Previously the lack of reagents to simultaneously identify Nts, GABA and glutamate prevented this analysis. To overcome this obstacle we designed a dual genetic recombinase approach to simultaneously label Nts and GABA or glutamate-containing neurons. First, we generated mice that express FlpO recombinase specifically in Nts neurons (*Nts$^{FlpO}$* mice). Injecting *Nts$^{FlpO}$* mice in the LHA with a vector for FlpO-inducible green fluorescent protein (GFP) causes GFP expression only within LHA Nts neurons, enabling their detection via fluorescent microscopy. Next, we crossed *Nts$^{FlpO}$* mice with mice that express Cre recombinase-induced Tomato (a red fluorescent protein) in GABA or glutamate neurons. Injecting AAV-GFP into the LHA of these mice permits simultaneous detection of Nts (GFP expressing neurons) and GABA and/or glutamate containing neurons (Tomato-expressing neurons) via fluorescent microscopy. Brains from these mice are currently being analyzed. These studies will, for the first time, define the classical neurotransmitter content of LHA Nts neurons and suggest how they control neuronal targets to mediate ingestive behavior.

# CHEMICAL ENGINEERING AND MATERIALS SCIENCE

### STUDIES OF THE PERFORMANCE OF DIFFERENT TRIVALENT CHROMIUM PROCESS COATINGS ON ALUMINUM ALLOYS 2024 AND 7075

**Diego David da Silva (UFSCar)**
**Category & Time:** Chemical Engineering and Materials Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 147
**Mentor(s):** Greg M Swain (Chemistry), Brandon Whitman (Chemistry)

Billions of dollars are spent annually around the world to protect metals from corrosion. This is particularly true for aluminum alloys, which are used extensively in the aerospace industry. Aerospace aluminum alloys are generally protected by a multi-layer coating system: conversion coating, primer and topcoat. Historically, the conversion coatings have utilized hexavalent chromium as a component. While these coatings perform well in terms of adhesion promotion and corrosion protection, the hexavalent chromium is carcinogenic and a priority pollutant. There is a drive within the industry to find suitable alternate coating systems that are more eco-friendly. Our laboratory is investigating the structure and performance of trivalent chromium process (TCP) coatings that contain no added hexavalent chromium. This study seeks to compare the performance (i.e., corrosion protection) provided by different commercially-available forms of TCP on two important aerospace aluminum alloys: AA2024 and 7075. The alloy specimens are carefully degreased and deoxidized before applying the conversion coating by immersion. We will report on (i) the open circuit potential (OCP) and (ii) cathodic and anodic polarization curves for the coated and uncoated alloys in naturally-aerated 3.5% NaCl. These electrochemical data will provide us with key information on how effective the coating it at protecting the aluminum alloy from corrosion. It is anticipated that the different TCP coatings will provide similar levels of corrosion protection to both alloys. The corrosion inhibition will result from the barrier-like properties of the coating, which will inhibit both the anodic (aluminum oxidation) and cathodic (oxygen reduction) reactions.

### EXAMINING THE EFFECT OF LIGAND TYPE AND COVERAGE ON THE PROPERTIES OF CADMIUM SELENIDE QUANTUM DOTS

**Emily Paige Aldrich (Saint Mary's College)**
**Category & Time:** Chemical Engineering and Materials Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 148
**Mentor(s):** Remi Beaulac (Chemistry), Mersedeh Saniepay (Chemistry)

Quantum dots are defined as nanocrystals of a semiconducting compound with a diameter smaller than the size of an exciton in that material, which is typically around 10 nm. At these small diameters, the electrons become quantum confined, meaning that quantum dots behave as an intermediate particle between bulk semiconductors and individual particles with optical, electronic, and chemical properties that can be tuned by changing the size and shape of the nanocrystal. For instance, cadmium selenide (CdSe) quantum dots absorb and emit photons at almost any wavelength in the UV-Visible range, depending on their size. As a result of these properties, technologies such as LCD displays, medical imaging agents, and solar cells can utilize these materials. The surface chemistry of a quantum dot greatly affects its properties and behavior. In this research project, Nuclear Magnetic Resonance (NMR) is being used to study the types and number of ligands bound to the surface of quantum dots. Ultrafast transient absorption and photoluminescence spectroscopy provide information about the light absorption and emission of the dots with different ligands. In particular, these spectroscopic techniques indicate the presence of electron and hole traps, which interfere with the ability of quantum dots to emit light efficiently. By using different ligands to passivate the surface of the dots and reduce these traps, the quantum yield of photoluminescence can be improved, leading to more energy-efficient optical emission properties for CdSe quantum dots.

### HIGH PRESSURE PYROLYSIS CATALYSTS FOR OXYGEN REDUCTION

**Jacob Anibal (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 149
**Mentor(s):** Scott Calabrese Barton (Chemical Engineering and Materials Science), Cenk Gumeci (Chemical Engineering and Materials Science)

Increasing fossil fuel consumption in the twenty first century has led to the call for new, renewable forms of energy to replace internal combustion engines. Fuel cells provide one replacement option, but are hindered by the high cost of platinum cathode catalyst. To reduce costs, many researchers have worked to develop metal-nitrogen-carbon (MNC) catalysts as replacements for platinum in oxygen reduction. These MNC catalysts are synthesized from inexpensive nitrogen-carbon compounds and metal salts, usually in a process involving one or more pyrolyses. Of the MNC synthesis techniques, the high pressure pyrolysis (HPP) method, developed by the SCB group, shows promise in MNC catalyst synthesis. The HPP method forms catalysts by the thermal decomposition of a nitrogen precursor onto a carbon support. The process occurs in a sealed batch reactor at high pressures generated by the decomposing precursor. To synthesize a more active catalyst, the HPP process was optimized by varying the pyrolysis temperature and the catalyst's iron and nitrogen content. HPP catalysts were synthesized from iron acetate and melamine, with Ketjen© carbon black serving as a carbon support. Catalyst synthesis occurred under autogenic pressure at

temperatures between 700 and 900 °C. Electrochemical performance was evaluated using the rotating disk electrode and membrane electrode assembly techniques. Scanning electron microscopy, thermal gravemetric analysis, and x-ray photoelectron spectroscopy were used to characterize catalyst morphology and composition.

**OPTIMIZATION OF A BI-ENZYME BIOSENSOR SYSTEM FOR ELECTROCHEMICAL DETECTION OF ORGANOPHOSPHATE COMPOUNDS**
**Marissa Beatty (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 150
**Mentor(s):** Kirti Bhardwaj (Chemical Engineering), Kelly Potts (Chemical Engineering), Paul Satoh (Chemical Engineering), Robert Worden (Chemical Engineering)

This study optimizes fabrication methods for a rapid, selective, bi-enzyme biosensor used to detect organophosphate (OP) compounds. OP compounds are widely used as pesticides in agriculture, as well as chemical warfare agents in military applications. These compounds are highly toxic, and can inhibit enzymes like acetylcholinesterase (AChE). Inactivation of AChE leads to accumulation of neurotransmitters, and causes a variety of related clinical problems, including death. Since symptoms of exposure can take weeks to present, development of a biosensor able to rapidly detect exposure to toxic compounds would provide an early warning of OP exposure. A limitation of existing OP detection methods is their low sensitivities and slow response times. The electrochemical biosensor under development includes an electrode with AChE immobilized onto its surface. The AChE initiates a chemical pathway that produces an electrical signal whose magnitude is a measure of the AChE's activity. The biosensor's signal rapidly drops in the presence of OP compounds that inhibit AChE, providing a rapid, quantitative indication of potential OP toxicity. Biosensor sensitivity is increased by coupling the AChE with the oxidative enzyme tyrosinase (Tyr) to achieve a redox recycling mechanism that amplifies the biosensor's signal up to 100-fold. The presented research will combine liquid-phase optical assays with electrochemical measurements to help determine the rate-limiting step in biosensor signal generation and optimize biosensor performance.

**PERFORMANCE OF A-SITE DEFICIENT (LA(0.6-X)SR0.4CO0.8FE0.2O3-DELTA, X=0.02, 0.1, 0.35) INFILTRATED NANOPARTICLES AS MIEC MATERIALS FOR SOFC CATHODES**
**Brandon Bocklund (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 151
**Mentor(s):** Theodore Burye (CHEMS), Jason Nicholas (CHEMS)

Lanthanum Strontium Cobalt Iron Oxide (LSCF) nanoparticles are commonly used as a Mixed Ionic Electronic Conducting (MIEC) material in Solid Oxide Fuel Cell (SOFC) cathodes. Unfortunately, the high oxygen surface exchange resistance of the conventionally-used $La_{0.6}Sr_{0.4}Co_{0.8}Fe_{0.2}O_{3-\delta}$ composition has restricted SOFC operating temperatures to >550°C. However, bulk sample measurements have shown that LSCF A-site deficiency can lead to improved SOFC performance and stability. Here, for the first time, nano-sized La-deficient ($La_{0.6-x}Sr_{0.4}Co_{0.8}Fe_{0.2}O_{3-\delta}$, x=0.02, 0.1, 0.35) LSCF particles were produced via a solution infiltration method. These nanoparticles were produced by infiltrating LSCF precursor nitrate solutions into porous $Ce_{0.9}Gd_{0.1}O_{1.95}$ (GDC) cathodes and thermally decomposing the nitrate solutions into LSFC through a 1 hour hold at 700°C. The resulting La-deficient LSCF powder phase purity, particle size, and electrochemical performance were characterized using X-ray diffraction, scanning electron microscopy, and open-circuit electrochemical impedance spectroscopy. Mathematical modeling was also used to show that the observed performance changes were the result of the reduced oxygen surface exchange resistance of the La-deficient LSCF.

**BIO-BASED UNSATURATED POLYESTER RESIN**
**John Kaufmann (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 1, 1:00 PM - 2:00 PM
**Poster:** 152
**Mentor(s):** Ramani Narayan (Chemical Engineering and Material Science), Chetan Tambe (Chemical Engineering and Material Science)

My research consists of the synthesis of Polyethylene Fumarate from the polycondensation reaction between Ethylene Glycol and Fumaric Acid with Titanium Tert-Butoxide acting as a catalyst. The product of Polyethylene Fumarate is an unsaturated polymer that will be transformed into a bio-based, biodegradable coating used in everyday life. The first step involves an equilibrium reaction between Fumaric Acid and Ethylene Glycol with Titanium Tert-Butoxide acting as a catalyst, as stated previously. Hydroquinone is a component as well due to its ability to keep the unsaturated bonds in Fumaric Acid unsaturated in the final product of Polyethylene Glycol Fumarate as well. The progress of this step is tracked through the use of acid value titrations. A vacuum pump is utilized in this step as well. This employs Le Chatelier's equilibrium principle which states if stress is applied to a system, the composition of the system will change to relieve this stress. The second step in this reaction involves increasing the molecular weight of the product through esterification.

**IMPROVING THE ANALYSIS OF ORIENTATION DATA WITH MATLAB**
**Jeremy Kray (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 2, 1:00 PM - 2:00 PM
**Poster:** 154
**Mentor(s):** Christina Chan (ChEMS), Chun Liu (ChEMS)

Swift and accurate processing of data is an important aspect of research; the quicker the data turnover, the faster results can be produced. Currently, our lab is focusing on promoting aligned growth of axons for nerve regeneration after spinal cord injury. The process of measuring and monitoring the regeneration of axons is a time-consuming process when performed manually. To increase the speed of processing the data, a MATLAB program was developed to expedite data collection, automate the data processing, and yield quantitative statistics on axonal length and orientation. We found that implementing this program into our process significantly reduced the time required for data processing and improved the accuracy of the analysis.

**TRANSPARENT LUMINESCENT SOLAR CONCENTRATORS**
**Kevin Chase (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 2, 1:00 PM - 2:00 PM
**Poster:** 155
**Mentor(s):** Richard Lunt (Chemical Engineering and Materials Science), Yimu Zhao (Chemical Engineering and Materials Science)

The aim of this project is to design, synthesize, and enhance materials for transparent luminescent solar concentrators. A typical luminescent solar concentrator (LSC) absorbs a fraction of incident light and reemits that energy as monochromatic light into a more concentrated form around the edges where it can then be converted to electricity using thin strips of solar cells. Films that collect visible photons cause the glass to be colored and visible emission can cause a colored "glow". Transparent LSCs therefore work by absorbing ultraviolet and near-infrared light, then emitting this energy as infrared light. Because the light absorbed and emitted is outside of the visible spectrum the glass it is applied to will still be clear and work as a functional window or screen. Existing transparent LSCs employing phosphorescent nanoclusters and organic salts have modest efficiency, so we are developing strategies to improve the performance through host-emitter interactions and nanoparticle coupling to enhance these LSC systems.

**SYNTHESIS AND ELECTROCATALYTIC HYDROGENATION OF MODEL B-O-4 LINKAGE DIMER**
**Joan Cheng (Emory University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 2, 1:00 PM - 2:00 PM
**Poster:** 156
**Mentor(s):** Pengchao Hao (Chemistry)

Electrocatalytic hydrogenation (ECH) with RANEY® Nickel electrodes in aqueous solution is a technique that holds potential for converting lignins into biofuels via hydrogenation and deoxygenation. A method is proposed for the synthesis of a lignin dimer with a β-O-4 linkage, the most widely distributed linkage, to further test the cleaving ability of ECH on. Through simple $S_N2$ reactions, guaiacol ethyl acetate (methyl 2-(2-methoxyphenoxy)acetate) and benzyl protected vanillin (4-(benzyloxy) 3-methoxybenzaldehyde) can be prepared. After purification, the two compounds undergo aldol condensation with LDA in THF at -78 C. The resulting compound (ethyl 3-(4-(benzyloxy)-3-methoxyphenyl)-3-hydroxy-2-(2-methoxyphenoxy) propanoate) has its ester group reduced with DIBAL-H and benzyl group removed with $H_2$ and Pd/C to form the model β-O-4 linkage dimer. This dimer then undergoes ECH. If ECH is successful in cleaving the C-O bonds in β-O-4, then the technique can be attempted on more complex lignins.

**DEVELOPMENT, CHARACTERIZATION, AND VALIDATION OF NEW PLASTICS MADE FROM NATURAL RESOURCES.**
**Hines Croshon (Alabama AM University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 2, 1:00 PM - 2:00 PM
**Poster:** 157
**Mentor(s):** Eva Almenar (Packaging)

The replacement of petroleum-based films with bio-based materials for food packaging applications due to environmental concerns has led to innovative studies that are changing the way researchers develop packaging materials such as films and bags. Egg-white protein-based films are novel materials that are fully bio-degradable and made from natural resources with the potential to be used for packaging applications. In this study, we hypothesized that the egg-white protein-based material has potential on becoming a commercialized bag for produce packaging. Petroleum-based materials such as polyethylene terephthalate (PET), polystyrene (PS), and low-density polyethylene (LDPE) and bio-degradable materials such as polylactic acid (PLA) will be used as controls. EWP and control films will be characterized for barrier properties. Oxygen transmission rate (TR) will be measured at 23°C at 0 %RH and water vapor TR at 23°C at 100 %RH according to specific ASTM methods. Aroma compound TR (ethanol, hexanal, and cis-3-hexen-1-ol) will be measured gravimetrically. Furthermore, the material will be formed in bags and the bags will be validated by conducting shelf life studies with blueberries. The EWP bags will be compared to the PLA and LDPE bags. The packaged blueberries will be characterized for physico-chemical (weight loss, headspace composition (carbon dioxide and oxygen), color, texture, and antioxidants) and sensory changes for14 days of storage at 3°C. Properties of the bags before and after shelf life studies will be compared in order to prove the stability of the egg-white protein bag.

**COMPOSITION ANALYSIS OF LIGNOCELLULOSIC BIOMASS: DEVELOPING AN ACCURATE SMALL SCALE PROCEDURE TO MINIMIZE SAMPLE SIZE**
**Nicholas Feringa (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 2, 1:00 PM - 2:00 PM
**Poster:** 158
**Mentor(s):** Jacob Crowe (Chemical Engineering), David Hodge (Chemical Engineering and Material Science, Biosystems and Agricultural Engineering)

Chemical composition of plant cell wall polymers and proteins is a key component in lignocellulosic feedstock evaluation for biochemical and thermochemical conversion to value added fuels and chemical. Potential feedstocks are often grown in small scale cultivars, limiting the available material for analysis. Traditional composition analysis following the NREL protocol requires about a gram of sample for composition analysis; with other methods such as the JOVE protocol or the GLBRC i-wall method requiring less material at the expense of utilizing specialized instruments such as Nuclear Magnetic Resonance or automated sample prep and analysis scaffolds found at the GLBRC. In this work, a modified version of the NREL protocol was developed to utilize 100 mg of sample for full composition analysis, while maintaining a rapid and high throughput method of analysis. Composition analysis of polysaccharides, acetyl, and lignin content were determined for multiple bioenergy feedstocks using both the NREL and the modified scale-down version. Results were compared to evaluate the precision and accuracy of the modified composition analysis compared to the NREL protocol. Methodology developed was then applied to develop scaled-down versions of pretreatment and enzymatic hydrolysis for determination of fermentable sugar release. Scaled-down enzymatic hydrolysis results were compared to in-house pretreatment and enzymatic hydrolysis methods for predictability of sugar release at lower biomass loadings.

**MORPHOLOGICALLY CONTROLLED CARBON NANOFIBERS BY ADJUSTING ELECTROSPINNING SOLUTION COMPOSITIONS**
**Koji Foreman (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 3, 2:00 PM - 3:00 PM
**Poster:** 160
**Mentor(s):** Scott Barton (Chemical Engineering), Cenk Gumeci (Chemical Engineering)

Carbon support materials for electrochemical applications require high surface area, good structural and chemical stability and high conductivity. These supports can be created using carbon fibers, and adjusting the morphologies of these fibers can change all of the desired variables. The fibers can be formed using a process called electrospinning, which is when a high voltage (15 kV) is added to a polymer solution, causing it to leap to a grounded metal plate. The solvent, dimethylformamide (DMF), evaporates and all that is left is a thin strand of polymer fiber mesh composed of polyacrylonitrile (PAN), polyvinylpyrrolidine (PVP), and polymethylmethacrylate (PMMA). Changing variables in this process allows for changes in the fiber sizes, porosity, surface area per gram, and conductivity once fully processed. The fiber meshes containing PVP are rinsed in water at just below 100°C for two hours to remove the PVP, increasing porosity. All samples are then stabilized by heating at 250°C for 2 hours, then carbonized by heating at 850°C for 3 hours and 1100°C for 1 hour to create graphite, and to remove PMMA. Structural characterizations of carbon nanofibers will be evaluated by X-ray diffraction (XRD), Raman and scanning electron microscopy (SEM) techniques. Cyclic voltammetry (CV) will be employed to assess the electrochemical active surface area of the samples.

**DEVELOPMENT OF A DUAL ENERGY ACQUISITION AND DATA PROCESSING SCHEME FOR PERFORMING MOLECULAR IMAGING BY CT**
**Ali Ghorbanpour (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 3, 2:00 PM - 3:00 PM
**Poster:** 161
**Mentor(s):** Elahé Crockett (Medicine), Erick Shapiro (Radiology)

Computed Tomography (CT) is a non-invasive clinical diagnostic tool, which allows for 3D reconstruction and segmentation of tissues to diagnose different diseases. A new imaging modality called dual energy CT uses two X-ray tubes with two detectors, in which the second tube's energy is less than the first one, for creating an image with high quality. As each material has different X-ray attenuation properties across the X-ray spectrum, dual energy CT can potentially distinguish between tissues and various materials, such as bismuth, gadolinium and iodine. Thus, our goal is to develop a dual energy acquisition and data processing scheme for performing molecular imaging by CT. For our experiment we utilized a Micro CT Scanner and a Dual Energy Clinical CT. We imaged various materials including Bismuth, Gadolinium, Iodine, Zinc and Zirconium at different concentrations ranging from 15mM to 100mM. These contrast agents were scanned with the two different CT machines. The results obtained by CT were processed by ImageJ software to calculate image ratios for each material as well as Hounsfield Unit (HU)/mM for all contrast agents. By comparing the image ratios of different materials we will be able to differentiate between contrast agents in tissue by employing micro CT technology in a way similar to dual energy CT capabilities. The experiment gives us the ability to visualize contrast agents, which are targeted in cells, or tissues for diagnosis and treatment of the disease like cancer.
Support: A.G. is a NHLBI-scholar, supported by NIH-5R25-HL108864 award to Elahé Crockett, REPID-program Director.

**THE EFFECT OF HEAT TREATMENT AND CRYSTAL ORIENTATION ON VICKERS HARDNESS OF TI-13CR-1FE-3AL**
**Rachelle Harris (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 3, 2:00 PM - 3:00 PM
**Poster:** 162
**Mentor(s):** Carl Boehlert (Material Science Engineering), Vahid Khademi (Material Science Engineering)

Beta titanium alloys are appealing in the biomedical field due to their high specific strength and elongation-to-failure as well as their low Young's modulus. The effect of heat treatment and crystal orientation on hardness was investigated on Ti-13Cr-1Fe-3Al, which is a meta-stable beta titanium alloy. The samples were heat treated from 400 to 650 C. Then the samples were polished using the standard mechanical polishing procedure, which was followed by O-PS suspension. The Vicker's hardness was measured using a Scanning Electron Microscope (SEM) at each condition. Furthermore, for investigating the effect of crystal orientation, the Electron backscatter diffraction (EBSD) was performed to determine the grain orientation.

**ESTABLISHING A RELATIONSHIP BETWEEN THE LIGNIN STRUCTURE FROM DIFFERENT PH FRACTIONATION TO OXIDATION REACTIVITY**
**Nicholas Hool (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 3, 2:00 PM - 3:00 PM
**Poster:** 163
**Mentor(s):** David Hodge (Chemical Engineering and Materials Science), Thanaphong Phongpreecha (Chemical Engineering and Materials Science)

Lignin is one of three main polymers in cellulosic biomass, along with cellulose and hemicellulose. Alkali pretreatment process separates these three components to render the biomass more susceptible to conversion to ethanol production. In the process, lignin dissolves in alkali solution and is regarded as waste. The recovery of lignin is obtained by lowering the pH of the waste solution. The structure of lignin is composed of three monolignols (coniferyl alcohol, sinapyl alcohol, p-cournaryl alcohol) linked by up to twenty different types of bonds, **β**-O-4, **β-β**, 5-5, **α**-O-4 are just a few of the unpredictably arranged bonds in lignin. This makes it difficult to valorize lignin to single valuable product. However, previous literature has suggested that precipitated lignin at each pH has its own unique traits in structure. Therefore obtaining a better understanding of the characteristics of the structure may lead to higher yields of oxidation products. Oxidation of lignin primarily produces aromatic acids and aldehydes including the compound vanillin. Vanillin is valuable and more profitable than burning the lignin off as a heat source after pretreatment. The structure of lignin can be revealed using 2-D NMR and $^{13}C$ NMR. The yield of oxidation products, as catalyzed by $CuSO_4$, is examined by high-performance liquid chromatography. The correlation between oxidation product yields and lignin structure can be applicable to understanding which characteristic contributes most to its reactivity. This understanding may lead to increased valorization of lignin and biomass conversion as a whole.

**ALTERATION OF ULTRA AND NANO FILTRATION MEMBRANES TO IMPROVE THE SEPARATION OF ACETIC ACID FROM MONOMERIC SUGARS**
**Andrew Izbicki (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 3, 2:00 PM - 3:00 PM
**Poster:** 164
**Mentor(s):** Ilsoon Lee (Chemical Engineering and Material Sciences), Oishi Sanyal (Chemical Engineering and Material Sciences)

Many current digestion processes for biofuels yield sugars and acetic acid as products. The acetic acid produced then inhibits the process, and so removal of acetic acid is necessary. It has been shown that commercial nanofiltration membranes can achieve this separation, but the process is slow so that requiring large energy input. Ultrafiltration membranes run the process faster (i.e., less energy required), but are less selective. The goal of this project is to modify the surface of ultrafiltration membranes in order to effect the same separation as nanofiltration membranes, while maintaining a higher flux. The surface will be modified using polyelectrolyte layer by layer depositions in order to create an additional layer on the surface that will block sugars from passing through, while allowing small salts such as acetic acid to continue passing through. Additionally, the integration of poly(dopamine) onto membranes has been shown to reduce fouling during the separation process, allowing for higher flow rates to be maintained for longer durations. This could provide a means to allow ultrafiltration membranes to be further improved over nanofiltration membranes for this process.

**BIO-BASED UNSATURATED POLYESTER RESIN USING SILICATES**
**John Kaufmann (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 3, 2:00 PM - 3:00 PM
**Poster:** 165
**Mentor(s):** Ramani Narayan (Chemical Engineering and Material Science), Chetan Tambe (Chemical Engineering and Material Science)

In the world today unsaturated polyester resins (UPRs) are used in a wide variety of coating applications. Almost all of these UPRs are petroleum based and use the carcinogenic styrene monomer as their primary cross linking agent. My research focuses on the formulation of a bio-based UPR with an inert, silicon cross linking agent. This bio-based UPR is formulated using silylated soybean oil with crosslinking agent, dibutyltin dilaurate catalyst, and water. The crosslinking agent used in conjunction with the silylated soybean oil is tetraethyl orthosilicate (TEOS). The use of silicone not only replaces the carcinogenic behavior of styrene but also due to its inertness there is no issue of flammability like styrene. Due to silicon's relative inertness, it doesn't give off carcinogenic fumes as the styrene monomer does. The main objective of the research is to produce a cost effective resin with properties comparable to UPRs used in industry today. Ideally, the composition of the resin will have the highest percentage of silylated soybean oil possible while also having the desired mechanical properties. Thus far, various compositions of TEOS, catalyst, and water have been tried to yield the desired mechanical properties and increase the cure rate. TGA, DSC, FTIR and the Brookefield viscometer have been used extensively for determining the compositional change and the cure rate of the resins with various compositions. Future goals of this project would include finding the optimum resin composition that would provide properties equivalent to those used in industry.

**MICROELECTRODES FOR THE DETECTION OF NEUROTRANSMITTERS**
**Darryl Lopez Velazquez (University of Puerto Rico Cayey)**
**Category & Time:** Chemical Engineering and Materials Science, Section 4, 2:00 PM - 3:00 PM
**Poster:** 168
**Mentor(s):** Greg Swain (Chemistry)

ATP is one of the most important molecules for all living organisms because it is involved in many vital biological processes. In the GI tract, ATP is an important signaling molecule that helps to regulate motility. Being able to detect this signaling molecule in tissues is critical for understanding the mechanisms underlying normal motility and the abnormalities that might result in a disease state. The overall goal of this research project is to construct and test an enzyme-based, electrochemical biosensor for ATP. The sensor platform is a microelectrode of Pt that is modified with two enzymes, glucose oxidase and hexokinase. The enzymes are anchored to the Pt surface using a layer of polyphenol. Hydrogen peroxide is produced in the enzymatic reactions and it is detected as an oxidation current by the sensor. The hydrogen peroxide current is directly proportion to the local ATP concentration. The presentation will focus on the design and testing of the biosensor during the different stages of fabrication. The detection figures of merit will be reported, which include the sensitivity, linear dynamic range, limit of detection and the reproducibility.

**MICRO-ELECTRIC MITOCHONDRIAL SENSOR AS A GATEWAY TO METABOLIC DISORDERS.**
**Artem Muchnik (University of Maryland)**
**Category & Time:** Chemical Engineering and Materials Science, Section 4, 2:00 PM - 3:00 PM
**Poster:** 169
**Mentor(s):** Denis Proshlyakov (Chemistry)

Mitochondrial respiration relies on oxygen as a thermodynamic sink in order to capture energy stored in food and make it available for the cell. The tools currently available for studies on mitochondria are frustratingly limited, stifling progress of biomedical research on such diseases as cancer, diabetes, asthma, and many others. We propose to develop a radically new approach to mitochondrial studies based on the electrochemical nature of respiration and taking advantage of their effective autonomy in the cell. By treating mitochondria as electric nanodevices in an electric circuit we create a simple and accessible, yet highly sensitive tool for measuring natural electron currents in whole mitochondria. Electric circuits are completed using natural metabolic pathways and novel bio-modified electrodes. Here we prototype the device which utilizes an optical sensor to measure the concentration of O2 and simultaneously tracks mitochondrial current using electrochemical detection. We test different plastics, such as PMMA and 3D printed plastic, as well as sensor patches and electrodes to find the best combination for sensitive and fast oxygen and electrochemical measurements. The completion of this project will produce a device with improved sensitivity and specificity for measuring mitochondrial respiration in biological samples.

**BIOMIMETICS APPLIED TO CATALYST DESIGN: IMPROVEMENT OF WATER OXIDATION USING DOPED MANGANESE OXIDES**
**Christian Negron McFarlane (University of Puerto Rico at Mayaguez)**
**Category & Time:** Chemical Engineering and Materials Science, Section 4, 2:00 PM - 3:00 PM
**Poster:** 170
**Mentor(s):** Robert Y Ofoli (Chemical Engineering & Materials Science)

Constant increases in population have created greater demands for energy. Approximately 80% of the energy is currently provided by fossil fuels, which is a significant source of carbon dioxide emissions that worsen climatic conditions. Solar energy is a renewable and abundant resource that provides 125,000 TW, several magnitudes higher than our current energy requirement. However, it has the big drawback that it is intermittent, so the ability to store it is essential for its flexible utilization. Artificial photosynthesis produce hydrogen through water splitting enables solar energy to be stored as chemical energy. The availability of highly effective water oxidation catalysts (WOC) is a key to this process. Our goal is to assess the effect of dope manganese oxides ($MnO_x$) with nickel, cobalt and calcium on the efficiency of the WOC, based on the hypothesis that varying the ratio of Mn to doping elements will induce favorable changes in both crystal structure and surface morphology. Cyclic voltammetry (CV) is used to deposit the catalyst on a conductive surface to achieve nanostructure and suitable oxidation states. Results are analyzed by scanning electron microscopy and X-ray diffraction. Tafel and CV plots will enable the comparison of catalytic performance between different $MnO_x$-doped samples. In addition, a time-dependent current test will be conducted to assess the stability of the films. Identifying the best doping element and the best ratio for the catalyst will allow us to effectively produce hydrogen for fuel. Also, these ions can react with carbon dioxide to produce liquid fuels.

**PRODUCTION, CHARACTERIZATION, AND APPLICATION OF VARIOUS ANIONS OF ORGANIC SALTS FOR TRANSPARENT PHOTOVOLTAICS**
**Tyler Patrick (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 4, 2:00 PM - 3:00 PM
**Poster:** 171
**Mentor(s):** Richard Lunt (Chemical Engineering and Materials Science)

As solar energy has become a more promising alternative to fossil fuels, the ability to harvest energy using transparent solar cells represents a vast reservoir of potential usable surface area. Organic salts are an emerging class of materials that have selective absorption in the infrared and can enable the next generation of transparent photovoltaics. This poster explores the effects of varying the organic salt anion on the performance in transparent solar cells. By systematically synthesizing various salt-anion pairings, we vary aspects such as ion polarity, molecular weight, halogenation, and deposition geometry, and elucidate structure-property relationships for this important class of new organic semiconductors.

**THE EFFECTIVENESS OF ALKALI PRE-EXTRACTION: LOOKING AT ALKALI PRE-EXTRACTION CONDITIONS AND ITS EFFECT ON THE COMPOSITION OF DIFFERENT HYBRID POPLAR CULTIVARS**
**Shahrazad Polk (Texas Southern University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 4, 2:00 PM - 3:00 PM
**Poster:** 172
**Mentor(s):** David Hodge (CHEMS)

Hybrid poplar is composed mainly of lignin, hemicellulose and cellulose and is a great source for ethanol. One of the main problems is finding an effective way to remove the lignin portion with little mass loss. In this study, the conditions of alkali pre-extractions were tested on different cultivars of hybrid poplar, specifically the temperature and time as well as the sodium hydroxide loading. While looking at these variables the composition and mass loss is analyzed and recorded. Before the alkali extractions are performed, the composition of each type of poplar was identified and compared to the compositions of the pre-extracted poplar. The hybrid poplar used in this experiment is hybrid aspen (NE-222), NM-6, DN-34, NM-2, and NE-19 (GLBRC poplar), all of which is grown in similar areas. The overall goal of this work is (1) to find an effective temperature, time, and NaOH loading for alkali pre-extraction (2) determine the mass loss and sugar yield when using alkali pre-extraction (3) show how different cultivars of hybrid poplar that are grown in the same area results in varying responses to alkaline pre-extraction and enzymatic hydrolysis performance.

**DETECTION OF ORGANOPHOSPHATE COMPOUNDS USING AN ENZYME-IMMOBILIZED ELECTROCHEMICAL BIOSENSOR**
**Kelly Potts (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 5, 3:00 PM - 4:00 PM
**Poster:** 175
**Mentor(s):** Marissa Beatty (Chemical Engineering), Kirti Bhardwaj (Chemical Engineering), Paul Satoh (Chemical Engineering), Robert Worden (Chemical Engineering)

Organophosphate (OP) compounds are used as pesticides in agriculture as well as chemical warfare agents in military applications. These compounds deactivate one or more enzymes involved in the central nervous system, resulting in a range of health problems, including dysfunction of the nervous system, paralysis, and even death. An important enzyme targeted by OP compounds is acetylcholinesterase, which is required for the transmission of nerve signals. Biosensors can be used to detect some OP compounds. Currently the biosensors have a detection limit in the range of micromolar and a response time on the order of minutes. Timely detection of potent, fast-acting OP compounds will require biosensors with a lower detection limit and faster response time. One goal of this project is to fabricate and characterize an electrochemical biosensor for detection of OP compounds in the nanomolar concentration range that responds rapidly enough for OP-exposed personnel to take effective countermeasures. The biosensor can be fabricated using layer-by-layer assembly of alternate layers of enzymes and polyelectrolytes. The objective of the presented work is to optimize the enzyme-reaction system variables in liquid phase, including pH, buffer, and substrate concentration. The activity of enzymes and the sensitivity of the biosensors can be determined both optically, using spectrometric analytical techniques, as well as electrochemically, using a potentiostat.

**INVESTIGATION OF MONOLAYER ASSEMBLIES**
**Thomas Reidy (King's College)**
**Category & Time:** Chemical Engineering and Materials Science, Section 5, 3:00 PM - 4:00 PM
**Poster:** 176
**Mentor(s):** Stephen Baumler (Chemistry), Gary Blanchard (Chemistry)

This research explores how the introduction of structural variation in a monomolecular film influences its morphology and fluidity. The monolayer film consisted of octadecylphosphonic acid and varying amounts of Lyso PA tagged with the fluorescent probe BODIPY. A Langmuir-Blodgett (LB) trough was used to deposit the monolayer onto a glass slide drawn through the trough air-water interface. Barium ions were present in the aqueous subphase and were used to aid in adhesion of the monolayer to the glass slide, with no surface modifications being applied to the glass slide. A Brewster Angle Microscope was used to evaluate the morphology of the monolayer as it was formed on the LB trough, and Fluorescence Recovery After Photobleaching (FRAP) Microscopy was used to determine the translational diffusion constant of the monolayer after its deposition on the glass support. In addition, Fluorescent Anisotropy Image Microscopy (FAIM) was used to measure the rotational motion of the probe molecules within the supported monolayer. Comparison of the FRAP and FAIM results provided insight into the motional freedom of the probe and compositional variations in the monolayer as a function of its composition.

**DIMETHYL CARBONATE FORMATION FROM UREA-BASED PRECURSORS WITH A ZINC CATALYST**
**Rachel Sturtz (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 5, 3:00 PM - 4:00 PM
**Poster:** 178
**Mentor(s):** Dennis Miller (Chemical Engineering and Material Science), Lars Peereboom (Chemical Engineering and Material Science)

Carbon dioxide ($CO_2$) is a primary greenhouse gas and a primary contributor to the destruction of the ozone layer. Rather than being emitted, it can be used to form valuable compounds, such as dimethyl carbonate, a valuable green reagent that is exempt from a volatile organic compound classification. Dimethyl carbonate (DMC) can be formed from $CO_2$ and methanol, with the recycling of ammonia, through a series of reactions. Urea is formed from $CO_2$ and two ammonia and can be reacted further with methanol to form methyl carbamate (MC) and ammonia. The rate limiting step is the conversion of MC and methanol to DMC and ammonia. The goal of the project is to determine the kinetics of MC to DMC so that it can be applied to the design of a commercial process. The formation of DMC from MC and methanol was studied with an added zinc catalyst. This experiment utilized a well-mixed 75mL high pressure batch reactor. The reactions were run under high pressure to keep the methanol in solution. A variety of zinc catalysts were tested, with a homogeneous zinc/urea complex resulting in the best yields. The reactions were run under various temperatures, initial MC concentrations, and catalyst concentrations and analyzed by gas chromatography in order to determine kinetics. An undesired side product, n-methyl methyl carbamate (nMMC), was also formed from DMC reacting with MC. We also discovered that the DMC could react with the catalyst and reverse the reaction to form MC.

**MECHANISTIC ELUCIDATION OF HECK-TYPE COUPLING OF E-2-METHYL-4-(TRIBUTYLGERMYL)BUT-3-EN-2-OL TO ALKYL HALIDES**
**Kiyoto Tanemura (Kalamazoo College)**
**Category & Time:** Chemical Engineering and Materials Science, Section 5, 3:00 PM - 4:00 PM
**Poster:** 179
**Mentor(s):** Robert Maleczka (Chemistry)

There is interest in replacing tin with germanium in synthetically important C-C coupling reactions to reduce toxicity of reagents. Previously, the coupling of E-2-methyl-4-(tributylgermyl)but-3-en-2-ol to iodobenzene under Heck condition produced Z, E, and internal isomers at low yields with Z isomer as the major product. Establishing a trend on the effects of reaction conditions (solvent ratio, base, and ligand) on conversion and E/Z/internal product ratio provides data to determine the mechanism of this new C-C coupling reaction.

**IMPACTS OF PARTICLE SIZE FRACTIONATION AND ALKALI PRETREATMENT ON ENZYMATIC HYDROLYSIS YIELDS FOR ENERGY SORGHUM**
**Pedro Ursulino dos Santos Junior (Federal University of Sergipe)**
**Category & Time:** Chemical Engineering and Materials Science, Section 6, 3:00 PM - 4:00 PM
**Poster:** 182
**Mentor(s):** David Hodge (Chemical Engineering and Materials Science), Lisaura Maldonado (Chemical Engineering and Materials Science)

Lignocellulosic biomass is composed primarily of cellulose, hemicellulose, and lignin and offers the potential as renewable source of sugars for the production of biofuels. These components present in the plant cell walls are bound to each other, forming a complex structure, which makes cellulose accessibility to polysaccharide-depolymerizing enzymes quite difficult. Biomass pretreatment aims to alter the higher order structure of these components and, consequently, make the biomass more porous and readily accessible by enzymes. Moreover, it has been studied the effect and the difference in results of alkaline pretreatment on different types of tissues for a same plant. This study aims to evaluate and compare the response of a physical fractionation approach that classifies milled biomass by particle size for two different sorghum cultivars (TX08001 and Della) at different alkali pretreatment conditions. The goal of this work is demonstrate that (1) different tissues in these sorghum cultivars can be classified by size following milling, (2) that these fractions exhibit different responses to alkaline pretreatment, and (3) that this approach can potential improve a process to generate optimal yields for each size-segregated fraction.

**COMPRESSIBILITY AND MODELING OF ALTERNATIVE FUEL BLENDS**
**John van Schaik (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 6, 3:00 PM - 4:00 PM
**Poster:** 183
**Mentor(s):** Carl Lira (Chemical Engineering and Material Science)

With alternative fuels becoming very prominent, numerous studies address alternative fuel properties both as neat fuels and when mixed with petroleum fuels. To represent fuels containing hundreds of components, surrogates are developed to mimic the neat fuels and predict blend properties. In this investigation, various alternative fuel surrogates and fuels were evaluated for their cloud point, cetane number, distillation

curve, density, speed of sound and compressibility. The surrogates represent both low and high temperature properties better than most surrogates in the literature. An echo technique and densitometer were used together to measure the speed of sound, density and compressibility for each of the fuels and any mixtures. Specifically, JP-8, a military Jet fuel, and Isoparaffinic Kerosene (IPK) are presented. Fuel properties were measured for both pure fuels and as blends. The Group Contribution (GC) PC-SAFT equation of state was used to model the compressibility and speed of sound at elevated pressures. When compared with experimental data, the (GC) PC-SAFT equation of state underestimates the speed of sound measurements. UNCLASSIFIED: Distribution Statement A. Approved for public release.

**SYNTHESIS OF MULTIPHASE MICRODROPLETS USING MICROFLUIDIC DEVICES**
**Brad Varner (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 6, 3:00 PM - 4:00 PM
**Poster:** 184
**Mentor(s):** Maddalena Fanelli (Chemical Engineering and Materials Science)

Microdroplets find a wide range of application in science and technology, leading to novel routes and methods for drug delivery, food production, cosmetic formulation, protein engineering, and materials synthesis. Microdroplets are generated as a result of the flow instability that occurs when pumping one immiscible fluid into another through T-junctions, flow-focusing, or co-flow geometries. The manipulation of geometries and flow parameters offers unique control over properties that significantly affect microdroplet performance, such as size, uniformity, and morphology. This study aims to improve current understanding of microdroplet synthesis by simulating droplet formation and deformation with ANSYS Fluent, a computational fluid dynamics software. Simulations are performed under co-flow conditions for varying fluid properties and flow rates. The application of Fluent is validated through the modeling of a tubular flow reactor and droplet shearing between two moving parallel plates. A low-cost microfluidic device, composed of glass capillaries and a pneumatic pump, is also assembled and used to understand droplet formation.

**CADMIUM COORDINATION POLYMERS CONTAINING 3-PYRIDYLMETHYLNICOTINAMIDE**
**Charmaine White (Michigan State University)**
**Category & Time:** Chemical Engineering and Materials Science, Section 6, 3:00 PM - 4:00 PM
**Poster:** 185
**Mentor(s):** Robert LaDuca (Chemistry)

Coordination polymers have various application in explosives detection. Hydrothermal reaction of cadmium nitrate with 3-pyridylmethylnicotinamide(3-pmna)and several different dicarboxylic acids supplied a series of coordination polymers whose structures were determined using X ray diffraction. $\{[Cd_2(succ)_2(H_2O)_2(3\text{-pmna})]*3H_2O\}_n$ (**1,** succ=succinate) displays a 2D sandwich structure containing $Cd_2O_2$ layers connected into sandwich by 3-pmna. $\{[Cd_4(2,2\text{-dms})_4(H_2O)_4]*4H_2O\}_n$ (**2,** dms=dimethyl succinate) illustrates a 3D diamond structure based on Cd4O4 clusters in the absence of 3-pmna. $\{[Cd(glu)(3\text{-pmna})(H_2O)]*3H_2O\}_n$ (**3,** glu=glutarate) displays a wavy sheet . Thermal, optical and sensing properties of these new polymers were also investigated.

**EFFECTS OF TRIVALENT CHROMIUM CONVERSION COATINGS ON THE OXYGEN REDUCTION REACTION KINETICS AT ALUMINUM ALLOYS**
**Paulo Zutim (Federal University of Sao Carlos - Brazil)**
**Category & Time:** Chemical Engineering and Materials Science, Section 6, 3:00 PM - 4:00 PM
**Poster:** 186
**Mentor(s):** Catherine Munson (Chemistry), Greg Swain (Chemistry)

Protection against corrosion is important for many alloys. Good corrosion protection extends the operational lifetime of the material and reduces costly repairs. Aluminum alloys are used in the aerospace industry and are protected from corrosion by a multi-component coating system. The industry has utilized chromate-containing conversion coatings, while these coatings work well; they are not environmentally friendly as they contain hexavalent chromium. Unfortunately, hexavalent chromium is carcinogenic. Our laboratory is investigating more environmentally-friendly conversion coatings that contain no added hexavalent chromium. These more eco-friendly coatings are referred to as trivalent chromium process coatings, which contain trivalent chromium. The goal of this project is to learn more about how these coatings inhibit cathodic processes on the aluminum alloy surface, namely the oxygen reduction reaction. Using three aluminum alloys (2024, 6061 and 7075), rotating disk voltammetry was employed to study the electron transfer and mass transfer kinetics of dissolved oxygen reduction on the alloy. Results for coated and uncoated alloys like open circuit potential and cathodic polarizations curves in oxygen saturated solution as a function of the rotation rate will be reported. Comparing the mass transport limited current for oxygen reduction, the polarization curves for the coated and uncoated alloys, as a function of the rotation rate, will allow us to determine how effective the coating is at hindering the oxygen to the alloy surface. The significance of this is that the rate of aluminum alloy corrosion can be retarded by inhibiting the rate of oxygen reduction.

# CIVIL AND ENVIRONMENTAL ENGINEERING

**MECHANISTIC CHARACTERIZATION OF THIN ASPHALT OVERLAYS FOR PAVEMENT PRESERVATION USING FINITE ELEMENT MODELING APPROACH**
**Heena Dhasmana (University Of Illinois at Urbana Champaign)**
**Category & Time:** Civil and Environmental Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 189
**Mentor(s):** Imad L Ai-Qadi (University of Illinois at Urbana Champaign: Civil and Environmental Engineering), Hasan Ozer (University of Illinois at Urbana Champaign: Civil and Environmental Engineering)

This study aims at evaluating the performance of thin asphalt overlays under the impact of environmental conditions which include differing moisture levels in the pavement, gradual aging of asphalt binder and temperature variations in the mix. For this purpose, 2-D micromechanical models for different binder type, content, varying aggregate gradations are developed on a local scale using digital images. Finite element meshes constructed using these images are imported to a FE code which use linear viscoelastic material properties for the mastic phase for

some standard mixes generally used in thin overlay construction in Illinois. Stresses generated in asphalt mix samples of different geometries and mix attributes can be compared and further evaluated for model generation, to experimental results from tests like Semi-Circular Bend (SCB) test. Incorporation of moisture concentration fields throughout the entire mix using aggregate and matrix diffusion coefficients followed by the application of time dependent mechanical boundary conditions will help to generate a matrix of the degree of impact of varying environmental conditions on overlay mixes. Apart from the studies conducted at microscale, 3D models at macroscale will be evaluated for different loading conditions and mix attributes. Variation of properties along the tire trajectory gives an idea about mix consistency when subjected to external loads. Future work will involve the comparison of computational with experimental test results in order to analyze the extent to which different factors at microscale have an impact on behavior of the mix at macroscale.

**eDNA: AN INTERACTIVE CROSS PLATFORM APPLICATION FOR MONITORING AND CONTROL OF AQUATIC INVASIVE SPECIES IN THE GREAT LAKES BASIN**
**Umama Fakher (Lansing Community College)**
**Category & Time:** Civil and Environmental Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 190
**Mentor(s):** Syed Hashsham (Civil & Environmental Engineering), Maggie Kronlein (Civil & Environmental Engineering)

In this research project, a mobile application, "eDNA App" was developed using a cross platform IDE (integrated development environment), to be used on both Android and iOS platforms. The goal of the larger research project is the fieldbased monitoring of aquatic environments for invasive species using environmental DNA (eDNA). Specifically, eDNA is the extracellular DNA released from various organisms in water bodies. In the field, 17 invasive species (including 5 highrisk potential invaders) were detected using GeneZ (a handheld device) and isothermal DNA amplification. When invasive species are abundant, a small volume of water (1 µl) is sufficient to get positive results but for rare occurrences larger samples may be needed. eDNA App is the graphical user interface (GUI) to inform volunteers about the risk of invasive species, to communicate results of samples collected by them, to provide guidance on sampling, and to answer questions. The application includes the following functionalities or features: *Request eDNA Kit(s)*, *eDNA Sampling Videos, GPS Tag Your Sample, View eDNA Results, Other eDNA Studies*, *Invasive Species Information*, *FAQs* , and *Feedback*. Currently we have accomplished nearly 60% of the app development. Features to be included in the future include updating samples collected from different lakes and visualization of data on a map with the lake name and sampling date. There will also be updated list of all valuable information related to invasive species within the application. This app will connect researchers throughout Michigan and provide eDNA related data available globally.

**USE OF SHEAR WAVES TO CHARACTERIZE FREEZE THAW DAMAGE IN CONCRETE**
**Katelyn Freeseman (University of Minnesota)**
**Category & Time:** Civil and Environmental Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 191
**Mentor(s):** Lev Khazanovich (University of Minnesota: Civil Engineering)

Evaluation of migration-based reconstructions can give a qualitative characterization of large scale or excessive subsurface damage. However, for detection of stochastic damage mechanisms such as freeze-thaw damage, evaluation of the individual time-history data can provide additional information. A comparison of the spatially diverse measurements on several concrete slabs with varying freeze-thaw damage levels is given in this study. Signal characterization scans of different levels of freeze-thaw damage at various transducer spacing is investigated. The results show promise for a SH-wave classification system applicable for nondestructive characterization of freeze-thaw damage conditions.

**IMPACT OF DIAMOND GRINDING ON RIGID PAVEMENT PERFORMANCE**
**John Gondek (Michigan State University)**
**Category & Time:** Civil and Environmental Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 192
**Mentor(s):** Syed Haider (Civil & Environmental Engineering)

Diamond grinding is a method of preserving rigid pavements by improving the surface smoothness. The grinding of faulted joints and cracks will eliminate surface irregularities and improves the ride quality of the pavement surface. Generally, the effectiveness of diamond grinding may be assessed by evaluating before and after the treatment ride quality. In addition, the impact of diamond grinding on the predicted pavement performance can be evaluated by comparing the before and after treatment expected cracking, faulting, and IRI. The longitudinal pavement profile data from the Long-Term Pavement Performance (LTPP) database were used to help evaluate the effectiveness of diamond grinding. A total of ten (10) rigid pavement sections (7 from GPS-3, 1 from SPS-1, 1 from GPS-9 and 1 from GPS-1 experiments) were analyzed in this research. The longitudinal surface profiles before and after diamond grinding and axle load distributions were extracted from the database. These profiles were used in ProVAL to determine IRI, faulting locations, and power spectra density (PSD). Before and after treatment surface profiles were used in TruckSim software to characterize the dynamic load differences due to change in ride quality. Based on the dynamic analysis of axle loads, before and after treatment axle load spectra were determined. These axle load spectra will be utilized in the MEPDG software to predict rigid pavement performance (i.e., cracking, faulting and IRI). The change in predicted performance will be related to change in surface profiles before and after treatment to determine effectiveness of diamond grinding.

**EVALUATION OF CHIP SEAL TREATMENT ON PAVEMENTS USING IMAGE PROCESSING**
**Derek Hibner (Michigan State University)**
**Category & Time:** Civil and Environmental Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 193
**Mentor(s):** M. Emin Kutay (Civil and Environmental Engineering), Ugurcan Ozdemir (Civil and Environmental Engineering), Sudhir Varma (Civil and Environmental Engineering)

Chip sealing is a preventative maintenance treatment that is commonly applied to roads each year by many transportation agencies. It consists of an application of emulsified asphalt to an existing pavement surface and the spreading of uniformly graded aggregates onto the emulsified asphalt. The emulsified asphalt sets into a binder layer and creates an impermeable medium above the existing pavement surface. The primary purpose of this asphalt layer is to prevent rain/snowmelt water from penetrating into the existing pavement, whereas the aggregate chips

provide traction for vehicle tires on the road. If aggregate embedment into the asphalt binder layer is too high, then bleeding of the binder will occur, typically along the wheelpath. Insufficient embedment depth can lead to inadequate bonding between the aggregates and the binder, which results in aggregate loss. Aggregate loss can lead to reduction in tire/pavement friction and compromise the safety of drivers and passengers. It is important to determine percent embedment to verify the quality of chip seal construction. Currently, there is not a quantifiable method measuring embedment depth of the aggregates into emulsion. Aggregate embedment depth is one of the most important parameters of a chip seal design. The objectives of this project were to develop a laboratory apparatus to make chip seal samples with various embedment depths as well as develop an image processing tool to directly measure aggregate embedment. Upon completion of the project, the algorithm developed can be used by various transportation agencies as an acceptance method for chip seal projects.

**PAVEMENT SURFACE CHARACTERIZATION FOR OPTIMIZATION OF TRADE-OFF BETWEEN GRIP AND ROLLING RESISTANCE: INVESTIGATING FRICTION**
**Miguel Labrador (University of South Florida)**
**Category & Time:** Civil and Environmental Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 194
**Mentor(s):** Roozbeh Dargazany (Civil Engineering), Shabnam Rajaei (Civil Engineering)

The interactions between tires and pavement impact the fuel efficiency of vehicles and the safety of billions of commuters around the world. The objective of this study is to analyze tire-pavement friction, the force that resists relative motion between two surfaces, and assess how pavement surface characteristics can influence friction between tire and pavement surfaces. Pavement samples will be cored from city roads around the Michigan State University campus and the state of Michigan. Measurement of friction levels on each surface will be conducted by means of the British Pendulum Tester (BPT) and a locked wheel tester. The two main components of friction are adhesion and hysteresis. The hysteresis effect will be measured in the BPT by using a lubricant to eliminate the adhesive component, while dry tests give both the adhesive and hysteretic effects. In a parallel project, the surface texture of the samples will be measured by a laser scanner and modeled in MATLAB by using fractal techniques. Their results will be used in this project to find a relationship between friction and surface texture. This relationship could potentially serve as a friction coefficient prediction model. These results will then be used in future validation studies of multi-scale modeling of tire-pavement interaction. This model will be able to confirm some of the expected findings; micro-texture is more influential on adhesion and macro-texture on hysteresis. In addition, we will be able to evaluate the effects of micro-texture on hysteresis, which can be helpful in understanding the rolling resistance mechanism.

**IMPACT OF LOAD TRANSFER EFFICIENCY ON FAULTING PERFORMANCE OF RIGID PAVEMENTS**
**Sebastian Muniz (Universidad Polytecnica de Puerto Rico)**
**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 197
**Mentor(s):** Syed Haider (Civil Engineering)

Faulting of pavements is a functional distress contributing to pavement roughness; is the difference in elevation of adjoining slabs at joint or crack. When the average faulting is more than 4mm, preservation treatments can be considered to correct the elevation differences at discontinuities. However, to remedy the occurrence of future faulting, load transfer between slabs plays a vital role. The load transfer between slabs can be fixed by using preservation treatment like dowel bar retrofit (DBR). Early age load transfer behavior of slabs may impact the long-term faulting performance of concrete pavements. In this research, the question is how early load transfer efficiencies (LTE) relates to future faulting measured in field. The FWD deflection data for the rigid pavement sections in the SPS-4 experiment of the long-term pavement performance (LTPP) were analyzed to determine the average LTE and differential energy (DE). The analyses were conducted for the time series deflection data over the age of each pavement section. In addition, the average measured faulting over time was extracted for all the pavement sections. A total of 43 sections in 11 states were considered in this analysis. The objective is to related LTE and DE to faulting over time and establishes relationship to identify occurrence of future faulting from load transfer related variables. Such relationships allow to prevent the future faulting at joints or cracks in rigid pavements and in determining the best treatment timing for preservation treatments. Also it will be helpful for developing performance-related specifications for DBR treatment.

**PAVEMENT SURFACE MEASUREMENT AND CHARACTERIZATION FOR OPTIMIZATION OF TRADE-OFF BETWEEN ROLLING RESISTANCE AND GRIP**
**Lance Roth (Michigan State University)**
**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 198
**Mentor(s):** Shabnam Rajaei (Civil and Environmental Engineering)

Pavement surface texture affects the interaction between tires and roadways and can be broken down into four categories based upon their size; microtexture, macrotexture, megatexture and unevenness. Microtexture, the smallest standard pavement texture (wavelength less than 0.5 mm and amplitude from 1-500 μm), is the type studied the least because of its difficulty to accurately be quantified except for in a laboratory. This difficulty leads to a lack of research done on microtexture in pavement applications. This study was aimed at measuring microtexture as well as well-studied macrotexture simultaneously on a pavement surface via a high-resolution laser scanner. Specifically, the experiment looked at different types of pavements used for road surfaces such as Hot Mix Asphalt, Thin Asphalt overlay, Chipseal and concrete. With the measurement results obtained, they can be used in surface simulations for optimizing the trade-off between rolling resistance and grip that a vehicle encounters while driving. The measurement and characterization method started with core samples of pavement being pulled by the group from Michigan State University's campus as well as by the Michigan Department of Transportation for off-campus locations. This provided surface samples that could be further prepared in the laboratory for laser measurement.

**MULTI-FUNCTIONAL CONCRETE INLAYS FOR PAVEMENT PRESERVATION**
**Sushobhan Sen (University of Illinois at Urbana Champaign)**
**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 199
**Mentor(s):** Jeffery Roesler (University of Illinois at Urbana Champaign: Civil and Environmental Engineering)

Pavement Preservation is a modern approach to maintaining pavements to enhance service life while ensuring adequate functional requirements for users. While asphalt treatments are the traditional tool for preservation, recent advances in concrete technology in the form of Flowable Fibrous Concrete (FFC) have made thin concrete inlays an attractive option. When combined with photocatalytic cement containing Titanium Dioxide ($TiO_2$) nanoparticles, this inlay can meet structural requirements while also providing enhanced environmental benefits. A concrete mix made of this specialized material was tested at 7 and 28 days for strength and fracture properties and found to provide satisfactory results. The higher albedo of the concrete was determined and found to mitigate the Urban Heat Island (UHI), which could be quantified by means of a the Global Warming Potential (GWP) of a hypothetical pavement as well as by analyzing the heat flux through the pavement over time. The ability of the FFC mixture to combat air pollution through photocatalytic reactions with nitrogen oxides ($NO_x$) was also investigated. Mortar and paste samples were prepared and tested in the laboratory to characterize the $NO_x$-depollution potential of prospective FFC mix designs, as well as their ability to mitigate the deterioration of photocatalytic activity caused by carbonation.

### LABORATORY PERFORMANCE CHARACTERIZATION AND FIELD EVALUATION OF HOT IN-PLACE RECYCLED ASPHALT MIXTURES

**Punit Singhvi (University of Illinois Urbana Champaign)**

**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 200
**Mentor(s):** Imad Alqadi (University of Illinois at Urbana Champaign: Civil & Environmental Engineering), Hasan Ozer (University of Illinois at Urbana Champaign: Civil & Environmental Engineering)

Hot in-place recycling (HIPR) is a pavement preservation technique that can be used as an effective pavement rehabilitation technique to improve pavement performance and eventually improving its service life. However, it is equally important to know the timing and condition of the pavement where HIR is a choice of treatment. Field and laboratory investigations were conducted on three sites to assess the effectiveness of HIPR. The HIPR method used was a surface remixing of top 1.5-2 in thickness using rejuvenators followed by a 2-in-thick asphalt overlay. In order to evaluate the field performance, Falling Weight Deflectometer (FWD) was used to calculate the stiffness of the existing pavement, post HIPR treatment, and post overlay conditions. In addition, pavement roughness was measured for existing and the post HIPR conditions to evaluate the effect on riding quality using the International Roughness Index (IRI). In addition, Condition Rating Survey (CRS) before the HIPR was measured for all the sites. Laboratory evaluation of the asphalt mixture includes Semi-circular Bending (SCB) test for potential cracking evaluation and Hamburg Wheel track test for rut resistance potential measurements. Therefore, to evaluate the performance of HIPR and its suitability as an effective pavement preservation technique, continuous monitoring of the field sections along with extensive laboratory testing are underway.

### LIFE CYCLE INVENTORY OF TRANSPARENT ORGANIC PHOTOVOLTAICS

**Jack Stephan (Michigan State University)**

**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 201
**Mentor(s):** Annick Anctil (Civil & Environmental Engineering)

Photovoltaic technologies provide an attractive alternative to dependency on fossil fuels. Existing solar cells, thin film and silicon-based require scarce materials and high energy for fabrication respectively. OPVs are better alternatives that could solve both of these problems. The goal of this paper is to perform Life Cycle Analysis (LCA) on transparent small-molecule OPV technology still in the development phase. LCA allows for unintended consequences of new technologies to be evaluated. The current LCAs focus mainly on polymer OPVs and none have looked at transparent OPVs. Transparent OPVs can be used in new applications outside of power generation i.e. windows. The expected outcome is that when replacing non-power generating units such as windows the lower power conversion efficiency and lifetime expectancy of these technologies will be acceptable.

### IMPACT OF THIN OVERLAY ON RIDE QUALITY AND EXPECTED FLEXIBLE PAVEMENT PERFORMANCE

**Haibin Yu (Michigan State University)**

**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 202
**Mentor(s):** Ronell J Eisma (Civil & Environmental Engineering), Syed W Haider (Civil & Environmental Engineering)

Thin asphalt overlay is a flexible pavement preservation treatment to improve the functional serviceability of a structurally sound existing pavement. The functional serviceability of a road surface is measured in terms of International Roughness Index (IRI), which is the most widely used roughness index. IRI measures the vertical elevation changes along the longitudinal road profile. This research evaluates the impact of thin overlay treatment on the road roughness by comparing before and after treatment IRIs. It is hypothesized that the lower surface roughness will reduce the undesired vertical acceleration which may cause load-related pavement damage over time. The longitudinal profile and axle load data for fifteen (15) pavement sections from the Long-Term Performance (LTPP) database are used in this research to analyze the impact of thin asphalt overlay treatment on ride quality and predicted flexible pavement performance. All fifteen flexible pavement sections are from specific pavement studies (SPS)-3experiemnts. Analyses of the flexible pavement profile include power spectral density (PSD) and riding quality (IRI) by using ProVAL software. The before and after treatment profiles and axle load data are used in TruckSim software to simulate the dynamic loads due to before and after profiles. The change in axle load spectra due to surface roughness will be used to predicted flexible pavement performance which will indicate the indicate the effectiveness of thin overlay preservation treatment.

### DEVELOPING SMART SENSORS FOR HEALTH MONITORING OF PAVEMENT SYSTEMS

**Sahira Melo (Michigan State University)**

**Category & Time:** Civil and Environmental Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 203
**Mentor(s):** Nizar Lajnef (Civil & Environmental Engineering)

Recently, significant attention has been devoted to the utilization of new sensing technologies for pavement health monitoring systems. This study presents the development of a small-scale packaging system for self-powered wireless sensors to be used for the health monitoring of

pavement systems. The power of such sensors is supplied using piezoelectric transducers through harvesting energy from the mechanical loading experienced by the pavement. The packaging system developed herein is spherical with a diameter equal to 1.5 inches. In order to fabricate the spherical packaging, a mold is designed and manufactured with a 3D printer. Then, a specific type of proxy including urethane propolymer and black curative are blended together and carefully poured into the mold. Two piezoelectric polyvinylidene fluoride (PVDF) tapes are placed inside the mold. Finally, the packaging system is embedded inside the Superpave asphalt samples and tested.

# COMPUTER SCIENCE AND ENGINEERING

### USING MOLECULAR DYNAMICS TO IMPROVE SPACE EXPLORATION

**Myson Burch (Indiana University-Purdue University of Indianapolis)**
**Category & Time:** Computer Science and Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 205
**Mentor(s):** Yongjun Choi (Institute for Cyber Enabled Research)

Background: Electric propulsion (EP) is an energy efficient method of space travel where energy is generated by solar panels. EP devices use a magnetic field to trap injected ions that react with xenon gas creating thrust. Along with low thrust, the most limiting factor with using EP for long term missions is the erosion of the thruster. As the ions move using the magnetic field, they collide with the thruster wall causing it to erode. So, the goal is to see how EP devices, specifically a Hall thruster, can improve deep space missions. Any parameters that can be altered to improve the lifetime of the thruster will be investigated. Methods: The project will use molecular dynamics simulation to gather data regarding the erosion on the Hall Thruster wall. The project is based on C/C++ and LAMMPS code that define the system of particles. When the code is run, xyz files are created that contain data about the system. These files are opened using a visualization software called VMD where each time-step of the simulation can be displayed. This test is done many times testing varying collision factors to see which most has an impact on the erosion of the wall. Results: Graphical representations of the simulation will show the initial and the eroded structure of the wall. Also, outcomes such as percentage of the substrate eroded and Hall thruster lifetime will be shown. Conclusion: Interpretation of the data will be here regarding what can improve the lifetime of the thruster.

### HOW DIGITAL ANIMATS LEARN WHAT IS GOOD AND BAD FOR THEM

**Carolina Cabrera (University of Texas - Pan American)**
**Category & Time:** Computer Science and Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 206
**Mentor(s):** Arend Hintze (Microbiology and Molecular Genetics)

Decision-making is a complicated process influenced by many factors, including previous experiences and current conditions. One's current condition only matters in decision-making when gains and losses depend on it. We use digital evolution to understand how current condition influences decision-making. Our approach to use digital evolution will involve three steps: (i) design a world where a digital agent must take its own health, where health is a numerical representation of internal condition, into account (ii) evolve digital agents in such world, and (iii) analyze how their cognitive system takes health into account when making decisions. The significance of this project is to further our understanding of how intelligent behavior evolves. Digital evolution allows us to test evolutionary hypotheses that are otherwise challenging to test using natural systems. We use evolvable Markov Brains as agents in our artificial world. Markov Brains are genetically encoded networks of logical gates that make decisions based on inputs and internal states. We analyze how these internal states store information about an agent's health and affect the decision-making process. We utilize an artificial grid-like world where various resources are available to each agent - some beneficial, others harmful. If the agent consumes the potentially lethal resource before the less dangerous resource, the agent is not taking its own health into account when making decisions. Likewise the inverse is true- if it eats the potentially lethal resources last, it's taking health into account. The digital agent's responses determine how it utilizes its health in decision-making.

### UML MODELING FOR VISUALLY IMPAIRED PERSONS

**Brad Doherty (Michigan State University)**
**Category & Time:** Computer Science and Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 207
**Mentor(s):** Betty Cheng (Computer Science and Engineering)

Software modeling is generally a collaborative activity and typically involves graphical diagrams. The Unified Modeling Language (UML) is the *de facto* standard for modeling object oriented soft- ware. It provides notations for modeling a system's structural information (e.g. users, databases, sensors, etc.), and behavior, depicting the functionality of the software. Because UML relies heavily on graphical information, visually impaired persons (VIPs) may face challenges conceptualizing the often complex software layouts, usually composed of 20 or more graphical objects. The overall objective of this project is to create software that will automatically provide a haptic representation of the graphical models comprising UML diagrams. These haptic representations will be in the form of 3D diagrams fabricated by a 3D printer. Furthermore, text describing the models will be converted to Braille producing a VIP-friendly medium as the end product. By automatically creating a VIP-friendly UML diagram from the same graphical modeling tool used by sighted developers, VIPs will be able to participate more easily in the software design process. This project can be further extended to other types of graphical modeling, creating VIP-friendly formats of many models such as business work-flow charts.

### STRING ANALYSIS FOR JAVASCRIPT PROGRAMS

**Mashyaka Yves Engelmann (Wofford College), Serena King (Oakland University)**
**Category & Time:** Computer Science and Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 208
**Mentor(s):** Lu Lunjin (Oakland University: Computer Science)

As the usage of JavaScript is taking over web applications and applications development, and server side scripting, JavaScript's conciseness is a very important aspect of the language. Static analysis of JavaScript code is very difficult due to the dynamic nature of the language. JSAI

(JavaScript Static Analysis Interpreter) is designed to be provably sound with respect to a specific concrete semantics for JavaScript, which has been extensively tested against a commercial JavaScript implementation. The built-in domain for string analysis that comes with JSAI distribution is a constant propagation domain. The project will replace the constant propagation domain with the domain of Finite State Automata.

**ACCELERATING MOLECULAR DYNAMICS SIMULATION**
**Muhammed Emin Ozturk (Bilkent University)**
**Category & Time:** Computer Science and Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 211
**Mentor(s):** Hasan Metin Aktulga (Computer Science & Engineering)

Computational tools streamline research and provide significant insight into scientific problems, which are challenging and expensive to handle experimentally. Molecular Dynamics (MD) simulation enables scientist and engineer to study materials, chemical reactions or biological systems at atomistic resolution levels. However, MD simulations are computationally very costly and require the use of large numbers of processors in parallel. The use of hybrid MPI/OpenMP parallelism is likely to reduce memory consumption and increase performance efficiency of MD simulations on emerging many-core architectures. In this project, we implement and analyze the performance of previously reported thread-parallel algorithms using OpenMP on the Intel Xeon Phi many-core processor, and we compare their performance against newly developed algorithms in our group based on the Neutral Territory (NT) method. We observe that NT-based thread parallel algorithms can outperform the existing methods using the benchmarks the miniMD code.

**V2V NETWORKS, PRIVACY, OVERHEAD AND CONGESTION**
**Risalatul Hoque (Minnesota State University), Johnathan Cox (Park University)**
**Category & Time:** Computer Science and Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 212
**Mentor(s):** George Corser (Saginaw Valley State University: Computer Science and Information Systems)

Vehicular ad-hoc networks (VANETs) may one day prevent injuries and reduce transportation costs by enabling new traffic safety and traffic management systems, but VANETs raise privacy concerns because they would transmit data which could also be used for unwanted surveillance. Some researchers have proposed application-layer and link-layer privacy protocols that would require dummy event communications which may lead to network congestion and/or overhead. This research investigates the degree of additional network congestion and overhead resulting from these protocols.

**FACE CLUSTERING: EMPIRICAL COMPARISON OF CLUSTERING ALGORITHMS**
**Nayana Kodur (Michigan State University)**
**Category & Time:** Computer Science and Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 213
**Mentor(s):** Anil Jain (Computer Science and Engineering)

Data Clustering is the process of partitioning the given data set into a set of groups, known as clusters, such that the elements in each cluster have similar characteristics. One of the challenges to clustering is that there are many different ways to group the same data set based on the definition of similarity used. A collection of rocks, for instance, can be grouped by size, color, shape, and numerous other factors. For this reason, there is no single clustering algorithm that works best on all data sets. Another challenge faced by many clustering algorithms is the scalability to large data sets (no. of objects and no. of characteristics or features). Our interest is in face clustering: grouping a set of face images into clusters, each cluster containing the images of one subject. We analyze and report the accuracy and efficiency of a few selected clustering algorithms on two face image data sets: the LFW data set containing about 13,000 face images of 5,749 subjects and the PCSO data set containing about 1 million images of 403,619 subjects.

**QUANTIFYING THE VALUE OF MEMORY THROUGH GAME THEORETIC CONTEXTS**
**Mikaela Leas (University of Texas at Pan American)**
**Category & Time:** Computer Science and Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 214
**Mentor(s):** Emily Dolson (Computer Science and Engineering), Joshua Nahum (Biology/Computational Evolution in Action), Charles Ofria (Computer Science and Engineering)

Memory is an essential component of intelligence as it enables an individual to alter its behavior based on past experiences allowing for more optimal reactions. Furthermore, memory is necessary for communication between individuals of any species. In these contexts, how valuable is memory? If an individual must pay a cost to have memory, how much should they be willing to pay? We study the importance of memory through a game theoretic approach. Using genetic algorithms, we evolve strategies to play variations of the iterated Prisoner's Dilemma, a game where two individuals receive immediate rewards for defection, but potentially greater long-term rewards for mutual cooperation. To receive the highest combined payout, each individual needs its opponent to cooperate over time. Additionally, memory is needed to recall an opponent's previous actions in order to determine how trustworthy it is. One individual can earn a high payout by defecting, but will lose the trust of its opponent. Once an individual loses trust with their opponent, both can devolve into repeated defections, yielding lower payouts and fitness. We were able to determine the threshold of how much memory is valuable for variations of the iterated Prisoner's Dilemma. When memory has a high cost, the organisms decrease their usage of memory and use short-term greedy strategies, such as always defecting. Alternatively, when memory has a low cost, the organisms use well-known long-term cooperative strategies, such as Tit for Tat. Our findings indicate the importance of memory in facilitating cooperative strategies despite inherent fitness costs thereof.

**AMBIGUOUS MULTI-SYMMETRIC CRYPTOGRAPHY APPLICATION**
**Kevin Miller (Michigan State University), Yakeen Alwishah (Wayne State University)**
**Category & Time:** Computer Science and Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 215
**Mentor(s):** Huirong Fu (Oakland University: Computer Science and Engineering), Ahmad Mansour (Oakland University: Computer Science and Engineering)

Vehicular Ad-hoc Networks (VANETs) are an anticipated ad-hoc system that allows communication between vehicles and roadside infrastructure to increase safety on the road. It is essential that this system is able to send fast and secure messages to prevent accidents. In our paper, we implement Ambiguous Multi-Symmetric Cryptographic (AMSC) [1] primitive using Android. We experiment with multiple Android devices using Bluetooth communication. Furthermore, we examine the time and overhead of this Android implementation. We will apply AMSC as a future secure communication protocol in VANETs. [1] Richard Bassous, Roger Bassous, Huirong Fu, and Ye Zhu. "Ambiguous Multi-Symmetric Cryptography", IEEE ICC - Communication and Information Systems Security Symposium 2015.

**ESTABLISHING COMMUNITY IN VOLUNTARY ONLINE EDUCATIONAL ENVIRONMENTS: ANALYSIS OF A NEW BRAIN TECHNOLOGY COMMUNITY**
**William Renius (Michigan State University), Stephen Alfa (Michigan State University)**
**Category & Time:** Computer Science and Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 218
**Mentor(s):** Juyang Weng (Computer Science)

Computer technology offers the potential to educate students across the world at a significantly lower cost. Establishing communities around STEM subjects such as brain technology enables the interested participants to learn from each other and potentially integrate STEM ideas and techniques into their work. However, with the need to globally improve STEM education and low retention rates in online classrooms, techniques for organizing and retaining student engagement in online educational environments are needed. In this study we analyze where interest and engagement falls off in the process of becoming a voluntary community member. We look to see which pathways towards engagement lead to the most involved community members. Potential organizational structures to improve community recruitment and engagement in voluntary educational environments are discussed.

**MULTI-CRYPTOGRAPHIC RSA SCHEME**
**Matthew Wagner (Lindenwood University), Andrew Davis (University of Michigan Flint)**
**Category & Time:** Computer Science and Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 219
**Mentor(s):** Huirong Fu (Oakland University: Computer Science & Engineering), Ahmad Mansour (Oakland University: Computer Science & Engineering)

We propose a version of RSA encryption that uses the Chinese Remainder Theorem (CRT) for the purpose of concealing multiple plain-texts in one cipher-text. We prove the algorithm mathematically. Furthermore, we prove our algorithm secure against the chosen plaintext (CPA) attack. We also compare plain RSA against our algorithm and show the security and size advantages. The new algorithm can also take advantages of current methods that speed up the decryption process. This scheme will become a basis for further one to many public key cryptosystems.

**MULTI-PATH ROUTING TO INCREASE SECURITY IN MOBILE AD HOC NETWORKS**
**Adam Weckle (Oakland University), Maegan Dyakiw (University of Connecticut)**
**Category & Time:** Computer Science and Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 220
**Mentor(s):** Tao Shu (Oakland University: Engineering and Computer Science)

Some major concerns in wireless networking are the safety and security of communication channels utilized by Mobile Ad Hoc Netowrks (MANETS). We are investigating the multi-path routing algorithm as a non-cryptographic method to exchange keys. The multi-path algorithm will break the key into pieces and send them on different paths to their destination. Our algorithm will randomize and propagate the first set of hops away from the source and continue towards the destination by implementing a most efficient algorithm for mobile networks. Multi-path is typically performed in static networks. We analyze the effectiveness, efficiency and the impact on security that multi-path brings to a mobile and dynamic network. This process should make it very difficult to fully intercept the key transmission. This approach will make eavesdropping more difficult and ensure the efficiency and security of the communication.

**APPLICATION OF DATA MINING AND MACHINE LEARNING TO DETECT AND REMOVE SPYWARE**
**Richard Yang (University of Wyoming), Victor Kang (University of Michigan)**
**Category & Time:** Computer Science and Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 221
**Mentor(s):** Mohamed Zohdy (Oakland University: Computer Science and Engineering)

Spyware is a form of malware with the primary intention of stealing or monitoring the victim's online and offline activity. Spyware comes in many forms, including adware, keyloggers and scareware. Removal can be difficult if the spyware blocks access to legitimate antivirus solutions on a victim's system. With the recent advances in the automotive industry, consumers can be impacted by spyware through their automobile as a medium. The goal of our research is to create a spyware detection and anti-spyware solution that will serve three purposes: to appropriately identify and classify unknown files on a spectrum of spyware severity; to introduce a self-adapting structure to detect new or modified spyware traces; and to increase the accuracy of detection results. The identification, classification, and adaptation phase can be accomplished using machine learning and data mining concepts and algorithms. Data will be classified through a hybrid machine learning process. We will use supervised learning algorithms to classify a sample as spyware or not spyware. Then, out of those samples classified as spyware, we will apply the self-organizing feature map unsupervised learning algorithm to classify the spyware on a severity spectrum.

# ELECTRICAL AND COMPUTER ENGINEERING

### ADAPTING ROBOT LEARNING THROUGH NATURAL LANGUAGE

**Michael Aughton (Michigan State University)**

**Category & Time:** Electrical and Computer Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 223
**Mentor(s):** Yu Cheng (Electrical and Computer Engineering), Yunyi Jia (Electrical and Computer Engineering), Ning Xi (Electrical and Computer Engineering)

Traditionally, robots have been programmed by humans using computer-based coding. After being programmed, robots can only accomplish predefined tasks in relatively structured environments. Modern market demands increasingly require robotic systems to be more intelligent in order to learn new knowledge and accomplish new tasks by themselves. Therefore, the goal of this research is to develop an adaptive robot learning method to enable robots to learn new actions from humans through natural language communication, and then accomplish new tasks using the newly learned actions in unstructured environments. This method contains two sequential steps: human teaching and robot learning. In human teaching, humans control robots to accomplish new actions step-by-step using natural language instructions. In robot learning, robots learn environmental changes and then correlate them to the new actions through first-order logic representations. After the teaching and learning, robots will be able to execute new tasks using the learned actions. This method is implemented and validated on a mobile manipulator system. It will have a lot of potential for improving the intelligence of robotic systems in manufacturing, home service, and even the military.

### GENERALIZING INFORMATION EXTRACTED FROM A LINKED-DATA MODEL OF WORKFLOW-CENTRIC DECLARATIVE EXPERIMENT MODELS

**Ian Bacus (Michigan State University)**

**Category & Time:** Electrical and Computer Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 224
**Mentor(s):** Andrew Mason (Computer Engineering)

Our goal is to create a research object organizational system that aggregates domain-ontologically organized artifact objects and workflow objects, and allows for experimenters to develop methods for collecting and processing data by use of temporally organized workflow templates from their work and work in related fields. This will also allow a more general and unified structure and format for data involved in managing experiment methods implementation and re-purposing, signal delivery and acquisition, and a provenance system for reconstructing the states of workflow and artifact objects and their relations to other states of objects with time. Workflow networks are implemented with labeled, directed RDF graphs. These graphs will form templateable experiment models that express declarative, or schematic information about the possible information transactions in experiments and the necessary physical connections for delivering and collecting signals, or artifacts. Workflow refinement, data provenance, temporal operators, and partial automation of physical experiments are intended features of the proposed system. Models involving workflow refinement and data provenance have typically been implemented separately from systems that intend to automate experiments, and the systems that automate experiments tend to favor in-silico experiments. This system will be capable of working with more abstract systems consisting of physical actuators and sensors in addition to computer resources.

### DATA COLLECTION AND PROCESSING FROM A SENSOR CLOUD

**Ritwik Biswas (University of Michigan)**

**Category & Time:** Electrical and Computer Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 225
**Mentor(s):** Jongeun Choi (Mechanical Enginerring and ECE)

Much of the sensory data collection and processing in the field of sensor networks and robotics is post experimental, not allowing for real time feedback and analysis of a system or environment. In this research, we implement a decentralized predictive algorithm for a Gaussian random field with randomly sampled air pollution data from sensors on aerial vehicles. The data is transmitted in real time from localized sensors to a base station and is routed to a cloud-based server where the information is processed and a predictive field is generated. The information about the field is then sent back to the aerial vehicles for reactive movements and measures to be taken about the air quality. The advantage of being able to utilize a server side algorithm in the cloud is the quickness and versatility of the system. We include control of the sensor cloud via a mobile application. We find that a similar data transfer architecture has many applications in which it could be immensely useful such as in the military for tactical mapping of unknown territory or enemy camps and even for domestic use such as mapping traffic and pedestrians. We think that any system that has a variable dataset and needs immediate calculation can benefit from such a data collection protocol.

### BRAIN-COMPUTER INTERFACE FOR VOLUME AND TUNING CONTROL OF A RADIO SYSTEM USING THE EMOTIV EPOC+ HEADSET

**Walter Brandsema (University of South Carolina), Ibrahim Akbar (University of Rochester)**

**Category & Time:** Electrical and Computer Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 226
**Mentor(s):** Brian Dean (Oakland University: Electrical and Computer Engineering)

Brain-computer interface (BCI) technology is dependent on the capability of individuals to consistently produce discernable changes in their electroencephalographic (EEG) activity at will, thus providing a non-muscular channel for sending commands to an external environment. This poster explores the feasibility of using a commercially available EEG headset in the development of a BCI, with the ultimate goal of providing motor disabled persons with basic communication ability. The work presented in this poster investigates the applications of brain-computer interface through the use of the commercially available Emotiv EPOC+ interfaced with a radio console. It will be shown that an effective brain-computer interface can be designed via correlation of mental commands to actions of the radio system. Traditional biosignal processing algorithms were applied to the output EEG signals from the Emotiv EPOC+ headset in an attempt to localize physiological phenomenon. The algorithms presented in this article may provide a means to realize an accurate real-time BCI. Conclusions will be drawn regarding the feasibility and performance of the Emotiv EPOC+ as the BCI frontend.

**UTILIZING MULTIPLE MICROMODEMS FOR UNDERWATER COMMUNICATION**
**Antonios Doliotis (Columbia University)**
**Category & Time:** Electrical and Computer Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 227
**Mentor(s):** Osama Ennasr (Electrical Engineering), Xiaobo Tan (Electrical Engineering)

Micromodems are electronic acoustic communication devices that modulate incoming signals with data and sends the modulated signal to another device. Micromodems utilize frequency-shift keying (FSK) and phase-shift keying (PSK) modulation for underwater communications. Micromodems have been used for deep sea expeditions and submarines, and they have been tested to work at depths up to 11,000 feet. Micromodems transmit data faster using PSK modulation instead of FSK modulation. Each micromodem will have their own host microcontroller, and the two micromodems need to communicate wirelessly with each other as well as their respective host. One host will emit a ping that will be received by both micromodems. The micromodems will acknowledge that a ping was received and send a messages back to their host. After the ping, the distance between each micromodem will be calculated based on the type of signal used and the medium the micromodems are in (water or air). In addition, the micromodems must be able to detect if the other micromodem has received an FM sweep or mini-packet data. The micromodems will be tested and programmed on land first, then they will be installed on robotic fish to test their communication speed and efficiency in water. Once the two micromodems can successfully communicate underwater with each other and the host, more micromodems will be used to communicate with each other and the host in a mesh network. Using a large group of micromodems will be useful for effective deep sea communications for underwater rovers and submarines.

**INDUSTRIAL CALIBRATION ROBOT**
**Yan Liu (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 228
**Mentor(s):** Yunyi Jia (Electrical Engineering)

Our research lab is currently focusing on the Development of a Position Sensitive Device and Multi-position Alignment Control System. In today's industrial society, a large amount of industrial factories are using Industrial Robots, have a high repeatability but have low accuracy. The low accuracy and high repeatability of the robot are the two main reasons that the industrial society has a high demand of robot calibration. A new calibration system with low coast and higher accuracy is proposed and developed in our lab. To overcome the difficulty of implementing the pre-calibration and the low efficiency, DUAL PSD Calibration System is implemented. Because of the inaccuracy due to the joint offset and initial positions, an Offset Calibration System is implemented and forward kinematics model is developed

**EXTRACTION OF THE ELECTRIC AND MAGNETIC PROPERTIES OF ABSORBING MATERIALS USING A WAVEGUIDE STEP SYSTEM**
**Sean Ellison (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 230
**Mentor(s):** Jonathan Frasch (Electrical and Computer Engineering), Edward Rothwell (Electrical and Computer Engineering)

The ability to obtain the electromagnetic (EM) properties of a material is profoundly important. EM waves interact with all the materials around us and it is crucial to understand the interaction to predict the behavior of electrical systems and devices. Since the interaction is determined by the permittivity and permeability of the material, it is important to have a way to measure these parameters. We are attempting to obtain these properties by placing the material in an X-band waveguide and measuring the scattering parameters. The goal of this research is to develop and build a test system for samples whose heights do not completely fill the waveguide. Our hypothesis is that we can build small metal steps to gradually transition the waveguide's height to the height of the material sample to reduce the reflection component of the scattering parameters. To determine the proper sizes of steps, we ran several MatLab simulations that interfaced with a Fortran executable and with the commercial EM simulator HFSS to compute the S-parameters, then used an optimizer to maximize transmission through the system. We will construct the optimum step configuration using 3D printing, metalize the structure by sputtering copper, and verify the performance of the structure using measured data.

**IMPROVEMENT OF 3D MODEL OBJECT DETECTION ALGORITHMS**
**Israel Figueroa (University of Puerto Rico - Mayaguez)**
**Category & Time:** Electrical and Computer Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 231
**Mentor(s):** Daniel Morris (Electrical and Computer Engineering)

INTRODUCTION: Our main goal is to assess the robustness and accuracy of a 3D Object Detection method. The algorithm searches for previously scanned objects in a scene observed by a 3D scanner, and when it finds them, estimates their poses. METHODS: I first implement 2D and 3D point alignment algorithms that can score how well objects align, using the approach of average distance between two different objects. Then I have to work whit the development of searching algorithms that seek for the best matches of objects in a scene, manipulating its translation and rotation parameters. After that, I have to get the rotation and translation that were applied to the object as well as plot the object to be matched, the object with the scene that I am trying to match, and the object matched with the scene. Finally we check again how well objects align, using the point alignment algorithms and know how close or how far the object to be matched is from the scene object and try to improve that, reprogramming the different searching methods until we get a more accurate 3D Object Detection algorithm. RESULTS: We predict that our method's error percentage will decrease, meaning a more efficient algorithm. CONCLUSION: 3D Object Detection will be an advance on useful applications like Camera Surveillance, Biometrics, Robotics, and among others technology services.

**OPTIMAL GRASP FORCE CONTROL FOR A PARALLEL GRIPPER USING TACTILE PERCEPTION**
**Nicholas Gilreath (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 232
**Mentor(s):** Yu Cheng (Electrical and Computer Engineering), Yunyi Jia (Electrical and Computer Engineering), Ning Xi (Electrical and Computer Engineering)

Manufacturing companies are looking to move towards a more automated way of performing tasks including moving items around and organizing them. The goal of this research project is to design an algorithm that can generate optimal grasp force based on temporal sliding velocity of the grasped object. Optimal force means it is firmly being grasped without too much force to destroy it nor too little force to drop it. The designed LQR optimal controller tries to stop the slippage as soon as possible by minimizing the sliding distance. In the meanwhile, it tries to minimize the energy cost of the electric motor inside the gripper. The sliding velocity of the grasp object is estimated from real-time tactile perception. The proposed algorithm has been validated through MATLAB simulation. The robot uses a two-jaw gripper as a means to pick objects up. The robot will need to maintain a certain level of safety in case there is a mechanical or environmental disturbance, such as mechanical vibrations or a tap on the arm of the robot. In addition, the grasp force used should be minimized to help reduce the energy cost of the electric motor. The gripper has built in 6x14 tactile sensor array on each side of the gripper to collect data. The robot will need to be able to adjust for any slippage that may occur while the robot is in motion. The robot will also need to be able to adjust for slippage under translational movement and rotational movement.

**ADAPTIVE AND PROGRAMMABLE PLATFORM FOR AUTOMATED ELECTROCHEMICAL SENSOR DATA ACQUISITION**
**Yousef Gtat (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 233
**Mentor(s):** Andrew Mason (Electrical and Computer Engineering)

A platform for experiment design and automation achieved by employing lab instruments control, constructing data acquisition models, and applying signal analysis techniques for electrochemical gas sensors; with the ability to trace back an experiment throughout the provenance of data. The platform is modular therefore it is extendable and flexible to adapt new equipment, experimental methods, and data analysis techniques through user-plugins to meet specific design requirements. The platform is automatic resulting in uniform and repeatable experiments actuated by back-end computer program written in Python, which provides users the ability to design, execute and choreograph experiments via a novel interface. Meanwhile, real-time data digitization and arbitrary waveform generation is performed by custom software, written in C++, on a Texas Instruments C5517 DSP. This embedded target is regarded by the host hardware manager as an ordinary piece of lab equipment. The platform depicts the obtained data from the executed experiment in a higher level of abstraction, yet providing users the ability to refine the data provenance decomposing it to concrete degree.

**CHARACTERISTICS OF MOVING OBJECTS USING ECHOLOCATION**
**Brandon Harrington (Virginia State University)**
**Category & Time:** Electrical and Computer Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 234
**Mentor(s):** Subir Biswas (Electrical and Computer Engineering), Faezeh Hajaighajani (Electrical and Computer Engineering)

Echolocation is a biological sonar used by animals, such as bats and dolphins, in which the animal sends out a call and uses the echo to locate and identify surrounding objects. Ultrasonic sensors transmits high frequency sound waves and wait for an echo that is received back by the sensor. The distance of an object is determined by the time interval between the transmitted signal and the received echo. The objective of this work is to analyze time-series echo data in order to infer moving object dynamics, specifically those caused by human activity. We use data from a single ultrasound echolocation sensor as well from an array of sensors to characterize various types for human movement. Target applications include human posture classification under noisy ambient conditions. Our objective also includes the development of an end-to-end networked system that collects data from a set of sensors, sends it to a centralized server, and presents processed results to internet-connected handheld devices such as tablets and smartphones.

**HIGH PERFORMANCE ARCHITECTURES FOR REAL-TIME CYLINDER PRESSURE ESTIMATION**
**Joshua Mack (University of Arizona), Sam Bellestri (University of Alabama), Nia Simmonds (Case Western Reserve University)**
**Category & Time:** Electrical and Computer Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 237
**Mentor(s):** Daniel Llamocca (Oakland University: Electrical and Computer Engineering)

Hardware-in-the-Loop (HIL) Testing is a cost efficient method of development in complex real-time embedded systems. It has particular strengths in automotive systems design because it allows for testing of a vast number of configurations that would otherwise be infeasible. In many applications, dedicated hardware implementations are preferable to software implementations. We present a reconfigurable architecture for evaluating various engineering models, with a specific emphasis on cylinder pressure estimation in automotive engines. We utilize CORDIC, an iterative shift-and-add algorithm that allows for efficient hardware implementation of various trigonometric and hyperbolic mathematical expressions, as the basis for our architecture. Both fixed-point and floating-point architectures are considered. Trade-offs among design parameters (e.g.: word-length, number of CORDIC iterations), resource usage, and execution time are explored. The generic and parameterized architectures are developed in VHDL and validated using an FPGA implementation. The developed hardware shows great promise as it allows for fast and efficient computation of cylinder pressure estimation in automotive engines.

**PLASTICITY IN THE ELECTRICAL PROPERTIES OF NEURONS SURROUNDING NEUROPROSTHESES**
**Demetrius Moncrease (Michigan State University), Joseph Salatino (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 238
**Mentor(s):** Erin Purcell (Engineering)

Microelectrode array implantation is one of the most useful techniques in which neural activity can be examined, and electrode arrays can be used in a wide variety of research and clinical neuroprosthetic applications. However, one of the limitations to this technology is inconsistency in long-term performance; small signal amplitude and signal instability undermine the function of these devices. These inconsistencies may be due to a variety of factors such as device degradation, device malfunction or the reaction of nearby tissues following implantation, but understanding of the mechanisms underlying device failure is incomplete. In this study, we are assessing the impacts of device implantation on the ion channel expression in neurons local to implanted microelectrode arrays, since alterations in the expression of these channels would change the fundamental nature of the signals recorded by electrode arrays. Using immunohistochemistry and confocal imaging, we observed increased expression of the NaV1.6 ion channel in neurons near silicon microelectrode arrays implanted in the motor cortex of adult female rats. NaV1.6 is one of several voltage gated sodium ion channel subtypes expressed in neurons and plays a key role in signal generation. We used intensity profiling to quantify this response in comparison to contralateral control tissue, and early results verified elevated expression of the NaV1.6 channel around the device. We are currently expanding upon the data collection and exploring expression profiles in other subtypes of voltage-gated ion channels.

**TRANSFERRING PROCEDURES INTO MACHINE CODE**
**Samuel Scime (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 239
**Mentor(s):** Sam Boling (Computer Engineering), Andrew Mason (Electrical Engineering)

The purpose of my research is to allow a user, who is foreign to computer languages and models, to still be able to run code. I am creating a program that takes a document, containing user instructions, and then translating those instructions in to a script, usable by a computer. This program will give users the flexibility to run steps in an experiment both systematically and concurrently. There will also be a webpage available that allows a user to drag and drop devices to be used in an experiment. My immediate intention for this research is to fit the translating program into an archiving system. The archiving system will be able to store lab experiments along with the experiment's results. The user will be able to access the archiving system's database to conduct their experiments or other users' experiments. My piece's role in the project is to receive a user's file upload, and then create a function call, allowing user access to machines. A future possibility of my research is to allow a user more flexibility in inputting instructions. This would make programming even easier.

**OPTICAL TRACKING OF VO2-BASED MICRO-ACTUATOR USING ARDUINO AND LABVIEW SOFTWARE**
**Nelson Sepulveda-Ramos (University of Puerto Rico Mayaguez)**
**Category & Time:** Electrical and Computer Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 240
**Mentor(s):** Nelson Sepulveda Alancastro (Electrical & Computer Engineering), Tongyu Wang (Electrical Engineering)

This project presents a LabVIEW application and hardware implementation for optical monitoring of micro-devices. The system uses a single video camera connected to the PC via USB interface to track the movement of the device. The spatial information obtained from the camera is used to control a laser that is meant to track the device. An Arduino Uno and a stepper driver controller are used to move the laser holder. The image acquisition and processing is realized in LabVIEW graphical programming environment. LabVIEW provides a compatible interface for the Arduino, which makes it easier to provide commands to accurately control the movement of the stepper motor. The present implementation will provide the foundation to completely control and track the movement of VO2 microactuators in water using easily accessible and inexpensive equipment.

**EFFECTS OF MUSCLE FATIGUE USING ELECTROMYOGRAPHY**
**Diana Szeto (Oakland University), Hannah Fan (University of Michigan)**
**Category & Time:** Electrical and Computer Engineering, Section 3, 3:00 PM - 4:00 PM
**Poster:** 241
**Mentor(s):** Megan Conrad (Oakland University: Industrial and Systems Engineering)

Previous studies have shown that as muscle fatigues, an increase in root-mean-square amplitude (RMS) and a decrease in median frequency (MF) can be observed in its EMG signal. Studies also indicate that age has an effect on muscle recovery time after fatigue (Adamo et al., 2010). The purpose of this study was to analyze the effects of muscle fatigue using two techniques: RMS and MF. Four subjects were divided into two groups: two younger adults and two older adults. They each followed two protocols (Continuous and Intermittent) in which they were instructed to exert 50% of their maximum voluntary contraction for varying periods of time using a pinchometer connected to the Biometrics DataLOG System (Biometrics Ltd, Newport UK). The Continuous Protocol measured the effects of muscle fatigue during a sustained voluntary contraction while the Intermittent Protocol assessed the effects of fatigue during intermittent voluntary contractions after varying recovery times. The six muscles analyzed in this experiment include the first dorsal interosseous, thenar group, hypothenar group, flexor digitorum superficialis, extensor digitorum communis, and brachioradialis. The preliminary results indicate an overall increase in RMS and decrease in MF for each muscle as expected for the Continuous Protocol. The results for the Intermittent Protocol display as expected for shorter rest periods, but as recovery time increased, the RMS and MF values did not show an overall increase or decrease. Hence, further investigation into the effects of the length in recovery time for muscles may be necessary to reach a conclusion.

**EXPLORATION OF MICROCONTROLLERS WITH THE ARDUINO UNO**
**Elizalde Vasquez (Michigan State University), Zoinul Choudhury (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 244
**Mentor(s):** Kyle Foster (Diversity Programs Office)

A microcontroller is a small and low cost computer that can be used to control various functions of a machine or device. For example, the alternating red and blue lights found on police cars, or the lights on your coffee machine indicating whether or not your coffee is ready, are both controlled by microcontrollers. The Arduino Uno is a consumer friendly, low cost microcontroller that can be used to educate on how

microcontrollers are currently used today. This research, focuses on the exploration of its capabilities. A series of fifteen hands on projects were completed to explore the ways microcontrollers listen to sensors to observe the world. Additionally, these projects highlighted how microcontrollers talk to actuators to take action in the physical world. This knowledge can then be applied and used as the building blocks for innovation and finding new applications for microcontrollers.

**USING THE MICROSOFT KINECT DEVICE TO MEASURE TREMORS IN PATIENTS WITH DEGENERATIVE DISEASES**
**Alyssa Werner (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 245
**Mentor(s):** Daniel Morris (Electrical and Computer Engineering)

Degenerative diseases such as Parkinson's often cause uncontrollable muscle movements in patients' limbs which must be monitored and measured in order for physicians to accurately prescribe medication and adjust dosages. Our goal is to develop an in-home monitoring device that can record patient's movements and be used to analyze tremors in the body, which will reduce the amount of time patients have to spend at their doctor's office. This project explores whether the Kinect is sufficient to function as such a monitoring device. The necessary tasks include demonstrating accurate frequency measurements and recovering very small tremors that are barely visible. The research discussed here will use one primary experiment, which will be performed on volunteer patients from Michigan State University's Neurology and Ophthalmology Clinic. The patients stand in front of a Kinect and raise one arm at a time while being recorded. They also have 3-axis accelerometers attached to key limbs during recording to act as ground truth devices. Then the data gathered from the Kinect is analyzed through use of a Fast Fourier Transform algorithm to determine the frequency and magnitude of the tremor. This data is then compared against that of the accelerometer to determine accuracy.

**CHARACTERIZATION OF A HYBRID ELECTRIC-GLOW-ENGINE POWER SYSTEM FOR MULTI-ROTORS**
**Tyler Wiegand (Oakland University), Cameron Kazokas (Wilkes University), Sean McNeil (Georgia Institute of Technology)**
**Category & Time:** Electrical and Computer Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 246
**Mentor(s):** Hamzeh Alzubi (Oakland University: Electrical and Computer Engineering), Osamah Rawashdeh (Oakland University: Electrical and Computer Engineering)

The goal of this project is to develop a hybrid power system that can increase the capabilities of a multi-rotor unmanned aerial vehicle (UAV) in terms of both flight time and payload. This hybrid concept is realized in the form of a traditional hex rotor, but with two of the six motors being driven through belts by an on-board glow-engine. The glow-engine spins the two motors (acting as generators with attached propellers) to provide lift as well as to produce electric power. The speed of the glow-engine is controlled to provide the majority of the lift necessary for flight while the electrical energy generated is utilized to power the remaining four motors for altitude and attitude control of the UAV and to charge the on-board battery. The current focus is on building and developing the mechanical structure of the vehicle and on characterizing the hybrid power system. Results from characterizing the glow engine and the generators used under varying input and load conditions are presented in this poster. These results are then used to select a viable glow engine-motor-propeller combination that outperforms a comparable electric-only hex rotor.

**OPEN SOURCE SCIENCE: A LOW COST ALTERNATIVE FOR RECORDING ELECTRIC FISH**
**Bailey Winter (Michigan State University)**
**Category & Time:** Electrical and Computer Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 247
**Mentor(s):** Greg Gage (Neuroscience)

One of the biggest barriers to young students interested in pursuing a scientific career is the lack of access to, and cost of equipment used to conduct experiments. Collaborating with Dr. Jason Gallant, the purpose of this project is to replace the equipment in his lab and in the field that is used to record the high frequency electric organ discharges (EODs) of Mormyrid fishes. Using a BeagleBone Black, a high speed analog to digital converter, and the Backyard Brains Muscle Spikerbox, this low cost, open source, and portable alternative allows those who live near these species' habitats to investigate their EODs and behaviors.

**WATER-JUMPING ROBOT**
**RUOWAN JI (Michigan state university)**
**Category & Time:** Electrical and Computer Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 248
**Mentor(s):** Ning Xi (Electrical Engineering), Jianguo Zhao (Electrical Engineering)

Water-Jumping robot which can store energy and jumping on the water. Basically this robot is made of one main body and two feet. There will be a carbon fiber between two feet, when we press them, they can store energy, and after we release them, they will give force to feet and make the feet flap the water then the robot can jump.

# EPIDEMIOLOGY AND PUBLIC HEALTH

**IS RATES OF SMOKING DECLINING AMONG MINORITY AND LOW-INCOME POPULATIONS WITH DIABETES AND HEART DISEASE IN FEDERALLY QUALIFIED HEALTH CARE CENTERS?**
**Ugochukwu Agbakwuru (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 1, 1:00 PM - 2:00 PM
**Poster:** 250
**Mentor(s):** Ade Olomu (Medicine), Elahé Crockett (Medicine)

According to the Center of Disease Control (CDC) 17.8 out of every 100 individuals over the age of 18 in the US is an active smoker. A 3% decrease from 2005 when 20.9 out of every 100 individuals, and a 7% decrease from 1995 when 24.7 out of every 100 individuals were active smokers. This draws a somewhat linear national smoking cessation by about 3% every 10 years. This is presumably a product of user and potential user information about the fact that the CDC names cigarette smoking as "the leading cause of preventable disease and death in the United States, accounting for more than 480,000 deaths every year, or 1 of every 5 deaths." The joint study between Michigan State University and Ingham County Federally Qualified Healthcare Centers (FQHCs), seeks to determine the rate of smoking among diabetic and heart disease patients that receives care at FQHCs. We obtained smoking history from Over 400 patients enrolled in the Office-Guidelines Applied to Practice (Office-GAP) Program. The Office-GAP program is designed to improve secondary prevention of heart disease for patients with diabetes and heart disease in FQHCs. Through analysis of patient provided data this study will determine if the same 3%/10yr smoking cessation trend is applicable or more broadly if data of enrolled patients in medically underserved communities correlates with the current national 17.8% estimate. This project will do so by comparing the smoking rates of patients enrolled in the study to those of the national average. Support: U.A. is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**IS CANNABIS USE ASSOCIATED WITH CARDIOVASCULAR HEALTH: A PROBE INTO THE FREQUENCY OF CANNABIS USE AND POTENTIAL MODULATION OF ANTIOXIDANT COMPOSITES**
**Marven Cantave (Case Western Reserve University)**
**Category & Time:** Epidemiology and Public Health, Section 1, 1:00 PM - 2:00 PM
**Poster:** 251
**Mentor(s):** Omayma Alshaarawy (Biostatistics and Epidemiology), James Anthony (Biostatistics and Epidemiology)

Pre-clinical reports have found cannabinoids, the chemical constituents of cannabis, to be protective of certain cardiovascular outcomes (i.e., inflammation, vasoconstriction/high blood pressure), but evidence has also linked cannabis use to increased risk of various disorders like myocardial infractions (Mittleman et al, 2001). To examine the issue we ask: Do frequent cannabis users have better cardiovascular health (CVH) status than non-frequent past users? Using a sample of ~1000 participants from the National Health and Nutrition Examination Survey (NHANES) we plan to perform multiple regression analyses to estimate the association between biomarkers indicative of CVH (e.g., C-Reactive Protein) and frequency of cannabis use over a 30 day period. Also, wanting to assess the potential modulating role of an antioxidant composite (AOC) on this relationship, we will also use biomarker data related to the AOC (i.e., Vitamin A, C, D, E, and Carotenoids) to create a latent variable and use structural equation models to assess the associations. Controlling for potential confounders, which include age, sex, BMI, physical activity, cigarette smoking, alcohol status, fruit and vegetable consumption, and socioeconomic measures (i.e., race, income, education), our aim is to provide empirical evidence about the safety of cannabis use through statistical modeling which assesses how frequency of cannabis use is associated with specific CVH biomarkers, and also how these relationships are modulated once an AOC is included in the model.

**EVALUATION OF CHOLESTEROL ASSESSMENT AND MANAGEMENT IN DIABETIC AND HEART DISEASE PATIENTS IN FEDERALLY QUALIFIED HEALTH CARE CENTERS: THE OFFICE GUIDELINES APPLIED TO PRACTICE (OFFICE-GAP) PROGRAM**
**Crystal Holley (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 1, 1:00 PM - 2:00 PM
**Poster:** 252
**Mentor(s):** Elahé Crockett (Medicine), Ade Olomu (Medicine)

Hyperlipidemia is a condition in which there's an abnormally high concentration of lipids in the blood. People who have diabetes have a high risk of developing cardiovascular disease, which is the number one cause of mortality in diabetic patients. Through managing LDL cholesterol levels to below 100mg/dL, using medication, diet, and/or exercise, diabetic patients can reduce the risk of developing cardiovascular diseases and improve dyslipidemia. This study will examine cholesterol management in patients with diabetes and cardiovascular diseases in low-income, minority populations. Assessing the cholesterol of patients from the intervention site (River Oak Community Health Center) and the control site (Cedar Street Clinic) through examination of patient medical records involved in the Office-Guideline Applied to Practice (GAP) program. This includes examining whether or not the cholesterol of each patient is being assessed, and collecting information on the LDL cholesterol levels among those who have had their cholesterol levels checked. Many patients start cholesterol-lowering medications, such as statins or other lipid medicines, after being diagnosed with diabetes mellitus type-2 or cardiovascular diseases. However, not all patients are eligible utilize these medications due to age restrictions or not have hyperlipidemia, and thus are given a different management program to follow such as a low-cholesterol diet and exercise program. The results of this study can be used as a way to help improve cholesterol management in diabetic patients and/or patients with cardiovascular diseases. Support: Crystal Holley is an NHLBI scholar, supported by NIH-5-R25-HL108864 award to Elahé Crockett, REPID-Program Director.

**COMMERCIAL-GRADE CHARBROILING HAMBURGER EMISSIONS AND ITS EFFECT ON DENDRITIC CELLS INDUCED BY LPS**
**David Johnson (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 1, 1:00 PM - 2:00 PM
**Poster:** 253
**Mentor(s):** Ning Li (Integrative Toxicology)

Epidemiological and experimental evidence has established a close association between ambient particulate matter (PM) and allergic airway disease including asthma. Commercial charbroiling emissions are a major source of urban PM. Studies have found that PM emitted from charbroiling meat contains almost exclusively organic carbon such as polycyclic aromatic hydrocarbons (PAH), many of which have been shown to have adverse cellular effects including inducing oxidative stress, inflammatory response, and cytotoxicity in human bronchial epithelial cells. One of the major mechanisms by which PM contributes to asthma pathogenesis and exacerbation is to alter the immune response through interfering with the function of antigen presenting dendritic cells (DC). The organic extract of PAH-rich PM (e.g. diesel exhaust particles) can effectively inhibit lipopolysaccharide (LPS)-induced response in DC. We tested our hypothesis and discovered that the organic compounds emitted from commercial-grade charbroiling hamburger operations (CH-OC) can suppress DC response induced by LPS; leading to the altered immune response that favors T helper-2 immunity and this effect is mediated through cellular oxidative stress. We exposed bone marrow-derived DC to LPS with and without CH-OC and assess cellular oxidative stress and inflammatory response using the techniques of western blot and ELISA. We found that CH-OC will inhibit LPS-induced DC response through a mechanism involving oxidative stress and saw an induction of

antioxidant enzyme heme oxygenase-1 (HO-1), a sensitive marker for PM-induced oxidative stress, by CH-OC. Inhibition of LPS effect by CH-OC will be reflected by the decreased release of IL-12 from DC that are exposed to a combination of LPS and CH-OC compared to those treated with LPS alone.

**DETERMINATES OF OVERWEIGHT AND OBESITY AMONG MIGRANT AND SEASONAL FARMWORKER CHILDREN IN MICHIGAN**
**Crystal Nance-Panek (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 2, 2:00 PM - 3:00 PM
**Poster:** 256
**Mentor(s):** Elahé Crockett (Medicine), Sujin Song (Food Science and Human Nutrition), Won Song (Food Science and Human Nutrition)

Background: Each year, there are over one million migrant and seasonal farmworkers (MSFW) in the United States, nearly all were born in Mexico, Puerto Rico, or Central America, and approximately one third are migrants (United States Department of Agriculture, 2009). Michigan employs nearly 50,000 MSFWs each year. MSFWs and their families are one of the most economically disadvantaged and most vulnerable groups in the U.S. Childhood obesity among Latino children has increased substantially, placing them at risk for related health consequences. Knowledge of childhood obesity among MSFW communities is limited. (Rosado, 2013) Objective: This study aims to examine (1) the prevalence of obesity among MSFW children in Michigan Migrant Head Start (MMHS) programs and (2) the association between variables such as number in household, English proficiency, full/part time employment, movement in 24 months, WIC/SNAP participation, and geographic area and childhood obesity. Methods: We will analyze 2012-2013 Head Start data from 20 of Telamon's MMHS centers in Michigan using Statistical Analysis Software 9.3 (SAS). Results: The data is currently under review. We expect larger households, less English proficiency, part time employment, movement in 24 months, and combined WIC/SNAP participation to be associated with lower levels of obesity. Conclusion: The results of this study will lead to a better understanding of determinates of obesity in this population, which will support policy and public health efforts to improve the lives of MSFW families. Support: C.N.P. is a REPID scholar, supported through NIH-5-R25-HL108864-award to Elahé Crockett REPID-Program Director.

**STUDYING THE RELATIONSHIP BETWEEN BMI AND VAGINAL MICROBIOME AMONG PREGNANT WOMEN**
**Rehnuma Newaz (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 2, 2:00 PM - 3:00 PM
**Poster:** 257
**Mentor(s):** Elahé Crockett (Medicine), Claudia Holzman (Epidemiology and Biostatistics)

The Pregnancy Outcomes and Community Health (POUCH) study is a research project carried out in 1998-2004, with ongoing additional studies such as the POUCH Microbiome Project. My project is studying the relationship between maternal body mass index (BMI), vaginal microbiome, and bacterial vaginosis (BV) during pregnancy. It is important to study the vaginal microbiome because adversities here can cause impairments in women's reproductive system. We hypothesized that the association between BMI and microbes vary by race and that the underweight, overweight, and obese women compared to normal weight women have more BVAB (BV associated bacteria) community and a different lactobacilli profile. From the original POUCH study cohort a sub-cohort women with available vaginal samples from mid-pregnancy were studied (N=805). The women were analyzed by race, specifically white/others and African American women. The vaginal fluids were collected, frozen, and then analyzed for microbial DNA coding for 16s RNA, using PCR and 454 Life Sciences pyrosequencing technology clustering analysis. The Nugent scoring criteria was used to asses BV presence. For statistical analysis, weighted logistic regression was applied to determine odds ratios and their 95% confidence intervals for each category. So far, our data have shown no association or statistical significance between BMI and microbial communities within racial groups. However, we did find varying lactobacillus profile, such as white/other women have more lactobacillus crispatus and African American women have more lactobacillus iners. Further analyses are in progress and results will be valuable in diagnosis of adverse outcomes in pregnancy. Support: R.N. is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**DESCRIPTIVE CASE SERIES IMPLEMENTING PREVENTATIVE STRATEGIES FOR INJURIES FROM WORK-RELATED FALLS IN MICHIGAN**
**Roya Omari (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 2, 2:00 PM - 3:00 PM
**Poster:** 258
**Mentor(s):** Elahé Crockett (Medicine), Melissa Millerick-May (Medicine), Kenneth Rosenman (Medicine)

Introduction: Many American workers are exposed to fall hazards at work. According to 2013 data, 724 workers were killed and 229,190 workers were seriously injured by falls. In 2009, nonfatal fall injuries accounted for approximately 20% of all injuries in the workplace. According to the Center for Disease Control and Prevention the highest rate of fall related deaths are experienced by construction workers. However, the highest count of nonfatal fall related injuries are associated with health services, wholesale, and retail industries. These injuries comprise a substantial financial burden- at $70 billion annually in the U.S. Objective: To analyze nonfatal falls identified in a multisource surveillance system for work-related injuries in Michigan. Methods/Results: Two sources of data were used: 1) Medical records from Michigan's 136 hospitals/clinics of individuals who had a skull fracture in 2014. 2) Medical records of individuals hospitalized overnight for acute trauma where workers' compensation was the payer. Data for fall–related injuries from these two sources were compiled and included worker demographics (e.g. age, gender, and race), type of injury sustained, and industry. The Analyses were performed to determine the association between falls and season, industry, age, gender, type of injury, county, and severity of injury. Conclusions: Over 400 work-related fall injuries requiring hospitalization and/or emergency room visits were reported in Michigan in 2014. Strategies to prevent and minimize the severity of work-related fall injuries in Michigan will be presented. Support: R.O. is a NHLBI scholar, supported by an NIH -5R25-HL108864 award to Elahé Crockett, REPID-program Director.

**EVALUATION OF DIVISION I ICE HOCKEY PRACTICES AND GAMES VIA HEART RATE MONITORING AND DIRECT OBSERVATION: A PILOT PROJECT**
**Justin Shureb (Michigan State University)**
**Category & Time:** Epidemiology and Public Health, Section 2, 2:00 PM - 3:00 PM
**Poster:** 259
**Mentor(s):** Jim Pivarnik (Kinesiology), Ashley Triplett (Kinesiology)

Heart Rate (HR) monitoring (via telemetry) is used to assess sport training intensity, but the validity of such measurements has not been assessed in collegiate ice hockey. PURPOSE: We compared assessment of on-ice practice intensity via HR monitoring to direct observation. HR monitoring was then used to compare practice and game intensities. METHODS: On-ice practices consisted of high intensity drills, tactical discussions, and game simulations. HR was divided into five intensity zones (50-59%, 60-69%, 70-79%, 80-89%, and 90-100% of maximal HR) for analysis. Direct observation was used to classify intensity into four observation zones (2-5). Percentage of time spent in each HR and direct observation zone was computed for weekly practices on 12 players. Percentage of time spent in each HR zone was also computed for 3 games on athletes playing regular shifts. RESULTS: HR telemetry showed 29.7% of practices were spent at 50-59% of HR max, 23.4% at 60-69%, 22.1% at 70-79%, 22.2% at 80-89%, and 2.7% at 90-100%. Direct observation showed 58.2% of practice time was spent at an intensity level of 2, 28.9% at 3, 12.3% at 4, and 0.6% at 5. Players observed during competition showed 26.6% of games were spent at 50-59% of HR max, 31.9% at 60-69%, 17.6% at 70-79%, 16.4% at 80-89%, and 7.5% at 90-100%. CONCLUSION: HR monitoring appears to be a valid indicator of hockey practice intensity, compared to direct observation. HR data indicate that practice intensity is similar to game intensity for players playing regular shifts.

# INTEGRATIVE BIOLOGY

### SEX-SPECIFIC PHENOTYPES IN A PREDATOR EXPOSURE MODEL OF POST-TRAUMATIC STRESS DISORDER (PTSD)

**Rebecca Benjamin (Michigan State University)**

**Category & Time:** Integrative Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 262
**Mentor(s):** Marc Breedlove (Neuroscience), Cynthia Jordan (Neuroscience), Apryl Pooley (Neuroscience)

Women are more than twice as likely to develop PTSD as men; however, the reasons for this sex difference are not well understood. One possible reason for this disparity is underlying differences in the neurobiological mechanisms mediating the response to traumatic stress in men and women. Previous research from our lab using single prolonged stress (SPS), a validated PTSD animal model, indicated that female rats do not respond to SPS with the same behavioral, physiological, or cellular phenotype established in male rats. It is clear that males and females respond to stress differently, but whether these sex-specific responses are related to the characteristics of the stressor itself is not clear. To address this concern, we used another validated animal model of PTSD, the predator exposure (PredEx) model, in which the traumatic stressor is exposure to a cat. Using this model and same outcome measures that were used in our SPS study, we found that both models yielded the same pattern of sex-specific results, indicating that this sex difference is a result of traumatic stress in general, not one particular model or stressor. To our knowledge, this is the first study to examine PredEx in female rats.

### STRUCTURAL AND INFLAMMATORY ALTERATIONS DUE TO HIGH FAT DIET FED IN FEMALE AND MALE RATS

**Evan Carter-Taylor (Michigan State University)**

**Category & Time:** Integrative Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 263
**Mentor(s):** Hui Xu (Pharmacology and Toxicology)

Increased peripheral resistance by vascular remodeling/fibrosis contributes to hypertension, tissue hypoperfusion and complications in patients with obesity. Our lab has reported that HF-induced obesity promotes vascular remodeling/fibrosis, but does not necessarily promote hypertension in male mice. It has been reported that obesity-induced vascular remodeling/fibrosis may be mediated by inflammation and hyperglycemia. To determine if vascular remodeling/fibrosis and inflammation are unique changes in all HF-induced obese rodents, we compared the vascular structure in male and female rats fed with HF and control diets, we also determined if inflammation occurs in these HF fed rats. Sprague Dawley rats were divided into 4 groups at the end of 4 weeks and fed either a control diet (10 kcal% fat) or HF diet (60 kcal% fat) for 20 and 48 weeks. Mesentery, kidney and heart were collected and fixed. Morphological assessment of vascular collagen deposition was determined in Paraffin-embedded slices by Masson's trichrome staining. The inflammatory markers TNF-a and MCP-1 levels in plasma were analyzed using ELISAs, We found that all HF rats were obese and normotensive, but without diabetes, vascular remodeling/fibrosis in mesentery, heart and kidney, and the changes of TNF-a and MCP-1 levels. To assess immune cell infiltration in tissues, activated macrophages will be identified in the slices using immunocytochemical staining with anti-galectin-3 antibody. We expect that tissues from HF rats will lack the macrophage infiltration. Our studies suggested that hyperglycemia may play a key role in obesity associated vascular remodeling/fibrosis, regardless of age and gender.

### EXPLORATION OF CELL WALL COMPOSITION AND LIGNIN PATHWAY GENETIC VARIATION IN PANICUM HALLII, A DIPLOID MODEL FOR SWITCH GRASS

**Karen Chanchavac (Spring Arbor University)**

**Category & Time:** Integrative Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 264
**Mentor(s):** Billie Gould (Plant Biology), David Lowry (Plant Biology)

Background: Cell wall chemistry is an important determinant of the efficiency by which switchgrass can be converted to biofuel. Lignin is a part of plant cell walls that provides robustness and protection from insect damage, but makes it difficult for digestion. The goal of my project is to quantify lignin content in two ecotypes of Panicum hallii, a diploid model for switchgrass, and to characterize genetic variation near lignin pathway genes. Methods: We grew replicate plants from 40 populations in a greenhouse. At maturity, plants will be harvested and submitted to GLBRC facility for lignin and hemicellulose content analysis. To determine sequence variations of lignin pathway genes, we used BLAST searches in Phytozome to identify lignin pathway genes similar to switchgrass. We then designed primers near putative indels in these genes using the genome of P. hallii. We used Sanger sequencing to get the sequence of target regions and multiple alignments to examine sequence variation. Results: Preliminary data on cell wall chemistry shows P.hallii contains more glucose and less xylose than P.virgatum. The amount of specific sugars in a hybrid of lowland and upland P.virgatum suggests a possible influence of the maternal cytoplasm. Lignin content is higher in upland vs. lowland P. hallii. PCR for variable genome regions captured the correct target, but further sequencing is necessary to validate the presence of genetic variation. Conclusion: Further research will use these findings to help improve of cell wall digestibility for biofuel production in switchgrass.

**THE ROLE OF NRF2 IN THE REGULATION OF IL-17A PRODUCTION BY ACTIVATED T-CELLS**
**David Cook (Michigan State University)**
**Category & Time:** Integrative Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 265
**Mentor(s):** Cheryl Rockwell (Pharmacology and Toxicology)

Nuclear factor erythroid 2-related factor (Nrf2) is a transcription factor responsive to oxidative and electrophilic stimuli that regulates a number of cytoprotective genes. Nrf2 activators range from reactive oxygen species to electrophilic xenobiotics, one of which is tert-butyhydroquinone (tBHQ), a widely used food additive. Several studies suggest that Nrf2 modulates inflammatory immune responses in numerous murine models. Nrf2-null mice are more sensitive to inflammatory stimuli, such as experimental autoimmune encephalomyelitis and sepsis. The pro-inflammatory cytokine interleukin-17A (IL-17A) is secreted by T-cells and other immune cell types. High levels of IL-17A are associated with inflammation. Our lab observed that tBHQ treatment skews mouse CD4+ T-cell differentiation toward the Th2 subtype, suggesting that Nrf2 modulates T-cell function. However, the role of Nrf2 in regulating Th17 differentiation is unclear. Thus, the aim of the current studies is to determine the effects of Nrf2 on IL-17A secretion by CD4+ T-cells. For these studies, wild-type and Nrf2-null mouse splenocytes were treated with tBHQ (0.1-1μM) or vehicle (0.01% ethanol) for 30min, then the T-cells were activated with either phorbol myristate acetate and ionomycin or with antibodies against the T-cell receptor and a co-stimulatory receptor. 24h after activation, supernatants were collected and concentrations of IL-17A were quantified by ELISA. Results thus far have been inconclusive due to variability between experiments. Thus, further studies will be needed to determine the role of Nrf2 in the regulation of IL-17A production by activated T-cells. (This work was funded by NIH grant: ES018885.)

**STUDYING ASSOCIATIVE LEARNING IN ECOLOGICALLY DIFFERENTIATED STICKLEBACK SPECIES USING AN AUTOMATED DEVICE**
**William Fetzner (University of North Carolina Wilmington)**
**Category & Time:** Integrative Biology, Section 1, 1:00 PM - 2:00 PM
**Poster:** 266
**Mentor(s):** Jenny Boughman (Integrative Biology), Jason Keagy (Integrative Biology)

Optimal Foraging Theory proposes that individuals that obtain the greatest amount of food while expending the least amount of energy will have higher survival and/or reproductive success. In nature, there are situations where an individual repeatedly comes in contact with stimuli that signal the location of their food. If an association between these stimuli can be made with their food, then the individual would be able to forage more optimally. A powerful method for studying evolution of such cognitive abilities is to compare closely related species that differ in ecology. We take advantage of the recent adaptation of marine threespine sticklebacks, Gasterosteus aculeatus, to two ecological niches ("limnetic" and "benthic") in freshwater lakes in British Columbia. Limnetics feed on patches of plankton that are plentiful, but unpredictable in space and time. Benthics feed on macroinvertebrates in mud or on plants that are much more likely to coincide with particular microhabitats. Optimal foraging theory predicts benthics can learn associations between relevant stimuli and food quicker than the limnetics. In this study, we prototyped a novel automated stimulus presentation/reward device where individual fish are rewarded with bloodworms if they activate a sensor following a light stimulus. By creating this device, experimenter disturbance of the animals is minimized and efficiency is maximized. This study opens the door for future research that manipulates schedules of reinforcement, adds an additional stimulus to test discrimination learning, investigates impulsive choices, etc. Our automated design will also be beneficial to researchers using fish as biomedical models.

**EFFECTS OF LESIONING THE DORSAL RAPHE NUCLEUS ON POSTPARTUM MATERNAL BEHAVIORS**
**Santiago Cordoba (Christopher Newport University)**
**Category & Time:** Integrative Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 269
**Mentor(s):** Joe Lonstein (Psychology)

Maternal behavior in rats and vertebraes has been of interest for studies in animal behavior and neuroscience due to its significant effects on infants' early development and understanding factors regulating the mothers' parenting behavior. During the postpartum period the mother experiences many behavioral changes such as decreased anxiety, increased aggression and increased maternal instinct. These behaviors are important for the care of offspring. Many neurochemicals are involved in regulating maternal behaviors. Serotonin is a neurotransmitter primarily released from the midbrain dorsal raphe nucleus (DRN) and is important for the regulation of anxiety, aggression, and social behaviors in non-parous animals. A previous study from our lab found that lesioning the DRN on the second day of postpartum disrupts nursing and decreases aggression towards intruders. The focus of this study is to determine whether the lesion will disrupt the natural onset of maternal caregiving. We will be injecting a neurotoxin into the dorsal raphe nucleus and observing the changes in postpartum behaviors including aggression, anxiety, and undisturbed maternal behavior towards pups. These observations will be taken to determine whether the dorsal raphe nucleus is necessary for the onset of postpartum behaviors. We expect that there will be an increase in anxiety and decrease in aggressive behavior and maternal actions such as nursing and licking. If our observation results in being significant the following research can be important for moving forward in understanding the neuroscience of postpartum maternal behavior.

**THE SUSCEPTIBILITY OF NSC34, MOTOR NEURON AND SPINAL CORD CELL LINE IN MEHG INDUCED TOXICITY**
**Perla Elosegui (Universidad de Puerto Rico)**
**Category & Time:** Integrative Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 270
**Mentor(s):** William Atchison (Pharmacology & Toxicology)

Methylmercury (MeHg) is one of the environmental contaminants that remain a global concern. MeHg exerts neurotoxicity leading to neuronal degeneration in the central nervous system and peripheral nervous system. This study aims to compare the susceptibility of MeHg induced toxicity in motor neuron, NSC34 cells and spinal cord cell culture with different MeHg concentrations. It is expected to decrease the percent of viability of the cells when increasing the concentration of MeHg. The percentage of cell viability was determined by Trypan Blue and Acridine Orange (AO) & Propidium Iodide (PI) stains, Trypan Blue is a molecule that is cell impermeable same as PI and will not enter the cells that are alive, on the contrary AO will stain the living cells. Using Trypan Blue when applying 0uM, 1uM, 2uM and 5 uM of MeHg indicated 84, 73, 47, and

7 percentage of viability, respectively. Likewise using AO/PI when 0uM, 1uM, 2uM and 5uM of MeHg was applied the percentage of viability was 77, 70, 51, and 1.5, respectively. The results indicated that the percentage of viability of the cells depends upon MeHg concentration, the greater MeHg concentration, the greater percentage of cell death. In addition, the morphology of the cells exposed to MeHg revealed the retraction of neuronal processes and nuclear membrane condensation, which represented cell-undergoing apoptosis.

**THE BRAIN'S VISUAL STRUCTURE VOLUME IN RELATION TO DAILY ACTIVITY PATTERNS: THE VOLUME OF THE LATERAL GENICULATE NUCLEUS IN VARIOUS DIURNAL AND NOCTURNAL RODENTS.**
**Bridgette Farley (Bay Path University)**
**Category & Time:** Integrative Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 271
**Mentor(s):** Jennifer Langel (Neuroscience), Laura Smale (Psychology)

Predictable daily changes in the environment have led to adaptations that produce and support activity during the day in diurnal animals and the night in nocturnal ones. One interest in the lab is in understanding how various sensory systems may have evolved to promote diurnality or nocturnality. Visual systems are of specific interest because photic cues available during the day may be absent at night. Light is captured in the retina and this photic information is sent to the lateral geniculate nucleus (LGN) of the thalamus, but little is known about the differences in this brain region in relation to diurnality or nocturnality. Photic information available during the day may have promoted the enlargement of the brain structures involved in visual processing, including the LGN. We are testing this hypothesis using the brains of two nocturnal species (hamsters and rats) and three diurnal ones (Nile grass rats, squirrels, and degus). Specifically, we are measuring the volume of the LGN in relation to the surrounding diencephalon in these animals. The first step has been to trace the LGN and diencephalon in a series of brain sections using ImageJ. We are currently using ImageJ to measure these areas to calculate LGN and diencephalon volumes; the ratios of these volumes will be used as an index of investment in the visual system. This analysis will help indicate the evolutionary changes in sensory systems that may have accompanied transitions between diurnal and nocturnal adaptations to the day/night cycle.

**THE EVOLUTION OF VOLTAGE-GATED SODIUM CHANNEL GENE EXPRESSION IN THE PERIPHERAL NERVOUS SYSTEM OF AMPHIBIANS**
**Alejandra Ferrer (University of Puerto Rico at Cayey)**
**Category & Time:** Integrative Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 272
**Mentor(s):** Heather Eisthen (Integrative Biology), Patric Vaelli (Integrative Biology)

Voltage-gated sodium channels (VGSC) are proteins found within the membranes of neurons and muscle cells. In an early vertebrate ancestor, a VGSC gene duplicated twice during two rounds of whole genome duplication to produce four orthologous VGSC genes. These genes further duplicated within tetrapods to produce six VGSC genes in amphibians and nine in amniotes including humans. Somatosensory perception in amniotes is mediated by three genes within the VGSC channel gene family that arose after the divergence of amphibians and amniotes. These three genes are expressed in the dorsal root ganglia (DRG) of amniotes, where they are involved in propagating electrical signals encoding touch, temperature, nociception, and proprioception. The sodium channels expressed in somatosensory neurons in amphibians are unknown. We are examining the peripheral nervous system of amphibians using the Mexican axolotl (Ambystoma mexicanum) as a model system to determine VGSC gene expression in the DRG. We dissected the DRG from an adult axolotl and extracted total RNA. We designed specific primers for each VGSC gene using sequences mined from the Salamander Genome Project and verified using the NCBI BLAST tool. We are performing PCR and gel electrophoresis to determine which RNA transcripts are expressed in the DRGs and will be submitting the products for Sanger sequencing to confirm gene identity. We expect that these results will help elucidate the genetic bases for somatosensory perception through the early evolution of tetrapods, as well as contributing to our understanding of evolutionary changes in expression of this important family of ion channels

**TYPE 1 DIABETES EXACERBATES BONE LOSS IN AN OVARIECTOMY MODEL OF MENOPAUSE**
**Sanna Fraleigh (Michigan State University)**
**Category & Time:** Integrative Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 273
**Mentor(s):** Laura McCabe (Physiology), Sandi Raehtz (Genetics)

Type 1 Diabetes (T1D), an autoimmune disease caused by destruction of pancreatic beta-cells, leads to little or no insulin production and complications including osteoporosis. With better therapeutics, T1D patients are living longer and post-menopausal T1D patients are increasing. We hypothesized T1D and menopause have an additive effect on bone loss. To examine this, female mice were ovariectomized (OVX) at 11-weeks of age causing estrogen deficiency similar to menopause (controls received sham surgery). One-week later T1D was by low-dose streptozotocin injection. Four-weeks later, general mouse parameters, bone density and marrow cell maturation were determined. TID groups showed lower body mass, elevated blood glucose levels and serum glycosylated hemoglobin (HbA1c) levels >7. Micro-computed tomography (micro-CT) imaging revealed decreased bone volume fraction (BVF) in T1D and OVX mice as compared to controls. Additionally, T1D-OVX mice had even lower BVF than T1D or OVX mice alone. Furthermore, bone loss in T1D-OVX and OVX mice was prevented by continuous estrogen supplementation. To assess if bone formation was reduced, we injected mice with calcein, 2 and 7 days pre-harvest. Quantitation of distance between pulse-labeled fluorescent lines allowed calculation of mineral apposition rate (MAR), which didn't change across groups. Cultured bone marrow from these mice did not display differences in osteoclastogenesis or adipogenesis. While bone density changes were observed, lack of an effect on MAR and marrow cells suggests changes occurred early. Future studies will include earlier time points to elucidate mechanisms of T1D and OVX-induced bone loss.

**THE EFFECTS OF CHRONIC DAYLIGHT DEFICIENCY ON BDNF PROTEIN EXPRESSION IN A DIURNAL SPECIES**
**Shenee Martin (University of the Virgin Islands)**
**Category & Time:** Integrative Biology, Section 2, 1:00 PM - 2:00 PM
**Poster:** 274
**Mentor(s):** Antonio Nunez (Department of Psychology), Joel Soler (Department of Psychology), Lily Yan (Department of Psychology)

Seasonal Affective Disorder (SAD) is a major depressive disorder characterized by recurring depressive-like symptoms in fall and winter, and the remission of these symptoms in spring and summer. One important feature of SAD is the reduced intensity of daylight, prevalent throughout the winter. We have developed a diurnal animal model, the Nile grass rat (*Arvichantis niloticus)*, to assess how light intensity affects emotion. Previous studies have determined that chronic daylight deficiency causes the development of depressive-like behaviors in these rats. The objective of this study is to determine how light intensity affects neural substrates associated with cognition. Preliminary data shows that rats housed chronically in dim lighting conditions (4 weeks) show a down regulation of mRNA levels of a molecule involved in cognition known as brain derived neurotrophic factor (BDNF). We hypothesize that deficits in learning and memory in SAD are likely due to lower BDNF protein levels in the CA1 region of the hippocampus. Brain tissue from rats housed in bright light dark-cycle (BLD) and dim light dark cycle (DLD) will be analyzed using immunohistochemistry to stain for BDNF in the hippocampus. Cell bodies stained in the CA1 region will be counted and compared between BLD and DLD conditions. A decrease in BDNF protein levels may provide insights into how learning and memory is impaired, and the potential degradation of synaptic plasticity. This evidence could pave the way for future studies focused on finding therapies geared towards restoration of connections and improving spatial learning and memory in SAD.

### SEXUAL SELECTION AND ITS RELATION TO ISOLATIVE REPRODUCTION IN THREE-SPINE STICKLEBACK (GASTEROSTEUS ACULEATUS)

**Kyle Gonsalves (University of the Virgin Islands)**
**Category & Time:** Integrative Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 276
**Mentor(s):** Robert Mobley (Integrative Biology), Janette Boughman (Integrative Biology)

Sexual selection is a process by which a specific set of traits are favored and can consequently lead to divergent speciation. Recent studies have found that there is currently a divergence of species occurring amongst the three spine stickleback. This emergent speciation has caused scientist to categorize some populations as separate species know as limnetic and benthic. These populations are reproductively isolated. Understanding stickleback female mating choices is a key component to understanding factors that may contribute to the divergence of this species. Two primary sensory elements involved with sexual selection amongst three-spine stickleback are olfaction and the lateral line system. Thus, our research interest lie in the significance of olfaction and the lateral line systems in female mating choice of conspecific and heterospecifc males in three-spine stickleback. A behavioral study will be conducted. To do this I will be comparing courtship between benthic, marine and limnetic females with different males. During these trials the females will have the olfaction, lateral line system or both removed. Specific behaviors will be recorded in JWatcher. An analysis will be conducted comparing data collected on behaviors through statistical software to see if there are any noticeable differences or similarities in preferences. We anticipate that heterospecific mating will occurs because of the importance of the olfaction and the lateral line system in the maintaining of reproductive isolation. With these results we will understand the importance of these two sensory systems in stickleback mate choice both individually as well as their interactions

### DOES PSYCHOLOGICAL STRESS PREDICT TELOMERE LENGTH IN WILD SPOTTED HYENAS (CROCUTA CROCUTA)?

**Sonja Hansen (Washington State University)**
**Category & Time:** Integrative Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 277
**Mentor(s):** Kay E Holekamp (Integrative Biology), Nora Lewin (Integrative Biology), S Kevin McCormick (Integrative Biology)

Telomeres serve as important biomarkers of aging and can reveal how stress acts at the cellular level. Previous work in our lab showed a positive relationship between dominance rank and telomere length among spotted hyenas. The mechanism mediating this relationship remains unknown, but high levels of psychological stress are associated with shortened telomere lengths in humans and may be operating similarly in spotted hyenas. In hyenas, aggressive behavior is often directed down the social hierarchy to enforce the status quo, and may exact substantial psychological stress for subordinate individuals. Social instability is also associated with elevated stress hormones and may explain the significant inter-clan variation in telomere lengths previously found. In this study, we investigated the hypothesis that psychological stress negatively impacts telomere lengths. Psychological stress was coded as the rates and intensities of aggressive behavior received by an individual. As measures of clan instability, we calculated average clan-wide rates and intensities of psychological stress and the frequencies at which aggressive behavior was directed up the dominance hierarchy. We predict that low ranking individuals have short telomere lengths due to high levels of psychological stress. Additionally, clans with short telomeres should have high levels of clan-wide psychological stress and frequent challenges up the dominance hierarchy. Although correlational, this work is the first to explore the relationship between psychological stress and telomere length in social, free-ranging mammals.

### TWO TRAITS, OR ONE – THAT IS THE QUESTION: AN ANALYSIS OF SUBMISSIVE AND AGGRESSIVE BEHAVIOR IN FEMALE SPOTTED HYENAS

**Wangui Hymes (Spelman College)**
**Category & Time:** Integrative Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 278
**Mentor(s):** Kevin McCormick (Integrative Biology)

Aggressive personalities have been quantified in numerous social animal taxa for decades, but few studies of animal behavior have directly studied submissive behavior outside of aggressive interactions. This disparity is due to the assumption that submissiveness and aggressiveness are part of a continuum, such that more aggressive individuals are typically less submissive. However, recent psychological investigations have shown that submissiveness and aggressiveness can be uncorrelated or positively correlated, suggesting that submissiveness may be its own trait. We hypothesized that unsolicited submissiveness was independent of aggressive behavior in spotted hyenas. Aggressive and unsolicited appeasement behavior for 40 adult females over 24 months of age were extracted from observational field notes. Rates of aggression and submission were then compared within individuals utilizing a linear model to determine how the expression of both traits correlated over time and context. We then compared the individual variation of aggressive and submissive rates across all females, controlling for rank, clan, prey density, and anthropomorphic impact utilizing a general linear model. If the observed individual variation of aggressive and submissive behavior is consistent per individual regardless of these variables, this analysis provides credible proof that personality traits persist in spotted hyenas. In addition, this study may also prove that submissive behavior should be considered its own personality trait separate from aggressive

tendencies. Therefore, future field studies of social mammals should consider recording and quantifying submissive behavior outside of aggressive interactions.

**THE ROLE OF REARING ENVIRONMENT ON THE SPATIAL COGNITIVE ABILITY OF TWO SYMPATRIC SPECIES OF THREESPINE STICKLEBACK**

**Benjamin Wurst (Michigan State University), William Fetzner (University of North Carolina Wilmington), Jonatan Martinez (Michigan State University)**

**Category & Time:** Integrative Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 279
**Mentor(s):** Janette Boughman (Integrative Biology), Jason Keagy (Integrative Biology)

Comparative analysis of taxa early in the process of divergence is a powerful tool for studying trait evolution. In particular, this approach could greatly increase our understanding of cognitive evolution. Here we present a study of spatial cognition in recently diverged threespine stickleback fish (Gasterosteus species complex) that have adapted to two distinct ecological niches, the “limnetic” and “benthic”. The limnetics primarily occupy open water in lakes, a spatially simple environment. The benthics primarily occupy vegetated areas of lakes, a spatially complex environment. Previous studies show that wild-caught benthic sticklebacks outperform wild-caught limnetic sticklebacks in a T-maze spatial cognition task. However, evolution cannot occur unless variation in a trait has a genetic basis. It is currently unknown if differences in stickleback spatial cognitive ability are influenced by genetic differences, rearing environment, or the interaction between the two. We investigate this by rearing fertilized eggs from both species in spatially simple and spatially complex environments. Adult fish from each treatment were tested on spatial cognitive ability with the use of a previously validated T-maze test. With this information we can 1) determine whether differences in spatial cognitive ability in these species have a genetic component, 2) determine the influence rearing environments have on spatial cognitive abilities, and 3) determine whether the species differ in how their developmental environment influences their spatial cognitive ability. This study will add to our understanding of cognitive evolution and also has additional applications, for example influencing how fish are raised in fish hatcheries.

**2-D PROCESSING DEFICITS OBSERVED IN A CASE STUDY OF APPERCEPTIVE VISUAL AGNOSIA**

**Katharine Bruce, Mitch Distin, Mohan Gupta, Miles Joyce, Geanina Rahilly, Rachel Rapp, Christian Rohl (All Michigan State University)**

**Category & Time:** Integrative Biology, Section 3, 2:00 PM - 3:00 PM
**Poster:** 280
**Mentor(s):** Laura Symonds (Neuroscience)

Visual agnosia is a disorder of object recognition and perception following damage to the brain, such as stroke, blunt trauma, and carbon monoxide poisoning. Visual agnosia is generally divided into two major categories: apperceptive and associative (Farah 2004). In this case study we explore apperceptive visual agnosia, often defined as categorical loss (e.g. drawings, animals, dimensionality) of visual stimuli recognition, which results in an often profound impairment of visual perception. Many previous studies of apperceptive visual agnosia have demonstrated damage to V1. This study aims to explore whether apperceptive agnosia can be explained by damage to areas other than V1, such as higher-order visual modules in extrastriate cortex. Patient KP was diagnosed with apperceptive visual agnosia at the age of 20 in 2006 following blunt force trauma, causing a lesion to the right inferotemporal cortical area. Original neuropsychological testing following the diagnosis revealed deficits in 2-D processing, with preserved functions in navigation, spatial reasoning, facial recognition, and color perception. This patient’s visual deficit supports the idea that modules active in higher order visual processing include recognition of objects presented in two dimensions. Such specialization may explain the large categorical differences observed in patients with apperceptive agnosia.

**A RETROSPECTIVE STUDY OF THE EFFICACY AND SAFETY OF INTRAVENOUSLY ADMINISTERED TISSUE PLASMINOGEN ACTIVATOR (TPA) IN PATIENTS WITH MILD ISCHEMIC STROKE**

**Emmanuella Joseph MPH (Michigan State University)**

**Category & Time:** Integrative Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 282
**Mentor(s):** Elahé Crockett PhD (Medicine), Muhammad Farooq MD (Hauenstein Neuroscience Center), Philip Gorelick MD MPH (Hauenstein Neuroscience Center)

**Introduction:** Administration of intravenous thrombolytic therapy for acute ischemic stroke (AIS) has demonstrated improved clinical outcome with use of intravenous tissue plasminogen activator (IV-tPA). In 2013, the American Heart Association has taken into consideration the use of IV-tPA in patients with mild strokes; defined as a National Institutes of Health Stroke Scale (NIHSS) of </= 4. There is limited research to confirm the efficacy of IV-tPA in patients with minor strokes, however some preliminary studies have shown that assertive therapy can lead to improved outcomes. Specific concerns regarding suspected increase in hemorrhagic complications have been a major deterrent from its use. **Objective:** Conduct a quality improvement study to determine whether Mercy Health Saint Mary’s (MHSM) Hauenstein Neuroscience Center is meeting safety and efficacy outcomes for IV- tPA administration in minor AIS. **Hypothesis:** Use of IV-tPA, within 4.5 hours, in patients with minor AIS will achieve safety benchmark of <1% for symptomatic intra-cerebral hemorrhage and efficacy of improved modified Rankin Scale of 0 or 1 for 75% of patients at their 3-6 months follow-up visit. **Method:** Retrospective chart review of patients identified from MHSM standard stroke log who received IV-tPA between May 2012 – May 2015 to compare results between patients with an initial NIHSS </= 4 vs. NIHSS > than 4. **Conclusion:** Providing evidence that the use of IV-tPA in patients with minor strokes is administered safely and effectively at MHSM may improve stroke management policies and procedures throughout the Trinity Health Network nationwide. **Support:** E.J. is a REPID scholar, supported by NIH-5-R25-HL108864-award to Elahé Crockett, REPID Program Director.

**COMPARISON OF THE AUDITORY BULLAE IN CANIDAE**

**Stephanie Lamb (Olivet College)**

**Category & Time:** Integrative Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 283
**Mentor(s):** Cybil Nicole Cavalieri (Integrative Biology), Barbara Lundrigan (Integrative Biology)

Auditory bullae are paired rounded bony structures on the mammalian skull that house the middle ear. It has been suggested that the size of the auditory bullae influence the resonance and amplification of sound waves prior to entering the inner ear and thus hearing ability. This hypothesis has been rigorously tested in only a small number of studies, and is supported by anecdotal reports of unusually large ('inflated') bullae in species with infra- or ultrasonic hearing (e.g., cats, bats, and subterranean moles). This study examines the relationship between bullae size and behaviors involving sound perception in 10 species from the family Canidae (dogs, foxes, and their relatives). Bullae volumes and skull sizes for each species were measured on specimens from the MSU Museum collections. Data on sound frequencies used in intraspecific communication and in foraging (e.g., in locating prey) for each species were extracted from the literature. It is predicted that canid species that vocalize at a lower frequency over long distances will have larger bullae. It is also predicted that species that hunt smaller prey and hunt alone will have larger bullae. The ability to hear affects how successful a mammal is at communicating and catching prey. The results of this study will provide valuable information on the evolution of this part of the ear in canids, and potentially help to clarify its role in social communication and procuring prey.

**NEURAL AND BEHAVIORAL RESPONSES TO PALATABLE FOOD REWARD IN MALE AND FEMALE RATS**
**David Lozano (Michigan State University)**
**Category & Time:** Integrative Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 284
**Mentor(s):** Elaine Sinclair (Osteop Med - Dual Degree Mstp), Cheryl Sisk (Psychology)

The female bias in eating disorder risk is the most pronounced in all of psychiatry. The major types of eating disorders that prevail in women are associated with binge eating, defined as the consumption of a large amount of highly palatable food (PF) in a discrete period of time with an associated loss of control over bingeing. PFs activate the neural reward circuit, thus we hypothesized that the female bias in binge eating is due to greater behavioral and neural responsiveness to PF reward in females. Using the conditioned place preference (CPP) paradigm in male and female rats, we will first determine whether females have a higher CPP response to PF than males. CPP will consist of a pre-test, eight conditioning sessions using PF as the stimulus, and a post-test after conditioning. On conditioning days with PF, rats will be recorded to score their interactions with the PF. After the post-test, rats will be exposed to PF for one hour to induce Fos expression (a marker of neural activity) and will be sacrificed 30 minutes later. I will quantify Fos-immunoreactive cells in the neural reward circuit, specifically the ventral tegmental area, and the prefrontal cortex. Our hypothesis predicts that compared with males, females will have a higher CPP response to PF and a higher number of Fos-expressing cells in the neural reward circuit. This outcome would suggest that a greater responsiveness to PF reward in females might underlie the female bias in binge eating and the related eating disorders.

**MOBBING BEHAVIOR OF SPOTTED HYENAS DURING INTERACTIONS WITH LIONS**
**Sarah MacLachlan (Michigan State University)**
**Category & Time:** Integrative Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 285
**Mentor(s):** Kay Holekamp (Integrative Biology), Kenna Lehmann (Integrative Biology), Nora Lewin (Integrative Biology), Tracy Montgomery (Integrative Biology)

Lions and spotted hyenas are apex predators in African ecosystems. Spotted hyenas compete directly with lions for food; during direct interactions hyenas frequently "mob" lions to gain control of a carcass. A "mob" is two or more hyenas acting together to approach and aggress upon one or more lions in an attempt to gain control of a carcass. Mobbing behavior requires hyenas to act cooperatively. Mobbing behavior involves great danger for hyenas (Trinkel & Kastberger 2005). We have used chi square tests to analyze data collected from 1988-2012 in the Maasai Mara National Reserve in Kenya to test the following hypotheses: 1) Hyenas are less likely to form mobs when at least one male lion is present (Trinkel & Kastberger 2005). 2) Mobs formed in the presence of a male lion are more likely to fail (Cooper 1991), and 3) the mob is more likely to be successful when the hyena to female and subadult lion ratio is four to one or greater (Kruuk 1972). Our goal is to learn more about the factors that influence mobbing so we may better understand how cooperative behaviors arise.

**NOVEL LOW-COST METHOD FOR INVESTIGATING CIRCADIAN RHYTHMS IN THE COCKROACH**
**Karina Marie Matos (University of Puerto Rico)**
**Category & Time:** Integrative Biology, Section 4, 2:00 PM - 3:00 PM
**Poster:** 286
**Mentor(s):** Greg Gage (Neuroscience)

Your body has an internal clock, called circadian rhythm, that helps you go to sleep at night and wake up in the morning. Your sleep, health, and overall well-being is dependent on remaining synchronized with the night-day cycle. The most important external indicator for when to sleep is light. Because cockroaches are nocturnal, they are more active throughout the night. We asked what would happen to the activity patterns of discoid roaches (*B. discoidalis*) if they kept a normal 12 hour light/dark cycle for ten days and then switched to 24 hours of darkness for another ten days, and then with constant light. In the absence of external cues to tell the cockroach what time of day it is, our hypothesis is we will see free-running, and a new activity cycle will develop based solely on the internal biological clock. Along with no cues of external environment, how caffeine would affect. To track this, we measure the activity of the cockroach with running wheels to tracks its activity throughout the day in free-running conditions (no external cues), along with sensors to track light and temperature. From this we hope to develop the cockroach wheel as a model for educating students about circadian rhythms, animal behavior, and neuroscience, and to provide a simple, low-cost, but flexible experimental system for research into the behavioral effects of various commonly consumed substances such as caffeine.

**EFFECTS OF SEROTONIN ON RAT DISTAL COLON LONGITUDINAL MUSCLE**
**Diego Mendez (St Mary's University San Antonio Texas)**
**Category & Time:** Integrative Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 289
**Mentor(s):** Alberto Perez (Pharmacology and Toxicology)

Ninety-five percent of the body's serotonin (5-hydroxytryptamine, 5-HT) content is found in the enterochromaffin cells of the gastrointestinal (GI) mucosa and is of significant importance in the enteric nervous system and gut motility. After 5-HT is released by EC cells or nerve fibers it

is cleared by the serotonin transporter (SERT). The aim of this research was to investigate the receptors that 5-HT acts at to cause contraction of the longitudinal muscle of rat distal colon. We tested the hypothesis that 5-HT3 receptors are important by using the competitive antagonist Ondansetron which blocks the 5-HT3 receptor. The study was conducted using colon tissues from wild type and serotonin transporter (SERT) knockout rats. The method employed the preparation of longitudinal rat colon muscle in an isometric tension isolated organ bath. In this manner the contractions produced as a result of the addition of 5-HT in varying concentrations in the absence and presence of Ondansetron (1 μM) were measured. Preliminary data show that 5-HT acts at 5-HT3 receptors to cause muscle contractions. In addition, 5-HT3 receptors are down regulated in tissues from SERT KO rats and an unidentified 5-HT receptor is mediating longitudinal muscle contraction. These data highlight the complexity of signaling by 5-HT in the gastrointestinal tract.

### DIFFERENCES IN PUBERTAL HIPPOCAMPAL NEUROGENESIS BETWEEN FEMALE MOUSE CAGEMATES

**Shane Nieves (Florida Gulf Coast University)**

**Category & Time:** Integrative Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 290
**Mentor(s):** Marc Breedlove (Neuroscience), Cynthia Jordan (Neuroscience), Jenny Kim (Psychology), Cheryl Sisk (Psychology)

The hippocampus is a brain region highly sensitive to stress. High exposure to stressors can result in reduced hippocampal neurogenesis and increased anxiety- and depression-like behaviors. Female rodents appear to establish dominance hierarchies with subordinate females experiencing more stress than dominant females, yet the effects of dominance on the female brain are unclear. As anxiety and depression are more prevalent in females than males, the female hippocampus may be more sensitive to the effects of dominance hierarchies, increasing their susceptibility to psychopathologies in adulthood. The current study examines the relationship between anxiety- and depression-like behaviors and pubertal hippocampal neurogenesis between female cagemates. Four female mice were housed 2/cage and injected with bromodeoxyurdine (BrdU), a cell birth date marker, during puberty. Prior to sacrifice, mice were tested in behavioral paradigms including open field and novel object, and sucrose preference test to assess anxiety- and depression-like behaviors, respectively. All brains were sectioned into four series. One series was stained for BrdU-immunoreactive (ir) cells. A second series underwent double-label immunofluorescence to stain for BrdU and NeuN, a marker of mature neurons. Outcome measures, in addition to behavior, will include BrdU-ir cell density and proportion of colocalized BrdU/NeuN cells in the dentate gyrus of the hippocampus. We hypothesize that female mice cagemates will have a great disparity in pubertal neurogenesis potentially due to the effects of social stress, and those with lower pubertal neurogenesis will present more anxiety- and depression-like behaviors than females with higher pubertal neurogenesis.

### ASTROCYTES AS TARGETS OF METHYLMERCURY NEUROTOXICITY

**Jessica Ortiz (University of Puerto Rico at Cayey)**

**Category & Time:** Integrative Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 291
**Mentor(s):** Bill Atchison (Pharmacology and Toxicology), Rosa Jaiman (Pharmacology and Toxicology)

Methylmercury (MeHg) is a potent neurotoxicant that affects granule cells in the cerebellum. Although MeHg primarily affects these neurons, astrocytes are also targeted. This study compares the delay MeHg exposure with the immediate MeHg exposure, and the delay MeHg exposure with the delay MeHg+BAPTA exposure. Determining the onset of the effect of MeHg and the relationship between MeHg induce disruption of intracellular calcium with cell death could help us understand the mechanisms of MeHg toxicity. Primary astrocyte cultures from the cerebellum of mice were exposed for 3h to 0μM, 1μM, 2μM, or 5μM MeHg. Cytotoxicity was performed using EthD-1 and Calcein-AM. To determine if astrocytes death was due to an increase of internal calcium concentration, the chelator BAPTA was used. The mean percentages of cell death immediate after MeHg exposure were 0.10%, 15.26%, 31.06% and 56.62% at 0μM, 1μM, 2μM and 5μM respectively. The mean percentages of cell death 24h after MeHg exposure were 0.39%, 25.64%, 69.49% and 96.96% respectively. The normalized mean percentages of cell death 24h after MeHg exposure co-treated with BAPTA were 15.59%, 29.56% and 23.53% respectively. Comparing immediate vs. delay exposure, there was significance at 2 μM and 5μM MeHg. Comparing MeHg+BAPTA vs. delay MeHg there was significance at 5 μM MeHg. In conclusion, immediate exposure of MeHg produced significant astrocytes death, however the delay exposure of MeHg produced more severe damage to these cells. In addition, the comparison between MeHg and MeHg+BAPTA exposure suggest that BAPTA can protect the cells at high MeHg concentrations.

### TOOL CREATION FOR COMPOUND ACTIVITY ORDERING BY KINASE-SPECIFIC INHIBITION

**Jariel Ramirez (University of Puerto Rico Cayey)**

**Category & Time:** Integrative Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 292
**Mentor(s):** Thomas Dexheimer (Pharmacology & Toxicology), Richard Neubig (Pharmacology & Toxicology)

With the development of technology, compounds that inhibit kinases associated to disease-causing cells have been discovered and isolated. Many studies focus on calculating the inhibition of such compounds, yet none have opted for the creation of a tool that combines all the data to determine an order of inhibition of kinases, per compound. The purpose of our study was to create a tool which will identify and organize by potency the inhibiting compounds for any kinase, using the GSK protein kinase inhibition set from the CHEMBL database. Through the data, we estimated IC50 values with a derived formula for activity determination of the compounds. We used only positive-inhibiting values for geometrical mean, and negative values were not calculated nor placed on the table. Cell-based assays were used to compare and contrast the kinase inhibition in regards to the previous data obtained from the database. After observing the successful correlation between the protein-assays information and cell-based assays using Pearson's r methodology, we organized the results in a table that provides the IC50 of compounds within the set, and its values for the separate kinases. Therefore, this tool determines which compounds inhibit certain kinases within cell-cycles, targeting with better precision and knowledge of those elements in action. However, future research should overlook other sets to add to this tool and analysis of groups of targets or compounds for a better analysis of the structural behavior in order to have better predictions of this molecular activity.

**THE NOTORIOUS EKG: RECREATING THE STRING GALVANOMETER**
**Katelyn Rowley (University of Michigan)**
**Category & Time:** Integrative Biology, Section 5, 3:00 PM - 4:00 PM
**Poster:** 293
**Mentor(s):** Greg Gage (Neuroscience)

The electrocardiogram (ECG/EKG) is a powerful diagnostic tool that is used to observe the electrical activity of the heart in order to ensure its proper contraction. The problem with creating an ECG had long been the inability to measure the minuscule current produced by the heart. The 1924 Nobel Prize winner Willem Einthoven, considered the father of electrocardiography, invented the first instrument capable of accurately producing an electrocardiograph from this very small amount of electricity. This invention, the string galvanometer, consisted of two power electromagnets creating a magnetic field of approximately 22,000 gauss to induce movement by means of the Lorentz force in a 1–5 μm thick, quartz string that carried the heart's electrical current. This scientifically ancient instrument is recreated with modern means by using strong pyramidal magnets to obtain a dense magnetic field, 3D printed casing, a cellular device to capture string deflections, and motion tracking software. The intention of this device is to provide a tangible demonstration of a novel historical and scientific landmark that defined the rest of electrophysiology and deliver an educational opportunity for Backyard Brains to connect students to this remarkable achievement as well as teaching concepts of electricity, magnetism, and electrocardiography.

**LORD OF THE FLIES: DEVELOPING OPEN SOURCE OPTOGENETICS TOOLS**
**Jordan Salvi (Michigan State University)**
**Category & Time:** Integrative Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 295
**Mentor(s):** Greg Gage (Neuroscience)

The goal of this research is to perform conditioning using optogenetics on the fruit fly, Drosophila melanogaster using low cost, open source, and widely available tools and methods such as 3D printing and off the shelf electronic component. This is in an effort to bring down the barrier to entry for optogenetics experiments, a key part of the future of neuroscience. The experiments utilized flies with the gr64 sweet taste receptor coupled with red light excitatory optogenetic channels. Through light stimulation combined with presentation of a taste stimulus, the flies are anticipated to be conditioned to be less aversive to bitter stimuli vs control flies. We designed circuits and software to detect the electric connection between a fly and taste stimulus, and trigger an LED to flash, activating the optogenetic channels in the fly's taste neurons. The software handles variables such as LED delay and duration, as well as controls a motorized micromanipulator to deliver the stimulus with greater precision and reliability. This setup allows a wide range of optogenetics experiments to be performed efficiently and at low cost, opening up the field for students and researchers with lower budgets to perform these and similar experiments on fruit flies.

**GENE KNOCKDOWN IN MORMYRID ELECTRIC FISH USING SPLICE-BLOCKING MORPHOLINO**
**Sophia Sdao (Michigan State University), Fernando Fernandez (University of Puerto Rico Cayey)**
**Category & Time:** Integrative Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 296
**Mentor(s):** Jason Gallant (Integrative Biology)

The electric organ (EO), used for predation as well as navigation and communication, has convergently evolved from skeletal muscle in six separate lineages of fishes. Recent studies have begun to investigate the molecular mechanisms of these organs; however tools to manipulate gene function in vivo are presently lacking. Toward this end, we sought to interfere with a gene of known importance in the EO: the sodium channel gene scn4aa. Scn4aa is normally expressed in the muscles of teleost fishes, but is expressed only in EOs of electric teleost fishes, where it has undergone significant positive selection affecting ion channel kinetics. In this study we developed a splice-blocking vivo-morpholino that specifically targets the scn4aa mRNA and examined its effects on electric organ discharge (EOD) production. We injected Brienomyrus brachyistius daily for four consecutive days with either morpholino (N=2) or saline (N=2) and assessed EOD amplitude. We found a significant decline in EOD amplitude over four days of treatment with morpholino compared to saline. To verify that the morpholino had the intended effect, we performed RT-PCR. We expect that in morpholino-treated individuals that the RT-PCR product will be longer than in saline-treated individuals, because the morpholino forces the inclusion of a normally spliced intron. We will then verify the identity of the amplified RT-PCR products by cloning and sequencing. The results of this study outline and validate a simple and relatively inexpensive approach (i.e. vivo-morpholinos) for interrogating the role of specific candidate genes in the evolution, development, and physiological function of EOs.

**THE CONSCIOUSNESS DETECTOR: A LOW-COST, OPEN-SOURCE METHOD FOR RECORDING EVENT RELATED POTENTIALS**
**Kylie Smith (Michigan State University)**
**Category & Time:** Integrative Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 297
**Mentor(s):** Greg Gage (Neurocsience)

In the field of neuroscience, years are dedicated to learning even basic mechanisms of brain functions as well as how to use technology to measure this functioning. This makes for a small niche of people capable of competently operating an electroencephalogram (EEG) and interpreting the results. The objective of this project is to use the Backyard Brains Heart and Brain SpikerShield, powered by an Arduino microcontroller, to elicit the well-known P300 signal via a do-it-yourself inspired oddball task and record it using laptop based Spike Recorder software. Appearance of a healthy P300 in comatose patients given a passive oddball task has been found to be an indication of the potential for recovery of consciousness. We intend for this technology, in the hands of the scientific layperson, to inspire thought and development in the field of neuroscience.

**CAN YOU SMELL ME NOW?**
**Trevor Smith (Michigan State University)**
**Category & Time:** Integrative Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 298
**Mentor(s):** Greg Gage (Neuroscience)

The domesticated silkmoth (Bombyx mori) use pheromone specific receptors in their antennae sensilla hair to find potential mates up to 11 kilometers away. The female moth excretes the pheromone bombykol to attract potential male suitors, whose antennae receptors contain more sensitive pheromone receptors than their female counterparts. The ability to detect the pheromone bombykol comes from very specific odor detecting cells that make up the majority of the sensilla hair on the antenna. I have evaluated responses to powerful odors such as lemon oil and peppermint extract in comparison to the pheromone bombykol. I recorded responses with a modified version of the Backyard Brains SpikerBoxes and Arduino microcontroller mounted SpikerShields. I tracked both individual action potential units and broad receptor potentials using well-documented differential electroantennogram (EAG) recording methods to isolate the actions specifically in Bombyx mori antennae. Antennae respond to an array of stimuli, such as mechanical stimulation as well as chemical stimulation, which can be compared on the basis of size and length of both action potential units and receptor potentials. Delivery of odor stimulus is delivered through a constant air stream and using Arduino controlled solenoids for controllable and repeatable results. This study provides evidence that the receptors for the pheromone bombykol react with much more robust and unique action potential units and receptor potentials characteristics than any other potential stimulus, and a low-cost and open source means of investigating and educating about an integral sensory apparatus for many organisms, the antenna.

**MULTIPLE 5-HT RECEPTORS MEDIATE NEUROGENIC CONTRACTION OF THE RAT DISTAL COLON CIRCULAR MUSCLE IN VITRO**
**Melbaliz Velez Afanador (University of Puerto Rico at Arecibo)**
**Category & Time:** Integrative Biology, Section 6, 3:00 PM - 4:00 PM
**Poster:** 299
**Mentor(s):** Nadine El-Ayache (Pharmacology and Toxicology), James Galligan (Pharmacology and Toxicology)

Contraction and relaxation of the gastrointestinal (GI) muscles is controlled by the enteric nervous system (ENS). The ENS is found between the muscle layers of the GI tract. 5-hydroxytryptamine (5-HT, serotonin) is an important neurotransmitter in the ENS. The focus of this research project was to determine the mechanism by which 5-HT stimulates contractions of rat distal colon circular smooth muscle. The animal models used were wild type and serotonin transporter (SERT) knockout rats. SERT is responsible for the reuptake of 5-HT that takes place in the synaptic cleft of presynaptic neurons located in the myenteric plexus. 2mm rings from the distal colon were used for isometric tension organ bath preparations. The organ bath is filled with oxygenated Krebs solution at ~37 oC. Tissues were stretched a tension of 1g. Tension was measured using an isometric force transducer and data were recorded using a digital acquisition system, Lab Scribe, and Graph Pad Prism software. After the equilibration period, tissues were treated with either ondansetron (5-HT3 receptors antagonist) or Nw-nitro-L-arginine (LNA) a nitric oxide synthase (NOS) antagonist or both. Nitric oxide is an inhibitory neuromuscular transmitter. After pretreatment, we tested 5-HT (0.1-100 μM) capability to induce circular muscle contractions. Preliminary data indicate that 5-HT in high concentration acts at 5-HT3 receptors to cause contraction and unidentified receptor at low concentrations. We conclude that there are multiple 5-HT receptors in the ENS that contribute to nerve mediated contraction and relaxation of GI smooth muscle.

**THE PHYLOGENETIC DISTRIBUTION OF ELECTRIC DISCHARGING BEHAVIOR IN SYNODONTIS CATFISH**
**Nicole Thompson (Michigan State University)**
**Category & Time:** Integrative Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 302
**Mentor(s):** Jason Gallant (Integrative Biology)

There are six lineages of fish that have independently evolved an electric organ from skeletal muscle. Little is known about the ecological circumstances under which electric organs evolved. Several studies have suggested a seventh independent lineage, Synodontis (Teleostei: Mochokidae), which produces electric discharges utilizing muscle normally used in sonic communication. This raises the hypothesis that electric organs evolved for the purposes of electrocommunication. This study reports on our efforts to characterize the phylogenetic distribution of electric discharging behavior in various Synodontis spp. We accomplished this by obtaining Synodontis spp. and recording electric organ discharge using reference electrodes and a differential bioamplifier. Sonic communication was recorded using a Sony voice recorder and a hydrophone. Two behavioral contexts were used to test for electric organ discharge and sound production; a single individual and when with a conspecific. For both behavioral contexts, electric organ discharge was recorded for twelve consecutive 300 second intervals to obtain a total recording length of 60 minutes. Sounds were recorded simultaneously and continuously for 60 minutes. We found that S. nigriventris, S. flavitaeniatus, and S. alberti only produced electric organ discharges, and did so more frequently when with a conspecific. Furthermore, S. euptera and S. notata only produced electric organ discharges when disturbed. Finally, no species produced observable sounds. We interpret these results using phylogenetic and geographic relationships of Synodontis spp. This study concludes by considering the ecological circumstances that may underlie the evolution of electric discharging behavior of certain lineages of Synodontis.

**LABVIEW BASED SOFTWARE FOR RECORDING ELECTRIC ORGAN DISCHARGES FROM WEAKLY ELECTRIC FISH**
**Adam Gleichman (Michigan State University)**
**Category & Time:** Integrative Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 303
**Mentor(s):** Jason Gallant (Integrated Biology)

Mormyrid fish produce electric organ discharge (EOD) pulses in water with a specialized electric organ, which is used in communication and navigation. To better understand the behavior of these fishes, accurate recordings of their EOD behavior are critical. Using LabVIEW (National Instruments, Inc.), we developed a software program capable of recording and visualizing EOD behavior in real time. A requirement of such software is the ability to record electric discharges at high sampling rates (100khz-1MhZ) over a wide range of durations (10ms - 1hr). Due to limited hardware capabilities (CPU,RAM), this we solved this difficulty using a combination of direct disk writing and dynamic down sampling of displayed data. The software features a real-time display of data for instrument calibration, as well as real-time display of data during recording. In addition, controls for A/D acquisition can be adjusted 'on the fly' and metadata regarding specimens can also be recorded. The software is written as a user-friendly GUI for use in the classroom and by researchers that are unfamiliar with computer programming, and will be freely available for download and install on Mac, Windows and Linux platforms.

**INNATE LYMPHOID CELLS MEDIATE TYPE 2 IMMUNITY IN THE LUNGS OF MICE REPEATEDLY EXPOSED TO OZONE**
**Kaylin White (Spelman College)**
**Category & Time:** Integrative Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 304
**Mentor(s):** Jack Harkema (Patholobiology and Diagnostic Investigation), Kazuyoshi Kumagai (Patholobiology and Diagnostic Investigation)

High levels of ambient ozone, a common air pollutant, are associated with increased incidences of eosinophilic rhinitis and asthma in children. Repeated ozone exposures also cause eosinophilic rhinitis and nasal epithelial remodeling in mice. We have found that these nasal lesions are dependent on innate lymphoid cells (ILCs). The role of ILCs in ozone-induced pulmonary toxicity has not been previously investigated. In the present study, we determined the ILC-dependency of lung pathology caused by acute (1-day) and subacute (9-day) ozone exposure. Lymphoid cell-sufficient C57BL/6 mice, $Rag2^{-/-}$ mice devoid of T and B lymphoid cells (but ILC sufficient), and $Rag2^{-/-}Il2rg^{-/-}$ mice, devoid of all lymphoid cells (including ILCs) were exposed to 0 or 0.8 ppm ozone for 1 or 9 day(s) (4 h/day). Bronchoalveolar lavage fluid (BALF) was collected for inflammatory cell content and lung tissues were processed for histopathology. After acute ozone exposure, all mouse strains (ILC- sufficient and -deficient) had similar acute airway injury characterized by increased BALF neutrophils and bronchiolar epithelial cell proliferation in response to toxicant-induced cell death. After subacute exposure only ILC-sufficient mice had lung pathology that included increases of BALF eosinophils and lymphocytes, and mucous cell metaplasia of bronchiolar epithelium (type 2 immune responses). These results indicate that lung lesions in mice caused by acute ozone exposure are ILC independent, but the type 2 immune lung lesions induced by subacute exposure are ILC dependent. This study provides a plausible biological mechanism for underlying epidemiological associations of high ambient ozone and childhood asthma.childhood asthma.

**ASSESSING RHIZOBIAL DEPENDENCE OF MEDICAGO POLYMORPHA AS IT EVOLVES IN NON-NATIVE REGIONS**
**Katherine Wozniak (Michigan State University)**
**Category & Time:** Integrative Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 305
**Mentor(s):** Maren Friesen (Plant Biology)

Medicago polymorpha and its rhizobial symbiont, Ensifer medicae have evolved from thriving in the Mediterranean coast to cultivating regions as far as California and Chile. Specialized mutualisms that were heavily relied upon for legume growth are now less utilized in the invasive ranges, suggesting generalist plant genotypes are favored. Evolving a generalist approach in the invasive ranges requires recruiting differing levels of bacterial diversity from the rhizosphere, instead of forming a symbiosis with only a few efficient rhizobia. Our project aims to elucidate the below-ground interactions of native and invasive Medicago polymorpha genotypes by comparing their growth with rhizobial strains and soils from native and invasive regions. We found no difference in above-ground plant fitness among native and invasive genotypes; however, invasive genotypes had higher growth with mixed invasive bacteria while native plants had higher fitness with a single native bacterial strain. The number of nodules formed is significantly affected by whether a genotype is from the native or invasive range, with inoculated native genotypes forming the most nodules. These results support the hypothesis that invasive mutualisms are less specialized compared to native mutualisms. We saw an effect of genotype on root weights, specifically in an invasive Australia genotype, which furthers the hypothesis that invasive genotypes need a larger root system to recruit a more diverse microbiota. Investigating plant-bacterial associations in invasive regions could help us understand how genotypes are able to colonize and flourish in the invaded range, and could have implications for prevention of parasitic plant invasions.

**A DO IT YOURSELF CRICKET ELECTROPHYSIOLOGICAL RECORDER**
**Nick Weston (Michigan State University)**
**Category & Time:** Integrative Biology, Section 7, 3:00 PM - 4:00 PM
**Poster:** 306
**Mentor(s):** Greg Gage (Neuroscience)

Cricket ears are more similar to human ears than those of any other insect that we know of. Consisting of three different sections separated by air and liquid, these ears can detect frequencies on a much more precise level. My research this summer is concerned with determining the frequencies that optimally activate the neurons within cricket ears. Using recording electrodes placed in the front forearm, within the cuticle, action potentials can be picked up within the cricket's ear nerve. The nerves will be activated by different pure tone frequencies played from a speaker within 37 cm from the recording electrodes. The ranges being tested are between 3-6 kHz, 10-12 kHz and above 18 kHz, as these have been shown to be the frequencies that the brown cricket, Acheta domestica, hear best in. Different methods of recording neuronal spiking have been used, including differential recordings with pins, recording directly from the nerve with two silver wires, and a do-it-yourself inspired suction electrode connected to an exposed prothoracic ganglion nerve. All electrophysiological recordings were made with the Backyard Brains Spikerbox. This research, when completed, will show a full list of frequencies that can activate cricket's ear neurons and can be used to further our knowledge on the cricket's ear, and provide an accessible, open source, and low cost model for studying our own ears. As well, there is still debate on frequencies and activation patterns associated with the tympanal neurons of crickets and this research looks to answer those questions.

# MECHANICAL ENGINEERING

**AN INCORPORATION OF WASTE STREAM MATERIALS INTO PLASTIC COMPOSITES**
**Emily Bautista (Virginia Polytechnic Institute and State University), Michael Greene (University of Pittsburgh)**
**Category & Time:** Mechanical Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 308
**Mentor(s):** Dave Schall (Oakland University: Mechanical Engineering)

With the increasing demand of fossil fuels, the automotive industry is continually searching for methods to improve vehicle fuel economy. One approach lies in the reduction of vehicle weight by implementing cutting-edge composite materials in the interior components of vehicles. Currently, wood-plastic composites are of particular interest to the automotive industry. The incorporation of wood-based waste stream

materials as additives in plastic composites has shown to significantly decrease the plastic component weight without detrimentally affecting the mechanical properties of the plastics. Moreover, these materials further the global initiative to increase sustainability. This research investigates the alteration of the mechanical behavior of polypropylene that has been enhanced with long glass fibers and paper mill waste, a cellulose based material. Maleic anhydride polypropylene, a binding agent, is added in order to enhance the adhesion of the component materials. The concentration of paper mill sludge and long glass fibers within the polypropylene composite samples range from 10-30% and 20-40% by weight, respectively, as these percentages have proven to be the most effective. Tensile and impact tests will be performed on each sample to determine the extension capabilities, tensile stress and strain, and elastic modulus of the material. These tests are expected to reveal the optimal combination of paper mill waste and glass fiber within the composite so that the resulting material has the highest possible tensile and impact strength. This material would not only reduce vehicle weight but also overall vehicle cost while simultaneously following an environmental agenda.

**COMPUTATIONAL CARDIAC MODELING**
**Stheffn Borgg Reis de Almeida Freitas (Michigan State University), Candace Latnie (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 309
**Mentor(s):** Lik Chuan Lee (Mechanical Engineering), Ce Xi (Mechanical Engineering)

Patient-specific finite element (computational) modeling is increasingly used to elucidate the effects of heart diseases. The objective of this work is to develop biventricular computational (finite element) models of normal subjects and patients suffering from pulmonary arterial hypertension from magnetic resonance images (MRI). These models will be calibrated using clinical measurements and used to evaluate the regional mechanical properties of the heart in sick and normal patients. The evaluated mechanical properties are expected to be different between the two classes of patients.

**DECOUPLING OF DIAMETER AND PITCH IN NANOSTRUCTURE ARRAYS MADE BY COLLOIDAL SELF-ASSEMBLY**
**Matthew Bjork (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 310
**Mentor(s):** Xiaolu Huang (Mechanical Engineering), Junghoon Yeom (Mechanical Engineering)

Ordered nanostructures of different materials have attracted an enormous interest due to their unique physical properties and applications in electrical, optical, sensing and storage devices. Colloidal self-assembly is an inexpensive alternative to traditional approaches to create ordered nanostructures. Self-assembled colloidal crystals are made up of nanospheres that are assembled on planar substrates. Using these colloidal spheres as a template or mask on the surface, a variety of ordered nanostructures can be created such as nanowires, nanopillars, nanoholes, nano-crescents, nanotubes, and nanosprings by conventional and non-conventional techniques like etching, deposition, molding, embossing, and transfer. However, it's difficult to arbitrarily vary the dimension and pitch of these nanostructures because the spheres are touching each other in the original array and their sphere size determines both parameters in nanostructures. In this presentation, the authors present the fabrication of ordered, sparse-array nanostructures (specifically nanowires or nanopillars) by transferring self-assembled nanospheres to a stretchy viscoelastic substrate (like polydimethylsiloxane) and while stretched biaxially or radially over 100%; transferring these nanospheres with a new large separation back to a planar or curved substrate of any material. Once this technique is finished, it will be possible to further create more complex nanostructures.

**DESIGN OF A VERTICAL PERTURBATION PLATFORM FOR HUMAN AMPUTEE MOTOR CONTROL STUDY**
**Julia Briggs (Michigan State Univeristy), Hiroya Miyoshi (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 311
**Mentor(s):** Annette Pantall (Osteopathic Manipulative Medicine)

In individuals with transfemoral amputation, sensory input from the residual limb is considerably reduced due to the loss of receptors including foot cutaneous mechanoreceptors, muscle spindles, and Golgi tendon organs. This results in impaired motor control and consequentially, increased risk of falling and injury. However, it has been reported that in individuals with osseointegrated fixation for prostheses, sensory input is improved since the prosthesis is directly anchored to the bone. This is known as osseoperception. By building a one degree-of-freedom vertical perturbation platform, muscle response to changes in loading of individuals with transfemoral amputation can be observed. The platform is constructed out of two aluminum plates, large enough for one or both feet, with linear bearings keeping the drop completely vertical. The platform, when released, performs a sudden drop from heights of 2 cm – 10 cm. The platform also undergoes a period of deceleration by using shock absorbing springs, which can support a weight of up to 400 pounds. To ensure the safety of the test subject, handrails or a safety harness will be used in testing. This apparatus will help to further the understanding of the effect of transfemoral amputation on muscle function, as well as the effect of osseointegration on sensory perception. The hypotheses are that the pressure threshold will be lower and the EMG response time to vertical perturbation will be shorter for individuals with osseointegrated prostheses compared to individuals with socket prostheses.

**SCHLIEREN IMAGING OF TURBULENT JET IGNITION COMBUSTION EXPERIMENTS IN A RAPID COMPRESSION MACHINE**
**Evan Bushman (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 312
**Mentor(s):** Gerald Gentz (Mechanical Engineering), Elisa Toulson (Mechanical Engineering)

Schlieren imaging is a technique used to visualize density gradients present in a transparent media by passing a beam of collimated light through a test section. The resulting image exhibits how the light is refracted. The physical phenomenon that facilitates this imaging technique can be observed in the rippled shadows a flame casts on a wall when lit from behind (*schlieren* meaning "streaks" in German). While schlieren imaging is not new technology, its use in combustion experimental research has come into vogue in recent years. The project being undertaken is to design and build a schlieren imaging system for use in visualizing density gradients present in the combustion chamber of an existing

Rapid Compression Machine (RCM) in use for combustion research. The current set-up uses a high-speed camera to capture images in real color (i.e., the visible flame) of combustion and flame propagation in the RCM. In addition to procuring and setting up optical equipment for performing schlieren imaging, the major focus of the project is the design and fabrication of a new optical head (test section/combustion chamber) to adapt the RCM for this new imaging system. The addition of schlieren imaging to the apparatus will complement the analysis of experimental results, which in addition to the visible flame propagation will facilitate visualization of density gradients present in the RCM test section that would otherwise be invisible to both the naked eye and the high-speed camera.

**NUMERICAL SIMULATION OF AN UPWARD JET IMPINGING A FLAT PLATE**
**Sean Cassady (University of Virginia), Kathleen Dupre (University of Rochester)**
**Category & Time:** Mechanical Engineering, Section 1, 1:00 PM - 2:00 PM
**Poster:** 313
**Mentor(s):** Laila Guessous (Oakland University: Mechanical Engineering), Brian Sangeorzan (Oakland University: Mechanical Engineering)

Recent automotive advancements have increased the power density of internal combustion engines and have heightened the need for efficient cooling mechanisms. One promising method, known as oil-jet cooling, uses a pump to direct a jet of oil onto the underside of the piston. Oil-jets have long been used in heavy duty and high performance engines, but their use in passenger vehicles is growing. The power required to pump the oil-jet is considered a parasitic engine loss, thus designers must work to maximize convective heat transfer while minimizing pumping power. The effectiveness of oil-jet cooling depends on several parameters such as the jet velocity, oil temperature, nozzle-to-piston distance, and specific fluid properties. There has been very little research published on the flow characteristics of upward-facing jets, and what has been published is largely focused on specific applications rather than generalized correlations. Without a fundamental understanding of oil-jet heat transfer, determining the optimal conditions for cooling falls to guesswork. The current study aims to conduct a computational study of upward-facing jets, and to extend this analysis to heat transfer correlations. Using a structured 3D mesh within ANSYS Fluent, a jet impinging onto a flat plate is modeled as a transient, two-phase flow. The results of simulations that examine the effects of velocity, temperature, and plate height on the jet flow profiles and impingement area will be reported. Such results are expected to contribute to the development of heat transfer correlations for oil-jet cooling applications.

**HYBRID MATERIAL, STIFFNESS MATCHING PERFORATED ALUMINUM-TO-COMPOSITE JOINTS**
**Joshua Caudill (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 316
**Mentor(s):** Mahmoodul Haq (Civil & Environmental Engineering), Anton Khomenko (Civil & Environmental Engineering), Ermias Koricho (Composite Vehicle Research Center)

Hybrid material joining, specifically connecting fiber reinforced polymer (FRP) composites to metal has recently gained attention to obtain a balance between light-weighting and ductility. Nevertheless, the stress concentrations that arise from the joining technique used plus the elastic-stiffness mismatch of the adherends introduces premature failure in resulting joints. Perforated metal to composite joints have shown to minimize the stiffness-mismatch issue while creating mechanical interlock (shear keys) in the load path of the joints. In this work, perforated Aluminum and glass fiber-reinforced composites (GFRP) double lap-joints were studied. The effect of volume fraction of perforation, its location and size was studied and compared with pristine non-perforated joints and results in literature. The experimental results, effect of various parameter and resulting conclusions will be presented. To the best of authors' knowledge, the use of perforated aluminum to composite joints has not been studied elsewhere and hence provides a baseline for possible applications in a wide range of applications, especially in automotive industry.

**NOVEL HYBRID FASTENING OF ALUMINUM TO COMPOSITE JOINTS**
**Kalie Collins (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 317
**Mentor(s):** Mahmoodul Haq (Civil & Environmental Engineering)

Traditional joining methods used on homogeneous and isotropic materials are insufficient to safely anisotropic materials such as fiber-reinforced polymer (FRP) composites. Specifically for mechanical/ bolted joints, the drilling of holes in FRP composites introduces delaminations, stress-concentrations and bolt-adherent slips. A novel, hybrid fastening system has been shown to not only overcome these limitations but has further enhanced the load carrying capacity of resulting joints. This hybrid fastening system consists of a small (~ 1.2 mm) channel within bolt shaft that allows injecting an adhesive within the clearance between the bolt and the adherends, which upon curing produces a monolithic structural element. Such a hybrid fastening system has been proven to delay the onset of delamination by >550% and increase the load carrying capacity by >210% for composite-to-composite joints. In this work, for the first time, this novel fastening system is attempted for dissimilar materials, namely joining aluminum to glass fiber reinforced composites (GFRP). Additionally, tubular fiber sleeves will be used to reinforce the resin-rich area in the hole clearance. Experimental tests will be performed to evaluate the behavior of these novel joints and compared with conventional bolted joints. The experimental matrix, variation in adherend combinations, sleeve type and comparison with conventional joints will be reported.

**ESTIMATING COMPLETE GROUND REACTION FORCES BY PLANTAR PRESSURE INSOLES DURING INCLINE AND DECLINE WALKING**
**Andrew Crechiolo (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 318
**Mentor(s):** Jerrod Braman (Orthopedic Biomechanics), Roger Haut (Orthopedic Biomechanics)

Knowing the complete set of ground reaction forces (GRFs), i.e. Anterior/Posterior, Vertical, and Medial/Lateral, during walking is useful for various Orthopaedic applications such as injury prevention, inverse kinetics, as well as prosthetic and footwear design. It has been shown in previous studies that plantar pressure insoles can be used to estimate the complete set of GRFs using linear regression analyses (Fong et al., 2008). However, the correlation between pressure insole data and GRFs is unclear for incline/decline walking. For the current study, a force

plate was mounted into a ramp with adjustable incline angles from 0 to 20 degrees. Subjects will be asked to walk up and down the ramp at various angles wearing minimalist shoes inserted with plantar pressure insoles. Force plate and pressure insole data will be collected and analyzed for the purpose of developing a regression model between sensor pressures and force plate data to estimate GRFs during incline and decline walking. It was hypothesized that for greater accuracy of GRF prediction the footstrike should be broken into two phases, from heel-strike to mid-stance and from mid-stance to toe-off with separate regressions to predict each stage. A regression model for angled surfaces may allow the estimation of GRFs for the study of hiking shoe design in the field over mountainous terrain where force plates would not be available.

### TESTING TENSILE PROPERTIES OF COMPOSITE FAN CASINGS IN GAS TURBINE ENGINES

**Thorris Daniel (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 319
**Mentor(s):** Andy Vanderklok (Mechanical Engineering), Xinran Xiao (Mechanical Engineering)

Fan casings, the material surrounding the turbine, in jet engines are constructed with durable metals. The metals need to be durable in case one of the propeller blades snaps off due to some external force, otherwise known as the Fan Blade Out Event (FBOE). Essentially, the propeller generate so much force that during a FBOE, it could damage other parts of the aircraft, and so the fan casing needs to be durable enough to withhold the propeller blade within the jet engine. This is why metals are used, however metals are heavy. And so we are conducting research on the durability of composite material fan casings in order to find a reasonable substitute for metals. We have constructed a pneumatic gun that utilizes compressed air to fire materials at the composite material plates that we have developed, and by doing so, we can measure impact, stress, and fracture models in the composite material and essentially assess its durability. We have also constructed a simulator jet engine where we simulate a FBOE and once again measure impact, stress, and fracture models for the composite materials. With application of this research, we can find substitute and albeit lighter materials to build jet engines for aircraft with.

### MODELING AND ANALYSIS OF PATIENT SPECIFIC DATA OF PULMONARY ARTERIAL HYPERTENSION

**Candace Latnie (Michigan State University), Stheffn Borgg Reis de Almeida Freitas (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 320
**Mentor(s):** Lik Chuan Lee (Mechanical Engineering), Ce Xi (Mechanical Engineering)

Pulmonary arterial hypertension (PAH) exists in various types and forms, all of which affect millions of individuals who endure its costly implications. Pulmonary hypertension is a disease caused by an elevated blood pressure in the lungs' arteries. Treating a cardiovascular dysfunction such as this, however, comes with difficulties because the effects of this disease on cardiac function are not fully understood. Through the use of three-dimensional modeling of the left and right ventricles of the heart, paired with the knowledge of the ventricle pressure and measured volume, ventricular pressure-volume relationships can be constructed. Along with the use of this pressure-volume relationship, Finite Element Analysis (FEA) is used to determine the deformation of the heart and identify any irregularities in the pulmonary hypertensive heart. The use of this technique, will enable us to better understand this disease so that better treatment methods can be identified to treat patients affected by PAH.

### INVESTIGATING HIGH VELOCITY IMPACT ON FAN CASINGS

**Andrew Stamm (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 2, 2:00 PM - 3:00 PM
**Poster:** 321
**Mentor(s):** Andy Vanderklok (Mechanical Engineering), Xinran Xiao (Mechanical Engineering)

Fan blade release, otherwise known as fan blade out (FBO), caused by fatigue or bird ingestion in jet engines can cause catastrophic damage to flight critical components if not properly contained. Traditional containment methods are heavy, which reduces aircraft payload, range and overall fuel efficiency. This drives the use of composite materials in the fan case containment region. However, little to no information is available in open literature for high speed damage mechanics on composite materials from an FBO. A simplified testing procedure using a horizontal impactor was constructed. The procedure simulates an FBO by using a proposed projectile shape and specialized boundary conditions to mimic a circular fan case. A flat composite plate is placed at an oblique angle relative to the projectile trajectory at the end of the impactor. The projectile is then fired at the plate with a predetermined orientation. A high speed camera trained on the event provides detailed footage, which can be viewed frame-by-frame. Real time out of plane displacement will be analyzed to provide impact measurements. This test method is investigated versus actual experimental FBO tests and LS-DYNA simulations for validation.

### REVERSIBLE BONDED JOINTS USING GRAPHENE-MODIFIED THERMOPLASTIC ADHESIVES

**Bryce Ewing (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 323
**Mentor(s):** Mahmoodul Haq (Civil and Environmental Engineering), Ermias Koricho (Mechanical Engineering)

Joining of materials and components is inevitable as it allows versatility in assembly and repair along with reduction in time and cost of manufacturing. Adhesively bonded joints reduce structural weight, eliminate holes and associated stress-concentrations but cannot be dis-assembled or repaired. Thermoplastic adhesives modified by the incorporation of electrically conductive graphene nanoplatelets at a concentration above the percolation point allows energy to be deposited primarily in the adhesive, thereby selectively heating the adhesive. The percolated network of graphene particles in the adhesive at less than 2% can quickly couple to high frequency microwave radiations via non-contact methods and increase the adhesive temperature to above the required processing temperatures. The adhesive melts and flows over the adherends and upon cooling forms a structural adhesive bond. Furthermore, the process can be used to disassemble the adhesive joint if repair or reworking is required. In this work, the concept of aforementioned active adhesives was evaluated. Processing and thermos-mechanical characterization of the adhesive and resulting joints was performed. Preliminary results show great promise in dis-assembly and re-assembly of multi-material joints using this technique.

**SOFT TISSUE MODELLING: EFFECTIVENESS OF RADIOPROTECTIVE TREATMENT ON SKIN STIFFNESS REDUCTION**
**Chase Gunderud (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 324
**Mentor(s):** Sara Roccabianca (Mechanical Engineering)

The purpose of our research is to develop a mechanical model of the physical characteristics of soft biological tissues. Such a model would assist in future research in many areas, such as surgery or prosthetics. We use a uniaxial tensile tester to gather data on rat skin. Our research in collaboration with the University of Michigan focuses on determining the effects of radiotherapy on skin stiffness. After radiotherapy, most people undergo a secondary surgery to have their skin repaired. We are attempting to remove that need. In particular, we strive to quantify the effectiveness of a radioprotectant treatment meant to prevent the stiffening of the tissue. The uniaxial testing machine that we use is a custom built apparatus programmed through LabView. The results of our research will be a next step in affirming the usability of this treatment to allow for a better patient experience and to alleviate difficulties associated with surgery.

**3-D PRINTING USING POWDERED METALS**
**Matt Hamilton (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 325
**Mentor(s):** Patrick Kwon (Mechanical Engineering)

3-D Printing, or Additive Manufacturing, is one of the fastest growing technologies in engineering today. It allows for the mass customization and easy replacement of unique parts. It is also used for the development and fabrication of new designs and prototypes. My research group has been developing 3-D Printing technology using powdered metals, particularly stainless steel, to create solid metal parts. Additional powders need to be mixed in to make the part strong and usable.

**LEG SPLAY IN SEATED DRIVER'S POSITIONS**
**Lindsay Hoard (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 326
**Mentor(s):** Josh Drost (Mechanical Engineering), Tamara Reid Bush (Mechanical Engineering)

Posture and pressure interface between the seatpan and driver are often studied to better understand seated comfort in automobiles, however little research has been conducted on leg splay and bolster interference in a seated driving position. Leg splay occurs when the knees drop and rotate, causing thigh interaction with the seat bolsters. The aim of this work is to determine the maximum of leg splay a driver experiences while in a driving posture and how leg splay affects the pressure interface, focusing on the seat bolsters. Each participant was asked to assume 3 positions, no leg splay, maximum leg splay, and comfortable leg splay in three different driver seats with varying bolster sizes. Pressure and motion capture data were taken at each position. It was concluded that as the legs splay, overall contact area increases, pressure under the ischial tuberosities decreases, and pressure and contact area on the seat bolster increases. The results of this experiment will be beneficial in seat design and better understanding the range of leg movement while seated.

**MOTOR CONTROL: CORE AND CERVICAL MUSCLE FUNCTION**
**Saisha Johnson (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 327
**Mentor(s):** Jongeun Choi (Mechanical Engineering), Jacek Cholewicki (Surgical Specialties), John Popovich (Osteopathic Surgical Specialties)

It is a natural occurrence that throughout our lives, in one form or another, we will experience some variation of pain in the lower back and neck. In fact studies show that more than half of the population have experienced severe pain. While the cause for such ailments is unknown, motor control has been shown to possibly be a solution to this issue. To gain a better understanding of control of the spine, I am involved in two projects that aim to quantify changes in motor control following Osteopathic Manipulative Treatment. The first identifies cervical spine muscle function using muscle functional magnetic resonance imaging (mfMRI). mfMRI is a noninvasive technique that uses MRI technology in evaluating muscle function and accessing muscle activation. Another idea for the control of core function, is the CORE-BOTIC, which is a machine with an unstable seat attached to it and linked to a motor that changes its direction and dynamics. This provides a perturbation to the person seated on it causing them to react in order to maintain balance (i.e., control trunk posture). By using Systems Engineering, these separate but useful tools can both be used to detect the activity used in muscle control and aim to help with rehabilitation and identification of musculoskeletal impairments. If these projects are successful, they would contribute to the advanced study of muscle control and would change the way we look at pain altogether.

**THE EFFECTS OF FILM PROPERTIES OF SILICON NANOCRYSTALS ON PHOTOLUMINESCENCE AND QUANTUM YIELD OVER TIME**
**Duncan Kroll (Michigan State University), Emilie Daffion (University of Edinburgh)**
**Category & Time:** Mechanical Engineering, Section 3, 2:00 PM - 3:00 PM
**Poster:** 328
**Mentor(s):** Rebecca Anthony (Mechanical Engineering), Rajib Mandal (Mechanical Engineering)

Silicon nanocrystals have been studied in research for their use as efficient optical emitters. Silicon nanocrystals have been made and studied before, but their luminescence has been examined mostly in a colloidal solution [1]. The focus of this study is to analyze the effect of varying film properties of silicon nanocrystal films on photoluminescence and quantum yield over time when deposited on different types of substrates in the gas phase. The nanocrystals are made in a plasma reactor, which operates at low pressure. One percent silane (balance argon) gas and 100 percent argon gas are flown through a plasma at controlled rates, which forms silicon nanoparticles. These nanoparticles then go through a silt-shaped orifice and are deposited onto a substrate underneath the orifice. The film properties can be changed by changing the orifice width,

changing the orifice distance from the substrate, changing the amount of time the substrate is under the orifice, changing the gas flow rates, or adding other materials after deposition. The physical properties of the films will be examined through a Scanning Electron Microscope (SEM) and Fourier-Transform Infrared Spectroscopy (FTIR). To date, experiments indicate that oxidation of the films, as indicated by the photoluminescence peak position, is highly dependent on the porosity, thickness, and other properties of the samples.

### FORCE-DEFLECTION OF SOFT TISSUE IN SEATED APPLICATIONS

**Connor LaPres (University of Michigan)**
**Category & Time:** Mechanical Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 330
**Mentor(s):** Tamara Reid Bush (Mechanical Engineering)

The soft tissues of the body vary greatly based on factors including anatomical region, individual, and posture. In order to develop a human tissue substitute for applications in seating design, the mechanical properties of the human thigh and buttocks in a seated posture are required. Using a specifically designed chair, seven different regions on the thigh and buttocks were tested using a load cell in combination with a motion capture system. Initial testing was done with manual loading. We obtained force/deflection curves for each of the seven different positions. These curves represent the different mechanical properties of each location. These differences can be attributed to the varying composition and thickness of the underlying tissues. These large scale properties will be useful in the design of chairs with greater comfort and in human model development.

### THE INFLUENCE OF EDGE QUALITY ON EDGE STRETCHING LIMIT FOR ALUMINUM ALLOY

**Haley Linkous (Oakland University), Eduardo Bustillos (Youngstown State University)**
**Category & Time:** Mechanical Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 331
**Mentor(s):** Xin Xie (Oakland University: Mechanical Engineering), LianXiang Yang (Oakland University: Mechanical Engineering)

This study presents the measurement and analysis of the edge stretching limit of aluminum alloy using digital image correlation. The edge stretching limit, also known as the “edge thinning limit,” is the maximum thinning strain at a point of edge failure. Edge fracture is a vital failure mode in sheet metal forming, however it is very difficult to measure. The previous study enabled the measurement of edge strain by using advanced digital image correlation but how the edge quality can affect the edge stretching limit of aluminum alloy was not discussed. This study continues measuring edge strain by comparing polished to unpolished AA5754 to determine the effect of edge quality on the edge stretching limit. To enable the measurement by optical method for a very long and thin sample, a notch is used which localizes where edge failure occurs. The notched edges of the various pre-strained aluminum alloy samples are polished to eliminate surface micro cracks from punch machining. A dual camera 3-D digital image correlation system is used to measure strain during tensile testing in the thinning direction. The test results indicate that the both the pre-strain and the surface micro cracks do not have significant influence on the edge stretching limit of aluminum alloy.

### INVESTIGATION OF TRIBOLOGICAL PERFORMANCE OF IONIC NANO LIQUIDS

**Olivia McIntee (Oakland University), Daniel Pena (Florida International University)**
**Category & Time:** Mechanical Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 332
**Mentor(s):** Luan Gara (University of Prishtina: Mechanical Engineering), Qian Zou (Oakland University: Mechanical Engineering)

In this research, the tribological performance of ionic nanofluids were investigated. In previous studies nanoparticles and ionic liquids have been used separately as oil additives and have shown to reduce friction and wear. Now the results of combining nanoparticles and miscible ionic liquids together as oil additives will be reported. Zinc oxide nanoparticles were dispersed using ultrasonication in a mixture of Polyalphaolefin oil (PAO) and ionic liquid (Tetradecyltrihexylphosphonium bis(2,4,4-trimethylpentyl)phosphinate) using a Sonic Ruptor 400. The coefficient of friction was studied using a tribometer with a ball-on-disk configuration. The wear track was measured using a Bruker Contour GT-K Optical Profiler. Then the wear volume was calculated. The effects of concentration, load, and sliding velocity on friction and wear will also be reported. Stability of the solution was an important factor in deciding which mixture was best as this has been a problem in past studies. Therefore, in this research the effects of ultrasonication time and concentration on the stability of the solution were also studied.

### RELATION BETWEEN ARTERIAL STIFFNESS AND HEMODYNAMICS OF PULMONARY HYPERTENSION PATIENTS

**Nathan McLean (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 333
**Mentor(s):** Seungik Baek (Mechanical Engineering)

Pulmonary hypertension (PH) is a rare, but fatal, disease characterized by high blood pressure and the occlusion of blood vessels in pulmonary arteries. PH leads to an overload of the right ventricle in the heart, eventually resulting in heart failure. The research done for PH could help find more treatments or, more importantly, cure the disease. The pulmonary artery is responsible for transporting un-oxygenated blood from the right ventricle of the heart to the lungs. Then, it takes the oxygenated blood from the lungs and pumps it through the aorta to the entire body. When pulmonary vascular pressures increase, hypertension occurs. The occlusion and stiffening of the pulmonary artery are two main causes of pulmonary hypertension. Blood flow patterns, wall shear stress, proliferation of smooth-muscle cells, and activation of the endothelium may all influence occlusion of the pulmonary artery. Finding distensibility, which is the relative change in lumen area for a given change in pressure, is one way to determine the stiffness of the artery. A low distensibility value will tell you that the artery has high stiffness. A high distensibility value will tell you that the artery has low stiffness. Our results gave us an expected low distensibility value of 10.8264 %/mmHg, showing that patients with PH have characteristically stiff arteries. For understanding the relation between arterial stiffness and hemodynamics, we use a computational tool that integrates computational fluid dynamics (CFD) and arterial mechanics, calibrating with patient data.

**TRIMMING OF SHEET BLANKS FROM ULTRA HIGH STRENGTH STEEL SHEET**
**Kaicen Pan (Stony Brook University), Lindsay Brown (Arizona State University)**
**Category & Time:** Mechanical Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 334
**Mentor(s):** Sergey Golovashchenko (Oakland University: Mechanical Engineering), Saeid Nasheralahkami (Oakland University: Mechanical Engineering)

Lightweight sheet materials such as Aluminum Alloys, Advanced and Ultra High Strength Steels (AHSS and UHSS) are gradually replacing mild steels to reduce vehicle's weight and meet fuel economy requirements. Implementation of AHSS and UHSS is often problematic due to the splitting of parts from the sheared edge when stretching is applied along the sheared edge. In order to understand the limitations of sheared edge stretchability and account for them during die design process, an experimental study on trimming and tensile testing along the sheared edge is being performed for DP980 steel, currently the highest strength cold formed steel sheet used in automotive manufacturing in North America. The effects of cutting clearance and tool wear on quality of sheared edge and its stretchability were studied in this experimental work. A 65 ton mechanical press with an experimental trimming die capable of adjusting the clearance between the upper and lower cutting inserts was used in this experiment. Height of burrs and burnish zones were measured for six cutting clearances for new cutting inserts and also for cutting inserts which performed 35,000 cuts of 1.5mm DP980 sheet. Conducted measurements indicated that the height of burrs increases with the growth of the cutting clearance. It is also shown that the total elongation in the sheared edge of DP980 steel exhibits significant sensitivity to cutting conditions.

**LIMITATIONS BETWEEN ARTHRITIC AND NON- ARTHRITIC PATIENTS**
**Darrion Reeves (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 4, 3:00 PM - 4:00 PM
**Poster:** 335
**Mentor(s):** Tamara Reid-Bush (Biomechanical Engineering)

Osteoarthritis (OA) is the leading musculoskeletal cause of disability in most Western Countries. OA is the most prevalent form of arthritis and tends to affect the older adult population. The number of individuals with OA is expected to increase with the aging population. Approximately 27 million adults in the US population that are affected with OA; this includes the hand, hip, and knee but 30%-52% of the true population are affected with OA of the hand. OA of the hand is the degeneration of joint cartilage and the underlying bone, it is usually prevalent in the distal inter-phalangeal joints, proximal inter-phalangeal joints, and the metacarpophalangeal joints. OA causes tenderness, soft tissue swelling, hard tissue enlargement and deformity. The symptoms of these causes are pain and stiffness in the joints preventing daily activities such as writing or gripping small objects.The aim of this research is to develop a method where loading can be measured at each of the four fingers in multiple finger postures as well as the thumb. Subjects were tested with the device and force data obtained for near-maximal flexion for each finger. The device that will be used is a pressure mat designed by the company Tekscan. Each finger is tested in three possible postures pressing on a single sensor from the pressure mat to determine the maximum force load exerted. Both subject of arthritis and non-arthritis affected subject will be tested to see the limitations of arthritic patients.

**THE DEVELOPMENT OF A LONG LASTING AND DURABLE SOFT TISSUE SURROGATE**
**Zachary Sadler (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 5, 3:00 PM - 4:00 PM
**Poster:** 337
**Mentor(s):** Tamara Reid Bush (Mechanical Engineering)

Gelatins and silicones have previously been used as soft tissue simulants in applications ranging from ballistics penetration testing to the fabrication of facial prosthetics. These materials, however, are not cost-effective, and deteriorate rapidly. They also require extensive preparation, and have low reliability when used in large volumes. The purpose of this study is to identify a soft tissue substitute that corrects the above stated inadequacies and exhibits a similar mechanical response of human tissues. Current research of gelatins, foams, and other mechanical devices is being used to identify a multi-material soft tissue surrogate. Force/deflection data of this material/mechanism will be compared with that of human soft tissue. These data were obtained through a load cell and motion-capture system. The new and improved simulant will aid in future prosthetics, vehicle testing, and sports equipment construction.

**COLLECTION AND ANALYSIS OF WINGED APHIDS AND PLANT VOLATILES USING UAV MOUNTED REDUCED GRAPHENE OXIDE NANO SENSING TECHNOLOGY**
**Nickolas Santi (Michigan State)**
**Category & Time:** Mechanical Engineering, Section 5, 3:00 PM - 4:00 PM
**Poster:** 338
**Mentor(s):** Amberley Huang (Mechanical Engineering), Junghoon Yeom (Mechanical Engineering)

Highly mobile insect species that transmit pathogens to plants in agricultural lands or animals across landscapes are key elements of disease systems. The goal of this research is to identify the location of damaged or diseased crops by capturing insects around the plants that could be carrying disease. These insects are typically attracted by the volatiles emitted by the attacked plants, and therefore the detection of the plant-induced voltages can facilitate the disease detection in crops. We propose to utilize the unmanned aerial vehicles (UAV) technology to capture both insects and volatiles for early plant disease detection. Two separate efforts have been organized in this EnSURE program. A net lined with a sticky polymer layer has been designed to be attached to a UAV. The adhesion of the polymer is reversible, promoting the recovery of insects without contamination (as in case of using acrylic-based glue). The custom-designed net frame was 3D printed and mounted on the UAV. Plant volatiles are detected using polymer-functionalized reduced graphene oxide (rGO) sensors. The gas sensors are to be housed underneath the UAV so that the volatiles can be analyzed as they are collected. Early detection of plant diseases by insects or plant volatiles can help farmers to treat the affected plants with minimal intervention (less pesticides usage), promoting precision agriculture.

**HEMODYNAMICS STUDY OF CAROTID STENOSIS: CORRELATION BETWEEN WALL SHEAR STRESS AND STENOSIS SEVERITY**
**Mauricio Santos (Federal University of Pernambuco UFPE)**
**Category & Time:** Mechanical Engineering, Section 5, 3:00 PM - 4:00 PM
**Poster:** 339
**Mentor(s):** Seungik Baek (Mechanical Engineering), Hamidreza Gharahi (Mechanical Engineering)

The term Carotid stenosis refers to the narrowing of a carotid artery which is caused by the accumulation of plaque. Plaque is a substance composed of low density lipoprotein (LDL) cholesterol; calcium and immune cells that sticks to artery wall and leads to narrowing and hardening of the artery. This disease increases the risk of stroke of the brain due the narrowed artery. This diseased artery increases the possibility of plaque breaking off and the clot travels to small blood vessels in the brain. Conditions of hemodynamics and arterial mechanics, such as blood flow, pressure waves, blood vessel deformation, and wall shear stress (WSS) are directly related to the disease progression. The Carotid artery bifurcation is the place most affected by plaque accumulation because of the flow division and the low WSS that results in a biomechanical response of endothelium (inner layer of wall) that contributes to the increase of the permeability of this layer. The goals of this study are to find a relation between WSS and plaque formation in the bifurcation of carotid artery, find the influence of deformed lumen's profile to blood flow, and compare fluid mechanics proprieties of healthy and unhealthy patients. To perform this study, computational tomography (CT) scans are used to generate 3D model of carotid arteries and computational fluid dynamics are applied to predict the progression of the disease.

**SKIN AS A COMPOSITE MATERIAL: THEORETICAL AND PHYSICAL MODEL**
**Sierra Scott (Michigan State University), Chase Gunderud (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 5, 3:00 PM - 4:00 PM
**Poster:** 340
**Mentor(s):** Sara Roccabianca (Mechanical Engineering)

This demonstration will help high school students to better understand skin and its composition, while further enhancing my skills in the areas of soft biological tissue mechanics. This information will improve my teaching techniques, which will positively affect the learning experience of the students. Assess the performance of human skin (more specifically the dermis) using a physical model to express to youth its mechanics by creating a composite material to mimic skin. The dermis and epidermis provides tensile strength and elasticity to the skin through an extracellular matrix composed of collagen fibrils, reticular, and elastic fibers. These components serve to give elasticity to the integument, allowing stretching and conferring flexibility, while also resisting distortions, wrinkling, and sagging. Verhoeff-Van Gieson (VVG) and Mason's Tri-Chrome (MTC) stains were shown to help students visualize what the dermis looked like. During the experiment students were able to understand that the yard strings were similar to collagen and rubber bands were similar to the elastin in the dermis - students were able to take home physical copies of skin that mimicked the dermis.

**A MONTE CARLO SIMULATION STUDY FOR THE LOCALIZATION OF MAGNETIC ROBOTS**
**David York (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 5, 3:00 PM - 4:00 PM
**Poster:** 341
**Mentor(s):** U Kei Cheang (Drexel University: Mechanical Engineering and Mechanics), Jongeun Choi (Mechanical Engineering)

During many medical operations, it is important for surgeons to gain access to an internal organ non-invasively using small tools and to be able to find and manipulate the position of these tools to accomplish their task. Our project proposes a localization procedure that uses magnetic sensors to localize a small "swimming" robot that contains a permanent magnet. This robot could potentially be a tool that that surgeon uses to accomplish his or her task. The properties of the magnetic field produced by the robot is related to the position and orientation of the robot. Our procedure was to develop a simulation of a 2D sensor array of reasonable resolution and a robot that is magnetized to a certain intensity. We then seek the location of the robot by minimizing the simulated sensor array output using the appropriate governing equation for given a location and the experimental output for an unknown locations to develop a predicted localization for the magnetized robot. Given a certain value for sensor resolution, we sought to find the weakest permanent magnetization of the robot such that the robot could be feasibly localized. Finally, we project the localization output on the robot kinematics via an Extended Kalman Filter (EKF) by taking the output of the first stage localization as measurements.

**MECHANICAL DESIGN OF GLIDING ROBOTIC FISH**
**Tingyuan Zhang (Michigan State University)**
**Category & Time:** Mechanical Engineering, Section 5, 3:00 PM - 4:00 PM
**Poster:** 342
**Mentor(s):** Xiaobo Tan (Electrical & Computer Engineering)

The concept of gliding robotic fish combines gilder and fin-actuation mechanisms to realize energy-efficient locomotion and high maneuverability, and holds strong promise for mobile sensing in versatile aquatic environments. In this poster we present the water tank system, which will help glider fish up and down such as Swim bladder, includes two parts of battery support, one main tank stopper and one piston. And we also will display the wing mount and mechanical fish tail to show the mechanical movement of glider.

# PHYSICAL AND MATHEMATICAL SCIENCES

**DETERMINING NUCLEAR LEVEL DENSITIES FOLLOWING BETA DECAY**
**Elena Alemayehu (Michigan State University)**
**Category & Time:** Physical and Mathematical Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 345
**Mentor(s):** Sean Liddick (National Super Conducting Cyclotron, Chemistry)

Half of the elements heavier than iron are believed to be created in the rapid neutron capture process or r-process. Predicting the elemental abundances produced in the r-process is hindered due to the lack of accurate nuclear data including beta-decay half-lives, delayed neutron branching ration, and neutron capture rates. Recent experimental work has made large strides in the first two quantities but, to date, there are no neutron capture rate measurements in nuclei relevant to the r-process. Constraining neutron capture rates in short-lived nuclei will improve abundance predictions and could help determine the site of the r-process. Experiments at NSCL can be used to infer neutron captures but require key pieces of information to normalize the extracted experimental quantities. One of the normalization points is the nuclear level density. This quantity can be obtained near stable nuclei through neutron resonance techniques but is unavailable in short-lived radioactive nuclei important for the r-process. The present work explores to prospect of measuring nuclear level densities following beta decay. Beta decay is first used to populate excited states just above the neutron separation energy in the daughter isotope which subsequently emit neutrons. The energy of the neutron is determined by measuring the time-of-flight of a neutron from its emission point to a detector, 10 by 10 array of 1mm by 1mm by 1m plastic scintillators, approximately 1 meter away. Current work is being performed to optimize the energy resolution and detection efficiency of the system using simulations.

### IMPROVING SOLAR TO ELECTRICAL ENERGY BY STUDYING J-AGGREGATES

**Tatyona Fields (Michigan State University)**

**Category & Time:** Physical and Mathematical Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 346
**Mentor(s):** Marcos Dantus (Chemistry)

The long term goal of this research project is to improve solar to electrical energy conversion. The efficiency of this process depends on how efficiently energy that is captured as photons is converted into charge separation or electrons. Previous studies show that coherence provides evidence of dissipation of energy. Coherence is a property that tells us about how quickly energy dissipates as heat, longer coherence should correlate with higher efficiency. During experimental measurements we look under the microscope and see how long it takes for oscillations to dissipate. An ultrafast laser was used with pulse duration of 10 femtoseconds. We will investigate J-aggregates of indocyanine green (ICG), which are self-assembled stacks of molecules that mimics photosynthetic stacks of molecules in plants, and mimics semiconductor solar energy cells. We are learning how to best prepare the J-aggregate samples. We used a heating process to form the J-aggregates. UV-Vis was used to confirm the formation. Once formed, we spin coated the dye aggregates and placed them in a polymer solution on a coverslip. A pair of laser pulses will be used to measure the dephasing time. The first pulse causes the initial excitation and the second pulse probes the time it takes for energy to dissipate. The goal is to obtain a map of dephasing times and then use an electron microscope to learn which structures have longer dephasing times, which correlate with more efficient energy conversion. The information learned can then be communicated to scientists and engineers designing solar cells.

### TDHF SIMULATIONS FOR FUSION CROSS SECTION FOR RARE ISOTOPE REACTION 38S+208PB

**Bryant Avila (The City College of New York)**

**Category & Time:** Physical and Mathematical Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 347
**Mentor(s):** Zach Kohley (NSCL)

The fusion cross sections for the nuclear reaction of 38S + 208Pb was previously measured at the National Superconducting Cyclotron Laboratory at Michigan State University and showed unusually large cross sections near the Coulomb barrier. This experiment suggested that rare isotope beams, such as 38S, could offer an increase in the cross section for fusion. This is important for future experiments as it can help determine more accurately the rate of production of superheavy elements. To better understand these surprising results Time Dependent Hartree Fock (TDHF) calculations were carried out to simulate the fusion reaction. TDHF simulates the dynamical evolution of the nuclear reaction is a self-consistent manner through the evolution of the nucleon wave functions in a mean-field. The results from the theoretical calculations can provide guidance for future experiments seeking to validate the fusion enhancement with rare isotopes. The theoretical TDHF calculations where performed using the High Performance Computing Center at MSU for the nuclear reaction 38S + 208Pb with energies ranging from 140 Mev up to 262 Mev. The results of the calculated cross sections compared to the previous experiment will be presented.

### INCREASING THE COMPUTATIONAL EFFICIENCY OF GENETIC OPTIMIZATION OF OLED FLUOROPHORES

**David Bianchi (Michigan State University)**

**Category & Time:** Physical and Mathematical Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 348
**Mentor(s):** Benjamin Levine (Chemistry), Garrett Meek (Chemistry), Yinan Shu (Chemistry)

In organic light emitting diodes (OLEDs), singlet and triplet excitons form in a 1:3 ratio. Thermally activated delayed fluorescence (TADF) is a process by which an increased rate of radiative electronic decay from the singlet state relative to non-radiative decay from the triplet state occurs in OLEDs, producing a higher quantum efficiency. For TADF to occur two properties are required: a small singlet-triplet energy gap and a large transition dipole moment for fluorescence. A genetic algorithm (GA) is applied to explore a chemical space of organic molecules to identify those with properties favorable for TADF. In previous work, the 6-31G* basis set was used in the electronic structure calculations executed to compute the fitness of each molecule because as one of the larger basis sets it gives more accurate values for the dipole moment and energy gap. Utilizing 3-21G, a smaller basis set than 6-31G*, decreased the run-time by a factor of 3 for a GA of identical parameters. With this in mind, we report the results of a GA optimization which simultaneously computed fitness values using both 6-31G* and 3-21G. Fitness computed with 3-21G were used as the decision maker, and comparison to 6-31G* demonstrated a strong correlation between the respective fitness values generated, illustrating the utility of the less time-consuming 3-21G basis for a similar comparative analysis of OLED molecules.

### TRANSITION METAL DOPING OF THE BETA-$NaFeO_2$/T-$LiFeO_2$ SYSTEM FOR INCREASED ELECTRONIC CONDUCTIVITY IN BATTERY APPLICATIONS

**Christopher Birzer (University of Kansas)**

**Category & Time:** Physical and Mathematical Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 349
**Mentor(s):** Joshua Davis (Chemistry), Viktor Poltavets (Chemistry)

New batteries with improved energy and power output are needed for electric vehicles. The T-$Li_xFeO_2$ polymorph has shown promise as a cathode material in batteries with the potential of utilizing both the $Fe^{2+}/Fe^{3+}$ and $Fe^{3+}/Fe^{4+}$ redox couple. Utilizing multiple redox couples offers the potential for greater energy density than most traditional lithium ion batteries, as they only utilize a single redox couple. This project seeks to improve the electronic conductivity of this material by employing metal doping in the iron position in the T-$Li_xFeO_2$ sytem. In order for the final T-$Li_xFeO_2$ polymorph to operate using multiple redox couples, it must have a crystal structure with tunnels that are sufficiently large to accommodate an extra $Li^+$. For this reason, it is necessary for the intermediate material to contain the larger $Na^+$. Therefore, to obtain the desired polymorph of doped T-$Li_xFeO_2$, doped samples of $Na_xFeO_2$ were first synthesized. This was done via solid-state chemistry methods whereby starting materials including the dopant were grinded, pelleted and then heated at high temperatures. The T-$Li_xFeO_2$ was obtained through ion exchange with an exchange of $Li^+$ for $Na^+$. Both the intermediate and final products were characterized using x-ray powder diffraction and inductively coupled plasma. Electrochemical properties were investigated with cyclic voltammetry by use of a potentiostat. This presentation will report on the characterization of the resultant material.

**CONTROLLING THE SPACE OF INFINITE GRAPHS**
**Garrett Divens (Morehouse College)**
**Category & Time:** Physical and Mathematical Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 350
**Mentor(s):** Robert Bell (Mathematics)

Graph theory is a fundamental area of research in mathematics that has applications to large data sets, geographic positioning, and information distribution. In this work we investigate the game of cops and robbers on graphs. The original game involves two players, one controlling some number of cops and the other controlling a robber. The players take turns moving their pieces on vertices of a finite connected graph. The objective is to analyze aspects of the game of cops and robbers on infinite graphs. We study a family of infinite graphs called spider graphs. The spider graphs are a disjoint union of n-cycles which we refer to as layers. In the center of this collection of layers is a point with n rays intersecting this vertex and the other layers surrounding them forming the total number of vertices on each layer. The techniques used to conclude the number of cops necessary for each graph were shadowing and the sweeping method. Shadowing involves cops moving onto the same ray as the robber, preventing the robber from moving towards the center of the graph. The sweeping method involves a number of cops systematically moving through infinite graphs, cornering the robber and forcing him to another layer. We concluded during our research that two cops are necessary to push a robber arbitrarily far from the center of a spider graph. We have also developed methods to analyze generalizations of the spider graph which resemble higher dimensional objects.

**ANALYTICAL INSTRUMENT FOR MEASURE EQUITY IN STEM CLASSES**
**Jose Airton Fernandes de Farias (Michigan State University)**
**Category & Time:** Physical and Mathematical Sciences, Section 2, 2:00 PM - 3:00 PM
**Poster:** 353
**Mentor(s):** Niral Shah (Education)

This poster presents an observation tool that characterizes equity in STEM (Science, Technology, Engineering, and Mathematics) classroom discussions. This tool aims to support teachers and researchers in identifying patterns of equity and inequity in student participation, as well as how those patterns relate to teachers' efforts to equitably distribute opportunities to learn. The tool focuses on several dimensions of classroom interaction, including: the length and quality of student talk; the cognitive demand of teacher questions; and the ways in which a teacher responds to student ideas. For researchers, the tool offers a systematic way of quantitatively measuring some aspects of equity in STEM classrooms. For practitioners, the tool offers a way of formatively assessing and improving teaching practice with respect to equity.

**QUANTITATIVE ANALYSIS OF TRAPPING STOCHASTIC MOVERS**
**Priyanga Ganesan (National Institute of Science Education and Research)**
**Category & Time:** Physical and Mathematical Sciences, Section 2, 2:00 PM - 3:00 PM
**Poster:** 354
**Mentor(s):** Jeffrey Schenker (Mathematics)

The capture of individual animals in lure-baited traps can help us in understanding the dispersal of animals and estimating their population densities. My summer work is a part of a bigger research project that aims at interpreting trap data for estimating populations. In our study, we developed a mathematical model for predicting the catch in a trap depending on certain parameters such as mobility and duration of movement. MATLAB simulations of random walkers were used to find a function that translates the catch probability of this insect motion into the catch probability of Brownian movers. Analysis of the effect of different trap configurations and geometries is the next phase planned. Converting catch numbers into accurate measurements of insect density can be very useful for the detection and management of invasive species and allow pest managers to take better decisions regarding the necessity and frequency of insecticide sprays. We hope that outcomes of the project will offer societal benefit via improved pest control that also minimizes damage to the environment.

**OPTIMIZATION OF MENADIONE-MEDIATED MGPDH ACTIVITY ASSAY**
**Karissa Gorr (Michigan State University)**
**Category & Time:** Physical and Mathematical Sciences, Section 2, 2:00 PM - 3:00 PM
**Poster:** 355
**Mentor(s):** Denis Proshlyakov (Chemistry)

Mitochondrial glycerol 3-phosphate dehydrogenase (mGPDH), is a mitochondrial enzyme that catalyzes a reversible oxidation of glycerol-3-phosphate with the formation of dihydroxyacetone phosphate. In this process, two electrons are transferred from FAD to coenzyme Q in the mitochondrial electron transport chain. At this time, there are no cures for metabolic diseases such as Type 2 diabetes and Alzheimer's disease that results from mitochondrial dysfunction. Efficient GPDH activity measurements can help understand the electrochemistry that takes place in the mitochondria. Currently, iodonitrotetrazolium chloride (INT) and menadione are used in a spectrophotometric assay to measure mGPDH activity. As G3P becomes oxidized, INT is reduced to form a formazan dye with a distinctive optical absorption at 490 nm. This

spectrophotometric method poses several problems. First, INT is reduced by ambient light in the presence of menadione, negating the facilitating effect of menadione on this assay(1). Secondly, the reduced form of INT is not readily soluble in water, which leads to precipitation and inaccurate spectrophotometric measurements. We are developing a new, more robust approach that involves a combination of incubation in the dark to limit the light driven reactions, and using hexanol extraction to circumvent limited solubility of INT. Comparison between classical and newly developed protocols will be presented. 1. Garrib, A., and McMurray, W.C. (1984) Analytical Biochemistry 139, 319-321

**EMITTANCE MEASUREMENTS OF ION SOURCE INJECTORS AT THE NSCL USING ALLISON EMITTANCE SCANNERS**
**Alec Iverson (Gustavus Adolphus College)**
**Category & Time:** Physical and Mathematical Sciences, Section 2, 2:00 PM - 3:00 PM
**Poster:** 356
**Mentor(s):** Alfonse Pham (National Superconducting Cyclotron Laboratory), Michael Syphers (National Superconducting Cyclotron Laboratory)

Preliminary diagnostic measurements of ion beam emittance for two electron cyclotron resonance (ECR) ion source injector designs, the Superconducting Source for Ions (SuSI) and the iron-magnet based ARTEMIS ECR ion source, implemented at the Michigan State University (MSU) National Superconducting Cyclotron Laboratory (NSCL) are currently being carried out. The injectors are comprised of the ion source, corresponding beam transport line used to inject various ion species into the K500 cyclotron, and beam diagnostics for beam tuning and optimization. The main diagnostic tool being used is an Allison Emittance Scanner (AES), a device that scans through the beam to provide high resolution measurements for the characterization of beam quality. These AESs are used to quantify and validate beam properties before the delivery of beams to the experimental halls. Additionally, the resulting 4-dimensional phase space characterization will guide beam scientists to further understand and refine beam properties. These emittance measurements and their implications will be discussed.

**ON THE WEAK COPNUMBER OF INFINITE GRAPHS**
**Gregory Rodriguez (New York University), Garrett Divens (Morehouse College)**
**Category & Time:** Physical and Mathematical Sciences, Section 2, 2:00 PM - 3:00 PM
**Poster:** 357
**Mentor(s):** Robert Bell (Mathematics)

A game of cops and robbers is played on a graph G whereby the cops C, must chase the robber R, around an undirected, finite, and connected graph. The cops and the robber know where each other are and both play optimally. The game ends when a cop occupies the same vertex as the robber, but the robber wins if he can perpetually evade the cops. The copnumber of a graph is the minimum number of cops needed to capture the robber. In 1982, Aigner and Fromme studied the game played on finite graphs. We investigate a variant of the game where the graph is infinite and seek to discover the weak copnumber of a graph: the minimum number of cops needed to force the robber arbitrarily far from a reference point. We discovered that the weak copnumber of an infinite square grid is 2. Moreover, we have established upper bounds for the weak copnumber of infinite equilateral triangular grids, hexagonal honeycomb grids, and cylindrical triangular & square grids; we hope to prove that these bounds are sharp. We use a technique introduced by Aigner and Fromme called guarding: where a cop is said to be guarding isometric paths in finite graphs, but our investigation is novel in applying these techniques to infinite graphs. Extending the game of cops and robbers to infinite graphs seems natural, and we expect our results to be useful to other graph theorists.

**INTERLEAVED AND ENTANGLED DIVALENT METAL THIOPHENEDICARBOXYLATE COORDINATION POLYMERS WITH AN EXTREMELY LONG-SPANNING AND FLEXIBLE DIPYRIDYLAMIDE LIGAND**
**Alexander Sample (Michigan State University)**
**Category & Time:** Physical and Mathematical Sciences, Section 2, 2:00 PM - 3:00 PM
**Poster:** 358
**Mentor(s):** Robert LaDuca (Chemistry)

Research in the field of metal organic frameworks (MOFs) still continues due to the numerous applications (such as hydrogen storage, ion exchange, explosive detection, and non-linear optics) and seemingly limitless combinations of metals and ligands. These MOFs were made by adding a divalent metal salt, water, base, a dicarboxylate ligand, and a neutral dipyridyl ligand to a Teflon container. These mixtures were then heated at various temperatures for several days. Varying the components of the coordination polymer leads to different topologies which were determined by X-ray diffraction. [Cu(2,5-thiophenedicarboxylic acid)((propane-1,3-diylbis(piperidine-4,1-diyl))bis(pyridin-4-ylmethanone))(H2O)]•2H2O}n (1) created 2D layers that weave together to form a slab. [Co(2,5-thiophenedicarboxylic acid)( (propane-1,3-diylbis(piperidine-4,1-diyl))bis(pyridin-4-ylmethanone))(H2O)]n (2) shows 1D ribbons that interpenetrate with neighboring ribbons to form a 2D structure. [Ni(2,5-thiophenedicarboxylic acid)( (propane-1,3-diylbis(piperidine-4,1-diyl))bis(pyridin-4-ylmethanone))2(H2O)]n (3) has an unprecedented system of self-penetrating 2D layers that interpenetrate each other to form a different 2D topology when O–H···N hydrogen bonding patterns are treated as links. Physical properties including luminescence studies, infrared spectroscopy, and thermogravimetric analysis are also discussed.

# SOCIAL, BEHAVIORAL, AND ECONOMIC SCIENCES

**LITERARY NEUROSCIENCE AND TOP-DOWN ATTENTION**
**Mohan Gupta (Michigan State University), Lana Grasser (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 361
**Mentor(s):** Natalie Phillips (English)

Literary neuroscience is an emerging field that has had many implications of how we view reading and language processing. Previous studies have shown top-down attention can modulate brain activity during a task (Gallant 2013). How one allocates attention is therefore reflected in one's neural networks. In this study, top-down attention was explored during natural reading to identify differences in neural responses during two different styles of attention, analytical (close) and pleasure reading. Subjects read the second chapter of Jane Austen's Mansfield Park in an MRI scanner where functional activity of the blood oxygen level-dependent (BOLD) response was recorded. After the scan, subjects wrote

literary essays on sections they close read which were then categorized based on topics e.g. spatial, emotion, narrative, literary elements. This study aims to explore the differences in neural activity between subjects who focused their literary essays on narrative (lexical) elements versus subjects who focused on emotion. Based on behavioral results (post-scan literary essays) we hypothesize thematic content of essays will be a predictor of differential patterns of activation during the task for groups of subjects, despite all subjects doing the same task. These findings may lead to increased knowledge of how literary stimuli in a task can call different modes of attention for individuals.

**ASSOCIATIONS BETWEEN FACETS OF ANXIETY AND COGNITIVE CONTROL: A MULTIMETHOD STUDY**
**Isaac Arthur (Prairie View A M University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 362
**Mentor(s):** Jayson Moser (Psychology)

Anxiety is a multifaceted phenomenon characterized by a variety of symptoms including worrisome thoughts and physiological arousal. These tendencies of negative thinking and physical disturbance of anxious individuals can have different influences on cognitive control – i.e., the ability to focus attention, multitask, and hold information in short-term memory. Current research is equivocal as to how exactly anxiety relates to cognitive control, which begs the question, does anxiety bolster or hinder performance? Anxious individuals express high levels of vigilance, which might heighten attention, whereas worrisome thoughts can be distracting and cause problems for staying focused. In this study, we examined the relationship between these two types of anxiety – worry and arousal – and cognitive control using self-report and behavioral performance – computerized cognitive tasks – methods. Across two studies involving approximately 500 college students, self-reported worry and arousal related to poorer self-reported abilities to stay focused in the face of distraction and shift attention between multiple tasks. An interaction also emerged such that higher levels of worry in combination with higher levels of anxious arousal were associated with the lowest capacities for attentional control, especially with respect to the ability to focus attention. Further analyses in a smaller sample for which behavioral performance data were available suggested additional interactive effects of anxiety on cognitive control. These results lend insight into the types of relationships that exist among the components of anxiety and cognitive control, and, specifically, the nuances.

**UNDERSTANDING ONLINE SECURITY BEHAVIOR**
**Ruth Berman (Macalester College)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 363
**Mentor(s):** Rick Wash (Media and Information)

From email to online banking to Facebook accounts, passwords are an integral part of protecting online information. Yet, many people engage in insecure password practices, such as using the same password for multiple accounts or choosing commonly used passwords like '123456' and 'password'. These practices leave people vulnerable to online attacks that compromise personal information. Using a dataset containing the online activity and security practices of over 120 users of Microsoft Windows 7 and 8 collected over the course of six weeks, we analyze in which circumstances users adopt better password security practices. We use a measure of password security called 'entropy', which is a score assigned to a password based on its length and uniqueness of characters. Along with entropy, we look at whether users choose different passwords for different accounts. We then compare this information to users' understanding of online security and their descriptions of their own security practices, compiled from a survey completed by all participants both before and after the six week data collection period. We hope to better understand which systems of thought lead to safer password practices and more secure online behavior. Insight into these factors can help us to encourage better online practices and password behavior in the future.

**THE IMPACT OF STAKEHOLDERS ON YOUNG URBAN BLACK MALES COLLEGE GOING ASPIRATIONS**
**Christian Bonilla (Morgan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 364
**Mentor(s):** Chezare Warren (Teachers Education)

Entering college is a challenge many urban high school students face. The college enrollment rate for Black males in recent years has been stagnant or decreasing (NCES, 2014). Factors that are known to impact students likelihood of enrolling into college include their interaction within the high school (Berzin, 2010), and how the high school emphasizes students enrollment into college. (Bryan et al., 2015). This study seeks to understand how stakeholders' interaction with students attending Apple High, an urban single-gender high school in a large Midwestern city with a 100 percent enrollment rate in college, influences the young Black men's college-going aspirations. This qualitative study will examine students' prior knowledge about college, the messages they received about attending college, and how those messages informed their decision to enroll into college. Findings show that the adults' interactions with student play an important role for college aspirations. Furthermore, three themes help understand how the interactions played an important role, as we will discuss further into the paper.

**LANGUAGE BARRIERS, CO-WORKER INTERACTION, AND MEANINGFUL FEEDBACK REGARDING SOCIAL ISOLATION OF LATINO DAIRY FARM WORKERS**
**Stephanie Bonilla (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 365
**Mentor(s):** Ruben Martinez (Julian Samora Research Institute)

The focus of this paper is on U.S. dairy farm workers' and managers' attitudes and behaviors regarding social isolation among Latino dairy farm workers. Social isolation is the lack of social interaction, contact, or communication with other people. The research question addressed is: How do language barriers, interaction between co-workers outside of work, and lack of meaningful feedback from managers contribute to the social isolation of Latino dairy workers? Selected contributing factors of social isolation found in Vega and Brenna's (2000) taxonomy of social isolation including lack of community integration, degree of power, and meaningful feedback will serve as the guiding theoretical framework of this study. Indicators of these concepts to be observed include (1) language barriers between co-workers and managers, (2) little interaction between co-workers outside of work, and (3) negative reinforcement upon workers by managers. I will conduct secondary analyses of focus

group (N=30) and survey data (N=80) from dairy farms in Michigan, Florida and Pennsylvania. Data was collected by the Julian Samora Research Institute as part of the Quality Milk Alliance Project. I will be using their pre-test inventory of mastitis practices attitudes and behaviors (IMPAB) and human resource survey among managers and employees. This study is important because social isolation increases mental health issues, decreases productivity of dairy farms, and lowers the quality of life for the Latino dairy farm workers.

**OPERATIONAL COMPLEXITY IN THE AUTOMOTIVE INDUSTRY**
**Erika Burdt (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 1, 1:00 PM - 2:00 PM
**Poster:** 366
**Mentor(s):** Claudia Rosales (Supply Chain Management)

We examined the effects of many factors on financial indicators of firms in the automotive industry. We began by collecting an immense amount of data, cleaning it up, then analyzing it using different strategies. We ran multiple regressions and calculated p-values to determine what data was significant and what correlations were weak. There is still a lot to be discovered, but this project outlines what business strategies in the auto industry lead to supply chain efficiency and financial success.

**EXPLORING SUSTAINABLE BUSINESS PRACTICES OF LEED-CERTIFIED HOTELS AND THEIR IMPACTS ON HOTEL GUESTS' BEHAVIORS**
**Kortnie Bush (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 2, 1:00 PM - 2:00 PM
**Poster:** 368
**Mentor(s):** MiRan Kim (The School of Hospitality Business)

According to the U.S. Green Building Council (2014), "In the United States alone, hotels represent more than 5 billion square feet of space, nearly 5 million guest rooms, and close to $4 billion in annual energy use. Hotels and other hospitality venues have a significant opportunity to reduce negative environmental impacts through energy and water efficiency, waste reduction and management, sustainable and local purchasing, and use of alternative transportation." Hotels can also contribute to human well-being by providing healthy, comfortable, and productive indoor environments with improved indoor air quality, access to daylight and views, and occupant control of the lighting and thermal environment. In the hospitality industry, there has been a surge in Leadership in Energy and Environmental Design (LEED) applications and successful certifications in the last few years, indicating that LEED is becoming a competitive reality for the hospitality industry. LEED is a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighborhoods. As of October 2013, 235 green hotels had received LEED certification at various levels and 1,381 hotel/lodging projects are registered to pursue certification. The proposed research project is to identify the green business practices of LEED certified hotels. Specifically, this study aims (1) to examine sustainable business practices of Marriott Hotels, which have become involved in LEED-certified projects as one of the leading hospitality companies and (2) to explore the impacts of sustainable business practices on hotel guests' behaviors.

**THE CONNECTION OF INTERVIEWER CHARACTERISTICS WITH RESPONSES TO OPEN-ENDED QUESTIONS**
**Erica Dalzell (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 2, 1:00 PM - 2:00 PM
**Poster:** 369
**Mentor(s):** Merry Morash (Criminal Justice)

To best train interviewers to gather detailed qualitative data, it is important to know the effects of the structure of the interview, framing of interview questions, and the type of follow-up questions the interviewer asks. The intent of this research is to examine the connection between the way an interviewer asks a series of questions with the detail and length of the participant's response. The match between the race of the participant and researcher as a possible influence on responses will also be studied. The research will be conducted by coding for variation in the presentation of the research question and how that impacts the response detail for 52 women on community supervision in Michigan. The sample is stratified based on interviewer and participants with common (N=26) and differing (N=26) race. The outcomes of this research could have an impact on the way interviewers for qualitative research studies are trained, how research questions are designed, and how participant and interviewer are paired together based on race.

**FLOCKING TOGETHER: SOCIAL INFLUENCE AND HOMOPHILY INTERACT TO CREATE GROUPING BEHAVIOR**
**James Finch (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 2, 1:00 PM - 2:00 PM
**Poster:** 370
**Mentor(s):** Emilee Rader (Media and Information)

A typical property of social networks is autocorrelation, the tendency for one person's characteristics to predict the characteristics of those they have social relations with. Determining to what extent social autocorrelation is caused by similar people forming relationships (homophily) or by related people becoming similar (social influence) is an ongoing area of study. While previous research has studied the effects of homophily and social influence with real-world data, the lack of detail regarding subjects' social decision-making processes in these data prevents these studies from explaining social influence and homophily's impact on autocorrelation in terms of individual decisions and motives. The present study sought a more detailed, mechanistic understanding of social influence and homophily's effects on social networks through the construction of an agent-based model. By testing different social decision-making paradigms in a model social network and measuring the corresponding homophily and social influence behaviors that emerge, individual-level operationalizations of these two constructs were formed (e.g., "people avoid relationships with dissimilar others" is a decision paradigm that operationalizes homophily). These operationalizations then became conditions in experiments designed to assess their effects on autocorrelation, the overall structure of the network, and how information travels across it. Results indicate that decision-making paradigms analogous to homophily cause isolation between dissimilar people in social networks, while paradigms analogous to social influence cause clustering among related people. Broadly, these results suggest that social influence and homophily are fundamental and interacting social forces that uniquely structure our social world.

**MEASURING THE EFFECT OF CAPITAL PUNISHMENT ON MURDER DETERRENCE**
**James Monroe Gamble IV (University of Missouri)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 2, 1:00 PM - 2:00 PM
**Poster:** 371
**Mentor(s):** Jeffrey Wooldridge (Economics)

Since the reinstatement of capital punishment in 1976 (Gregg vs. Georgia), executions have been performed in 34 states. The efficacy of the death penalty is often evaluated by its ability to deter crime. We seek to answer the question; does the death penalty have a deterrent affect on murder rates? In this paper we use a fixed-effects model to examine county-level execution and murder data in an effort to elucidate the existence of a deterrent effect. Unlike previous authors we employ a novel approach using county-level data to exploit variation of capital punishment within as well as across states. Results will be given in terms of murders deterred for every one execution. This has legislative ramifications in a post-Gregg era, as it is widely accepted in the field of economics that the literature used to overthrow the death penalty moratorium (Ehrlich 1975) was flawed in its experimental design. These expected findings are significant in their ability to inform policy concerning the death penalty in a post-Gregg era.

**MANAGERIAL ATTITUDES AND BEHAVIORS REGARDING OCCUPATIONAL MOBILITY OF U.S. DAIRY FARM WORKERS**
**Daniel Gomez (California State Polytechnic University Pomona)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 2, 1:00 PM - 2:00 PM
**Poster:** 372
**Mentor(s):** Ruben Martinez (Sociology)

This research focuses on U.S. dairy farm manager's attitudes and behaviors regarding the occupational mobility of their employees. Occupational mobility refers to the movement of an individual of an occupational group either vertically or horizontally along the stratified system of occupational prestige (Marshall and Scott, 2009). Attitudes and behaviors of managers may serve decisive roles in determining employee occupational mobility. This research attempts to answer the questions: (1) What are the attitudes and behaviors of dairy farm managers regarding communication between managers and workers, employee training, and employee ambition and trust as it relates to their employee's occupational mobility? (2) How do these attitudes and behaviors impact the occupational mobility of Latino employees? Occupational mobility studies have been heavily concerned with macro-level trends, migrant networks, and language ability; primarily overlooking important dimensions such as communication between managers and workers and training of employees. Through secondary analysis of human resource survey (n=15) and inventory of mastitis practices attitudes and behaviors (IMPAB) focus group data among managers (n=40) collected by the Julian Samora Research Institute, I address the managerial communication, training, and attitudes toward employees by observing the training and communication processes of managers, the rate of contact of managers and employees, and manager perceptions on employee ambition, trust, independence on the job, and laziness. The survey covers farms in Michigan, Pennsylvania, and Florida. By investigating managerial roles in the occupational mobility of farm workers, more effective Human Resource practices can advance the skills and productivity of dairy workers and farms.

**CORRELATIONS BETWEEN ADOLESCENTS, ILLICIT DRUGS, AND VIOLENT BEHAVIOR**
**Johnny Jimenez (Northeastern Illinois University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 3, 2:00 PM - 3:00 PM
**Poster:** 374
**Mentor(s):** Sheila Maxwell (Criminal Justice), Andrew Osentoski (Criminal Justice)

The use of illegal drugs by adolescents and its frequent overlap with violent behavior is an ongoing problem in our society. Prior research indicates white youths are more likely to use illegal drugs, but African-American youths who use illegal drugs are more likely to get involved in violent behavior. This study will specifically focus on young adolescents aged 12-17 who use drugs and have engaged in violent behaviors. Most importantly this research project seeks to find out if minority groups who use illegal drugs have higher rates of violent behavior than their non-minority counterparts. The data for this research was collected by the National Survey on Drug Use and Health, 2013 edition. For this research two different types of test will be used: bivariate and multivariate. First, bivariate tests will be used to examine the basic relationships between race/ethnicity, illegal drugs, and violent behavior. Next, a multivariate regression test will explore how multiple risk factors including those mentioned above contribute to violent behavior. We anticipate a strong relationship between illegal drug use and violent behavior among adolescents, regardless of race. The overall objective is to understand which risk factors may contribute to the use of illegal drugs and violent behaviors among adolescents. Therefore the results may help develop methods that will aid in reducing violent behaviors among adolescents. If we can understand the role that illegal drugs play among adolescents that may contribute to finding methods that will reduce violent behavior in adolescents.

**PHONOLOGICAL AWARENESS AND ITS EFFECT ON LANGUAGE ACQUISITION BRAIN ACTIVITY**
**Cary Junior (Morehouse College)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 3, 2:00 PM - 2:00 PM
**Poster:** 375
**Mentor(s):** Fan Cao (Communicative Sciences and Disorders), Bethany Sussman (Communicative Sciences and Disorders)

When assessing language acquisition, phonological processing has proven to be very important in language skill development. Phonological awareness (PA) is a transferable skill between the Chinese, Spanish, French, and English languages (Cisero & Royer, 1995; Lafrance & Gottardo 2005; Luo, Chen, & Geva 2014). Chinese and English syllable structure can be similarly broken into onset and rhyme (Luo, Chen & Geva, 2014). Phonological skills are predictive of reading and spelling between the Spanish and English languages (Sun-Alperin & Wang, 2011; Riccio, Amado & Jimeñez, 2001). These similarities call into question PA's ability to predict brain activity when studying a particular language. We investigated whether phonological awareness predicts activity in the inferior parietal lobule (IPL) and superior temporal gyrus (STG) when performing language tasks, and what specific PA skills explain that association. It is hypothesized that the phonological awareness will have a significant association with brain activity and that the elision skill will explain the greatest amount of association for the Spanish language and the blending words task to explain the greatest for the Chinese language. Ten subjects aged 18 and older are pre-assessed and then underwent a 10-day training where they are taught 144 words (72 Chinese, 72 Spanish). The subjects, during fMRI, then performed sound and meaning judgement

tasks on the learned words in each language. We expect a significant negative correlation between PA and brain activity as well as the elision and blending words skills to be the greatest contributors in percentage of predictability explained.

**RETAIL INTERNATIONALIZATION: THE CULTURAL DISTANCE FACTOR**
**Cara Kaye (Michigan State University), Stacey Karl (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 3, 2:00 PM - 3:00 PM
**Poster:** 376
**Mentor(s):** Brenda Sternquist (Marketing)

Our main focus for this research is to evaluate the internationalization of 34 grocery stores and hypermarkets using Geert Hofstede's cultural dimensions theory. Hofstede's theory measures the effects of culture and values in a society using 6 dimensions. To conduct our research, we used Palisto's Cultural Distance Calculator to find the country score for each country one of our focus companies entered. The calculator used four of Hofstede's dimensions, power distance index (PDI), individualism versus collectivism (IDV), masculinity versus femininity (MAS), and uncertainty avoidance index (UAI). This allows us to be able to measure the difference in cultures within the internationalization of one store chain, and across multiple stores. Our research is part of a larger project being done by a marketing professor here at Michigan State University on international expansion patterns and trends of large companies. We have all been working together to try and find the best ways to identify and examine these patterns and have found that cultural distance can be a good indicator of why companies go where they go, or why they expand in the order they do.

**TECHNOLOGY'S ROLE IN ADVANCING SUPPLY CHAIN MANAGEMENT EDUCATION**
**Brian L'Heureux (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 3, 2:00 PM - 3:00 PM
**Poster:** 377
**Mentor(s):** Yemisi Bolumole (Supply Chain Management)

As technology advances, so must supply chain management education. Many business schools are criticized for not keeping up with the times, as technology expertise is a must for any modern business or supply chain professional. Implementation of new technology in course curriculum enables business schools to create an active learning platform that enhances students' understanding of topics while making students more adaptable to changes in workplace technology. At Michigan State University's Eli Broad College of Business, technology upgrades in 2012 led to the implementation of Rooms for Engaged and Active Learning, also known as R.E.A.L. classrooms. These rooms expose students to the newest forms of business technology solutions which often cause fear in students and professionals. This study examines Qualtrics data from student reviews of SCM 373, a supply chain management course at MSU that used R.E.A.L. to provide a transformational student learning experience. Student responses to 23 questions after a 16-week semester quantified perceptions of the technology and collaborative teaching methods, confirming that R.E.A.L. leads to positive exposure to new technology. The data from the surveys shows that most students saw R.E.A.L. as a beneficial tool in their supply chain management education. In addition, most students attributed R.E.A.L. to their favorable review of the instructor. If future classes that use technology like R.E.A.L. yield similar feedback, business schools will recognize the need to keep pace with new technology in their curriculum and will thus be able to produce more employable students.

**HOW DOES THE NUMBER OF MEMBERS IMPACT THE PERCEPTION OF ONLINE COMMUNITIES?**
**Ellen Light (University of Wisconsin-Madison)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 3, 2:00 PM - 3:00 PM
**Poster:** 378
**Mentor(s):** Rick Wash (Media and Information)

Online communities like Wikipedia, WebMD, Twitter, and GoFundMe generate, collect, and display knowledge. However, sustainable and productive online communities are difficult to create and maintain. Understanding how people think about online communities will help us understand how to create successful ones. One factor in a community's success may be its size, measured by the number of members. Previous studies suggest that large communities experience more movement in and out of the community than small communities: more people join, but more people also leave in the same amount of time. However, little research has been done on the thinking process behind user participation. This study attempts to characterize the differences, if they exist, between how people think about large communities and small communities. To do this, we constructed a survey that questions people about a fake online community where members discuss health issues. Participants will either observe this community with many members or with few members, then be asked about how they see the site, including the purpose and characteristics of the community, whether they would consider joining, and whether they noticed the number of members. We expect that large communities will seem more sustainable and less demanding, making people more likely to join. Small communities may seem to require a larger sense of personal responsibility and longer-term commitment, making it harder to attract new members. We hope that the results of this survey will give us insight into the success of online communities.

**STUDENT WRITING REVEALS MISCONCEPTIONS IN THE CENTRAL DOGMA OF BIOLOGY**
**Alexandria Mazur (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 4, 3:00 PM - 4:00 PM
**Poster:** 381
**Mentor(s):** John Merrill (Microbiology and Molecular Genetics), Rosa Moscarella (Center for Engineering Education Research), Mark Urban-Lurain (Center for Engineering Education Research)

An understanding of genetics is fundamental for the comprehension of biology core concepts. Yet, many undergraduate students have difficulty understanding genetic concepts, particularly the central dogma of molecular biology. The central dogma, often stated simply as "DNA codes for RNA which codes for proteins" encapsulates the general principle that hereditary information resides in nucleic acids and this information is expressed ultimately as protein. The Automated Analysis of Constructed Response (AACR) research group is investigating the use of constructed response (CR) questions to gain greater understanding of student thinking about core biology concepts through students' writing. AACR uses lexical and statistical analyses to predict expert scoring of student responses. We have developed CR questions to assess students' understanding of how mutations affect the three processes involved in the central dogma and administered it to introductory biology students.

The results revealed that students' understanding of transcription did not improve after instruction. We conducted interviews to better understand students' difficulty when learning transcription. In the interviews, students were asked to respond aloud to the same CR question and we assessed how students translated this knowledge to other biological processes. The interviews provided insight into the aspects of transcription that students struggle to understand. We then designed and piloted a new CR question specific to one aspect of transcription identified as difficult for students. The interviews and new CR revealed students' misconceptions already identified in the literature and a new one not previously reported.

### UNDERSTANDING DRIVERS & BOUNDARIES OF FIRM-CONSUMER RELATIONSHIPS

**Megan McKee (Michigan State University)**

**Category & Time:** Social, Behavioral, and Economic Sciences, Section 4, 3:00 PM - 4:00 PM
**Poster:** 382
**Mentor(s):** Stephanie Mangus (Marketing)

In an era where customer satisfaction with firms is declining (ACSI 2014) and customer complaints are at an all-time high (Freeman 2013), firms are increasingly interested in exploring ways to develop and maintain long-term relationships with consumers. Such positive relationships between firms and consumers are crucial to generating customer loyalty, improving firm performance outcomes, and facilitating customer retention (Dwyer, Schurr and Oh 1987; Palmatier 2008). To investigate how consumers form relationships with firms, this research explores specifically relationships that consumers develop with firms, representatives of the firm (salespeople or frontline employees), and brands. Of further importance to this area of research is how consumers form relationships with each of these entities. To explore these issues, 11 in-depth interviews were conducted with consumers and analyzed using a hermeneutical phenomenological approach (Hirschman 1992). This process allows for the evaluation of different relationship types, the boundaries of such relationships, and the outcomes of such relationships for the consumer and the firm. This study has managerial implications for firms aiming to develop optimum relationship with consumers such that understanding the propensity an individual has toward creating relationships with other people or organizations could prove vital in understanding how firms can improve customer satisfaction, brand loyalty, organizational commitment, and other important firm outcomes.

### THE SECRET TO SUCCESS IN CROWDFUNDING: WORD CHOICE

**Sean McNeil (Cornell University)**

**Category & Time:** Social, Behavioral, and Economic Sciences, Section 4, 3:00 PM - 4:00 PM
**Poster:** 383
**Mentor(s):** Rick Wash (Journalism)

Donorschoose.com is a non-profit crowdfunding platform where teachers can request donations to facilitate classroom projects. This study seeks to identify which words, phrases, and topics in a project description are more likely to lead to a project getting funded. Beyond that, we hope to discover whether teachers learn these words, phrases, and topics over time and become more successful at funding their projects by incorporating these features. Previous studies on text analysis not only lend insight on how to approach this kind of work, but also reveal that the different situational context impacts how the text performs. The same text has varying results in different fields and situations. This suggests we need to study the results that projects descriptions on donorschoose.com produce specifically. Using data from donorchoose.com between 2007 and 2012, we were able to analyze hundreds of thousands of text descriptions. We investigated several text analysis strategies including Linguistic Inquiry and Word Count, topic models, and n-gram frequency to select the best plan for studying these kinds of descriptions. We also sought to study whether teachers learned (i.e. whether they incorporated more qualities of successful projects and less qualities of unsuccessful projects over time) by comparing the project description of a teacher's first project to that of their latter projects. If we can better understand the reasons donors decide to contribute to certain projects and how project creators learn over time, we can better educate project creators on how to construct successful projects.

### RACE BIAS IN DECISIONS TO SHOOT: PHYSIOLOGICAL RESPONSES TO IMMERSIVE AND NON-IMMERSIVE EXPERIMENTAL SHOOTER TASKS

**Chelsea Osuji (Montclair State University)**

**Category & Time:** Social, Behavioral, and Economic Sciences, Section 4, 3:00 PM - 4:00 PM
**Poster:** 384
**Mentor(s):** Joseph Cesario (Psychology), David Johnson (Psychology)

Recent events of police shooting of unarmed citizens has captured public attention. Social psychologists have studied the effect of race on an individual's decision to shoot another person using the "shooter task," a video game-like simulation that requires participants to quickly respond to pictures of potentially dangerous human targets by pressing buttons labeled "shoot" or "don't shoot." Results of such studies have found that participants shoot armed Black men more quickly than armed White men, and are also more likely to mistakenly shoot unarmed Black men than unarmed White men. However, previous research using this method has focused primarily on the speed and accuracy of responses, giving little consideration to the external validity necessary to generalize to real world police-civilian interactions. In an attempt to improve this task, we address these concerns by having participants (community members) fire a real handgun (modified to shoot an infrared laser) in response to pictures of armed and unarmed targets. In addition to evaluating racial bias in this task, we are also measuring subjects' physiological responses (including heart rate, heart rate variability, and respiration). We will compare physiological responses between button box and real gun task, and then determine whether these physiological measures correlate with behavioral performance. We hope that these data provide support for a more realistic method for identifying the factors important for decision making, in a realm in which incorrect decisions can have serious consequences.

**CLEANING COMPUTER SECURITY DATA**
**Robert Plant Pinto Santos (Universidade Federal do Ceara)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 4, 3:00 PM - 4:00 PM
**Poster:** 385
**Mentor(s):** Rick Wash (Communication Arts and Sciences)

Does how people think about computer security affects how they actually use their computers? Answering this question will help to create more efficient approaches to improving computer security and make people less vulnerable. To answer this question each person completed a survey about how they view their behavior and then they installed software on their personal computer that recorded every process that was executed by the computer over the course of 6 weeks. A computer can execute hundreds of processes in a minute and every computer runs in a different way, not only according to its hardware and software but also by the way the person uses it. This means that there is a lot of data to be analyzed and that data is messy. The data needs to be cleaned and reorganized to extract the information that we need to match computer and survey data. It is necessary to clean and reorganize the data to be able to analyze it and to avoid misleading results. Data cleaning includes examining the data and finding patterns in it, as well as search for cases that do not agree with those patterns. Then we must determine if these weird cases should be cleaned. This is unclear because a data point data does not follow a pattern is not necessarily inaccurate. We need to decide when the data is ready to be analyzed because it is possible to get caught in a loop of analysis and cleaning.

**BORDERLINE PERSONALITY AND PATTERNS OF FRIENDLY BEHAVIOR AMONG COLLEGE STUDENTS**
**Stephanie Price (California State University San Marcos)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 5, 3:00 PM - 4:00 PM
**Poster:** 388
**Mentor(s):** Christopher Hopwood (Psychology), Katherine Thomas (Purdue University: Psychology)

Borderline Personality Disorder (BPD) is characterized by emotional instability and interpersonal dysfunction. Difficulties regulating friendly behavior may underlie some of the interpersonal problems associated with disrupted relationships among individuals with BPD diagnoses. Attachment theory suggests that these difficulties are most likely to emerge in close relationships, and our previous research suggests that husbands with more BPD features are less friendly and have wives who are less friendly than husbands lower in BPD features. The aim of the present study was to examine associations between borderline features and patterns of friendly behavior among a sample of unfamiliar college students, to examine whether such patterns extend to non-close relationships. A sample of 360 college students reported on their borderline features and completed a video recorded discussion task in a laboratory setting. Each dyad was comprised of one male and one female participant. All videos were coded by research assistants to capture ratings of friendly behaviors on a scale from -1000 to 1000 (unfriendly to friendly) twice per second using a computerized joystick system. Actor-partner interdependence models revealed associations between borderline features and friendliness during these discussions among unfamiliar participants. Unlike in a previous study with couples, participants' borderline features were only associated with their own friendliness; their BPD features did not impact the friendliness of their interaction partners. Also, effects were similar for men and women. Taken together these findings suggest that BPD features impact friendliness in general, but may do so differently in close and unfamiliar dyads.

**DISPOSITIONAL MINDFULNESS AND GROWTH MINDSET ENDORSEMENT: UNIQUE AND INTERACTIVE IMPACTS ON ANXIOUS AROUSAL**
**Sean Roberts (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 5, 3:00 PM - 4:00 PM
**Poster:** 389
**Mentor(s):** Jason Moser (Psychology)

It has been shown that mindfulness or present moment awareness of one's thoughts, feelings, and sensations is protective against physical and mental distress. Basic beliefs about the self (believing that certain attributes can change) have also been shown to be protective against psychological problems. However, few studies have evaluated how these two protective factors interact in their relation to distress. In this study, we aimed to address this question by examining how both trait mindfulness (awareness of thoughts, feelings, and sensations) and growth mindset endorsement (the belief that self-attributes are malleable) related to physiological anxiety symptoms (anxious arousal). Two hundred and ten female participants completed the Mindfulness Attention Awareness Scale (MAAS), Implicit Theories Questionnaire (ITQ), and the Mood and Anxiety Symptom Questionnaire – Anxious Arousal subscale (MASQ-AA). Linear regression was conducted with the MAAS, ITQ, and their interaction entered as independent variables and the MASQ-AA entered as the dependent variable. A significant interaction suggested that growth mindset endorsement related to less anxious arousal, particularly for those with low trait mindfulness. This could be because the belief that anxiety can change breaks the self-perpetuating cycle that may arise when an individual is anxious about their anxiety and lacks the self-awareness to realize it. Taken together, these findings suggest that the treatment of anxiety using mindset interventions is especially effective for individuals who have low trait mindfulness. Our study also suggests that a more integrative approach to understanding protective factors against psychological distress may be fruitful.

**EFFORTFUL CONTROL IN DISADVANTAGED AND MINORITY CHILDREN**
**Billy Rodriguez (St Mary's University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 5, 3:00 PM - 4:00 PM
**Poster:** 390
**Mentor(s):** Catherine Durbin (Psychology)

This study will examine demographic correlates of individual differences in children's Effortful Control, which refers to their abilities to modulate emotions and behaviors in response to environmental contexts. Specifically, it will explore demographic factors of ethnicity, Socioeconomic Status (SES) factors such as Parental Education and Household Income, family size, and birth order. Data will be drawn from a sample of 277 community children. Effortful Control (EC) will be measured by parent report and laboratory assessment. Pearson Product-Moment Correlations will be used to determine the strength of the relationships between EC and demographic factors. Finding a relationship between EC and Ethnicity, SES Factors (Parental Education and Household Income), and sibling order can help determine which groups of populations to focus upon in further research. Since Effortful control has shown to be positively correlated with academic success, knowing which populations to

focus upon, interventions may be conducted to increase a child's Effortful Control, thus potentially increasing a child's chance at academic success.

**MODELING THE DIFFUSION OF SHARED VOTES ON FACEBOOK**
**Paul Rosemurgy (Michigan State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 5, 3:00 PM - 4:00 PM
**Poster:** 391
**Mentor(s):** Emilee Rader (Communication Arts and Sciences)

There has been much discussion concerning the potential for Facebook to influence the outcome of an election through social signals about voting behaviors, made possible by an "I Voted" button that users can click to let their friends know that they voted. Bond et al. (2012) found that receiving a social message about others' voting behavior resulted in greater voter turnout. This has raised a question about whether Facebook has the power to differentially mobilize voters and influence which political party receives more votes. We created an agent-based model to simulate how the diffusion of social signals of voting behavior results in network-level voting patterns. We simulated different scenarios by varying initial conditions such as the size of the network, average number of friends, and percent of participants who will initially share their vote to match data taken from Facebook's network. Our simulation measures network level outcomes such as the total number of votes induced by the interaction of individual agents within the network. When individuals in a social network recursively influence their neighbors by announcing that they voted, network-level voting patterns appear. An increase in the sharing of voting behavior is directly related to an increase in the number of votes. The model can also be utilized to suggest that Facebook not only has the power to influence the number of votes, but also which political party will vote more when the option to share votes is given to exclusively one political party.

**EMOTION DISPLAYS IN MEDIA: A COMPARISON BETWEEN MEXICAN, HISPANIC-AMERICAN, AND EUROPEAN-AMERICAN CHILDREN'S STORYBOOKS**
**Victoria Sanders (Grand Valley State University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 5, 3:00 PM - 4:00 PM
**Poster:** 392
**Mentor(s):** Wolfgang Friedlmeier (Grand Valley State University: Psychology)

Cultural artifacts like children's storybooks serve as a mechanism to facilitate socialization practices such as emotion norms in their respective cultures. We compared emotion displays in European-American (EA), Hispanic-American (HA), and Mexican (MEX) storybooks to infer cultural display norm differences. We expected that negative (powerful) emotions will be less prominent in Mexican books since this culture emphasizes interconnectedness more than European-Americans. We also expected higher intensity of emotion expression in EA books, especially negative emotions. Regarding the effects of acculturation of Hispanic-American culture, we assumed that authors and illustrators may shift toward the norms of the mainstream individualistic culture. N = 1059 images were coded based on 10 popular storybooks from each culture. The main focus was on emotion type (positive, negative powerless, and negative powerful emotions) and intensity of expression across cultures. Context variables like social partners, gender, protagonist, arousal level, and environmental context were also tested for cultural differences. Preliminary results indicated that positive emotions were dominant in all three groups, and occurred most often in HA books; negative emotions showed up in a similar rate for powerful and powerless emotions in EA books (about 13%) whereas frequencies of powerful emotions were much lower for Mexican books (6%) and nearly absent for Hispanic books (1%). Expression intensity was highest in EA books, followed by MEX books, and HA books for positive and negative emotions. Results support the acculturation assumption for HA books but also point to effects that may be explained by the minority status of HA.

**THE ROLE OF TRANSNATIONALISM IN ATTITUDES TOWARD VARIETIES OF SPANISH**
**Meztli Santamaría (Northeastern Illinois University)**
**Category & Time:** Social, Behavioral, and Economic Sciences, Section 5, 3:00 PM - 4:00 PM
**Poster:** 393
**Mentor(s):** Gabriela G Alfaraz (Romance and Classical Studies)

Language attitudes are shared beliefs about language forms that are shared among the members of a speech community. Research on the attitudes of Spanish-speaking groups, defined by their country of origin, has revealed patterns of evaluating other varieties of Spanish, both in the first and second generations, that are similar to the ones found in studies in their home regions. In this study, we examine the role of transnationalism in maintaining attitudes in the first generation, and as a means of acquiring evaluative norms in the second generation. The data was collected between first and second generation Mexican-Americans in the Lansing area through recorded interviews in Spanish. A direct method was used to study attitudes, following the methods of perceptual dialectology. A questionnaire was used to examine attitudes towards regional varieties, with a focus on correctness and pleasantness as indicators of the dimensions of status and solidarity. Participants rated regional varieties on a seven-point Likert scale. Along with demographic background, we ask questions about the type and intensity of transnational activities in which participants engage. The results for the attitudes of Mexican Americans in the local community towards regional varieties are expected to follow patterns previously found in Mexico, in which Spain and Mexico were rated the most correct varieties, and the US the least correct and the least pleasant. It is expected that the types of transnational activities and their intensity will correlate with attitudes towards the regional varieties of Spanish.

# RESEARCH MENTORS

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