university UNDERGRADUATE RESEARCH & ARTS forum

07.28.2011

Welcome to the first summer Undergraduate Research and Arts Forum at Michigan State University. Undergraduate students from diverse academic disciplines will present their outstanding research and creative endeavors. Approximately 126 students from MSU and visiting students from 23 institutions are participating in today's event. These students are mentored by 115 faculty members and graduate students.

As one of the nation's leading research institutions, MSU offers a breadth of experiences and opportunities that actively engages 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, mentors, and our 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.

This program was a collaborative effort between the Undergraduate Research Office, the Graduate School's Summer Research Opportunity Program (SROP), The College of Engineering, and the BEACON Center for the Study of Evolution in Action.

Undergraduate Research at Michigan State University

Undergraduate Research Initiative

Michigan State University's **Undergraduate Research Initiative** strives to increase opportunities for students to engage in scholarship, expand the pool of faculty and partners engaging undergraduate students in their scholarly work, and better understand the impact of this engagement on student learning and retention. Nearly one-third of MSU seniors have had a research experience with a faculty member. Research and creative activity opportunities are available in each of the 14 colleges that award undergraduate degrees. Our annual undergraduate research and arts forum, held each April, is one of the largest in the nation. Professional development workshops and travel grants for research presentations are available to undergraduate researchers. For more information about the undergraduate research initiative, contact Dr. Korine Wawrzynski at steinke7@msu.edu

Summer Research Experience for Engineering Undergraduates

The Michigan State University College of Engineering **Summer Research Experience for Undergraduates** is designed to engage high achieving students in faculty-mentored research. Students are paired with faculty in one of six engineering departments: Biosystems & Agricultural Engineering; Chemical Engineering & Materials Science; Civil & Environmental Engineering; Computer Science & Engineering; Electrical & Computer Engineering; Mechanical Engineering. Typically, students 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, such as experimental design, data collection and analysis, modeling, simulation, and various types of computational science and interdisciplinary engineering research. In addition to their research activities, students participate in weekly professional development activities designed to help students understand and prepare for graduate studies. For more information, contact Dr. Katy Colbry, Director of Graduate Recruiting, at colbryka@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 the Graduate School at gsaffairs@grd.msu.edu.

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.

Table of Contents

Schedule of Oral Presentations

Agriculture and Animal Science

Room	Time	Name of Presenter
310	10:30 AM	Brooke Murphy
310	10:45 AM	Jonathan Martinez
310	11:00 AM	Stephen Carney
310	11:15 AM	Sada Boyd
310	11:30 AM	Kristyn Carter, Monet Eason

Natural Science and Engineering

Room	Time	Name of Presenter
313	9:00 AM	Thiago Szymanski
313	9:15 AM	Kelly Montgomery
313	9:30 AM	Andira Ramos
313	9:45 AM	Tina Isaac
313	10:00 AM	Josephine Kilde
	Break	
313	10:45 AM	James Estell
313	11:00 AM	Stephen Jones
313	11:15 AM	Jonathon Barney

Social Sciences

Room	Time	Name of Presenter
316	9:00 AM	Abdifatah Ali
316	9:15 AM	Etienne Mahuli
316	9:30 AM	Marie Steele
316	9:45 AM	Nancy Nneka Nqaifejokwu
316	10:00 AM	Dialika Sall
	Break	
316	10:45 AM	Maritza Soto
316	11:00 AM	Rebecca Gidley
316	11:15 AM	Alphonzo Kilgo
316	11:30 AM	Tich Jones

Biological Sciences

Room	Time	Name of Presenter
307	9:00 AM	Christian Beato
307	9:15 AM	Kristoff Gayle
307	9:30 AM	Chivonne Gammon
307	9:45 AM	Lindsey Young
307	10:00 AM	Andres Torres, Angel Mendoza, Hurley Riley
	Break	
307	10:30 AM	Shonkela Pittman
307	10:45 AM	Abibatu OjoAmoo
307	11:00 AM	Avery Williamson
307	11:15 AM	Frank Chestnut
307	11:30 AM	Pastor Hurtado
310	9:00 AM	Dinayra Burgos
310	9:15 AM	Jay Jefferson
310	9:30 AM	Monica Rios
310	9:45 AM	Kareem Abdelnabi
310	10:00 AM	Marvin Harbour
312	9:00 AM	Albersy Armina
312	9:15 AM	Amarilys Lopez
312	9:30 AM	Lishann Ingram
312	9:45 AM	Odera Mbanugo
312	10:00 AM	Derick Huertas
	Break	
312	10:30 AM	Javier Mella
312	10:45 AM	Rahja Sharp
312	11:00 AM	Ashley Wallace
312	11:15 AM	Maria Elena Castello Toro
312	11:30 AM	Jennifer Ocasio

Abstracts

Agriculture, Animal Science, Environmental and Natural Resources

Oral Presentations

DISCOVERING THE ROLE OF REGULATORY T CELLS IN THE IMMUNE RESPONSE OF INFECTED CATTLE TO MYCOBACTERIUM AVIUM SS PARATUBERCULOSIS
Brooke Murphy
Location: 310 Bessey Hall, 10:30 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Mentor(s): Paul Coussens (Animal Science)
Johne's disease is a fatal gastrointestinal infection in ruminants caused by Mycobacterium Paratuberculosis (MAP), prevalent in the dairy industry. MAP is a close relative of M. tuberculosis and is implicated in human Crohn's disease. Regulatory T-cells (Tregs) are an important control against autoimmune diseases in humans and mammals. Tregs dampen inflammatory immune responses to pathogens, limiting damage to the host, and aiding development of immunological memory. It is proposed that Tregs play an important role in immune responses to MAP in cattle. Tregs are typically positive for CD4 and CD25 and express the FoxP3 transcription factor. I have helped develop techniques to identify and characterize Tregs in bovine blood lymphocytes and tissue using flow cytometry. I have successfully developed protocols for identification of Tregs in bovine blood and to monitor normal T cell activation in these cells. Stimulation of immune cells with MAP enhances the percent of CD4+ cells that are also CD25+ relative to nil stimulated cells. Work is being done to develop protocols for isolation of Treg populations prior to stimulation, using magnetic-activated cell sorting (MACS). MACS will be used to examine the effects of Tregs on immune responses upon MAP stimulation. My protocols have been used to demonstrate enrichment of Tregs following MAP stimulation of immune cells from subclinical MAP infected cattle. My protocols are also being used in studies of the relationship of bovine leukemia virus (BLV) status and Treg population levels in both infected and non-infected cattle.

THE EFFECT OF NUTRITIONAL STATUS ON FEMALE CHOICE IN DROSOPHILA MELANOGASTER
Jonathan Martinez
Location: 310 Bessey Hall, 10:45 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Mentor(s): Alex Shingleton (Zoology)
Previous studies have shown that females of the species Drosophila melanogaster prefer to mate with larger males (Pitnick & Garcia-Gonzalez 2002), however the effects of nutritional status on this choice are still speculative. Using the data from this project, we can detect the influence of nutritional status on mate choice within females. The hypothesis then is that females with a lower nutritional status will be less selective of potential mates than females with a higher nutritional status. To do this we will first need to design and construct an apparatus to appropriately answer the hypothesis. This will be tested by using a female choice apparatus, which consists of an entry point (for the female) opposed by two separate chambers to house males of differing sizes. The female will then be presented with her choice of mate. They will be separated with a Y-shaped connector in order to eliminate intrasexual combat and coercion. Females of lower and/or higher nutritional status will be released into the apparatus and will be allowed to choose between the potential mates. It is speculated that a female with a lower nutritional status will become less selective due to the fact that the process of selectivity is thought to require energy that the lower nutritional status female does not have to expend.

ASSESSING THE WELFARE OF PIGLETS RAISED ON A ROTATIONAL GRAZING PASTURE BY RECORDING THE FREQUENCY OF SWINE BEHAVIOR
Stephen Carney
Location: 310 Bessey Hall, 11:00 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Mentor(s): Laurie Thorp (Residential Initiative on the Study of the Environment)
We postulate that the frequencies of social and environmental interactions exhibited by piglets raised on pasture propose that our animals experience a higher quality of welfare. Our study commenced with post-weaned piglets, they were housed within a paddock and we transported the sows to the opposite side of the farm. Thereafter, we will establish a rotational grazing method where the piglets will be led by targets and clickers. Feed disappearance and average daily gain will be calculated as a compelling marker to evaluate feed efficiency for converting feedstuff into body weight. The piglets will be weighed and

examined for lesions, whose severity entails dominance and subordinance within the 'pecking order' or social hierarchy. To specify distinct behavior indicators, we mutually agreed upon the mechanism that procured an implicit action and discerned those practices that seem analogous. We employed an instantaneous scan sampling approach, which involves tallying the momentary behaviors of each of the 17 piglets at two minute intervals for one hour. We will take samples once during the morning, afternoon, evening, and nighttime of each week. Recent campaigns conducted by animal rights activists have beguiled the general public to force commercial producers to revise conventional practices, while innovations in alternative production have emerged and niche markets have shown provocation. With the increasing demand for organic products from animals raised in suitable welfare conditions, there is an exigency to evaluate the fulfillment of the animal's proclivity within these industries.

COODINATION OF EYE MOVEMENTS AND LEG MOVEMENTS IN WALKING CHAMELEONS
Sada Boyd – Bennett College
Location: 310 Bessey Hall, 11:15 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Mentor(s): Fred Dyer (zoology)
Chameleons are particularly challenged with the amount they can see because of their narrow field of view of 45º for each eye. This means that chameleons are virtually blind to a big area of their surroundings. However, chameleons can move their eyes over a huge range, and furthermore can move the two eyes independently of one another. This may help them focus on one location while also inspecting other parts of their surroundings, but it complicates the problem of controlling eye movements more efficiently. The goal of this study is to see how chameleons use eye movements to support the task of moving through a three dimensional surrounding system of branches. To study this we will use multiple video cameras to record chameleons as they move toward a food source. As the chameleons move toward their food source they will be faced with gaps and forks along the way. From the videos we will analyze the pattern of eye movements in relationship to body movement. This will help us decide not only how eye movements are correlated with both the stimuli in the environment and the nature of the task in which the animal is engaged, but also whether certain patterns of eye movements are particularly important for helping the animal travel the path to the food.

MARKER-ASSISTED SELECTION OF SOYBEANS WITH APHID RESISTANCE: DETERMINING LIFE EXPECTANCY OF SOYBEANS WITH APHIDS
Kristyn Carter, Monet Eason
Location: 310 Bessey Hall, 11:30 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Mentor(s): Kate Zhang (Crop and Soil Science)
Aphids are sedentary insects that rest on the leaves of soybeans and absorb its nutrients. However, not all soybeans are susceptible to the harmful effects of these insects. Our goal, as research assistants, is to locate the gene that determines whether or not the plant will die as a result of the Aphids.

Poster Presentations

A GENETIC APPROACH TO INVESTIGATE THE DIVERSE FUNCTIONS OF THE ELONGATOR COMPLEX
Christopher Beiser
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Poster: 1
Mentor(s): Steve Van Nocker (Horticulture)
The Elongator (ELP) is a highly conserved protein complex that is essential to normal cellular functionality. The ELP complex serves a diverse role in the cell; recent findings suggest its presence in an array of cellular functions including histone modification during transcription. Identification of genes that mediate ELP function can provide insight towards its role in normal cellular processes. Mutations in genes encoding the ELP complex subunits have been linked to epilepsy in humans; full understanding of the role of ELP complex could prove invaluable to research in human medicine. The goal of the study is to identify genes that mediate the function of ELP. This is achieved through a suppression screening as well as identification of ecotypic modifiers. The model plant, Arabidopsis Thaliana, offers a unique opportunity to investigate the ELP complex. A. Thaliana is ideal for this study due to its short life cycle and the extensive sequencing already completed on its relatively small genome. A genetic approach is utilized by transferring variant genes between the Columbian and Landsberg erecta strains of A. Thaliana. Observations of changes in the physiology of plant populations expressing the variant gene will help identify the genes that mediate ELP. The study offers a unique insight into the importance of the ELP complex to normal cellular function.

UNDERSTANDING PEROXISOME BIOGENESIS THROUGH CHEMICAL SCREENING AND MUTANT ANALYSIS
Siebidi Mills
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Poster: 2
Mentor(s): Jianping Hu (Plant Biology)
Peroxisomes mediate many essential metabolic pathways in plant cells. One of the primary research areas in the Hu lab is to understand the mechanisms underlying peroxisome proliferation and its regulation. In this project, I conducted chemical screening and mutant analysis to further understand peroxisome biogenesis, using the model plant Arabidopsis thaliana. In the first part of this project we used a chemical genetic approach to identify chemicals that alter peroxisome morphology. The assay was run on plants expressing YFP-PTS1 (yellow fluorescent protein-Peroxisome Targeting Signal type 1) that enabled visualization of peroxisomes using a fluorescence microscope. These plants were grown in 96 well plates, treated with chemicals from the Library of Active Compounds on Arabidopsis (LATCA), and then subjected to microscopic observation. A range of phenotypic changes such as elongation and aggregation of peroxisomes was observed under the treatment of some chemicals. The second part of this project is to understand the regulation of peroxisome proliferation through post-translational modification of the peroxisome division factor DRP3 (dynamine-related protein 3). The activity of DLP1, the homologue of DRP3 in animals, is regulated by the SUMO ligase MAPL. In this experiment, we have identified two homologues of MAPL in Arabidopsis and are trying to identify double knock-out mutant of AtMAPL to determine whether DRP3 SUMOylation plays a role in the control of plant peroxisome proliferation.

MORPHOMETRIC CHARACTERIZATION OF THE PULMONARY HYPOPLASIA PHENOTYPE IN A CANINE MODEL OF FETAL NEUROAXONAL DYSTROPHY
Valerie Takala
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Poster: 3
Mentor(s): Stephan Carey (Department of Small Animal Clinical Sciences)
Fetal neuroaxonal dystrophy (FNAD) is a rare fetal-onset neropathy in humans affecting the central and /or peripheral nervous system and often characterized by localized swelling, axon atrophy, fetal akinesia, pulmonary and cerebellar hypoplasia, and respiratory failure. Experimental animal models of FNAD which exhibit phenotypic characteristics of fetal akinesia, and particularly pulmonary hypoplasia, are lacking. Our laboratory has recently reported an autosomal recessive fetal-onset neuroaxonal dystrophy in a large family of dogs with a deletion of the mitofusin 2 gene (MFN2) that exhibit several phenotypic characteristics of FNAD, including fetal akinesia and post-natal death secondary to respiratory failure. We hypothesize that affected animals will exhibit morphologic and microscopic features of pulmonary hypoplasia. The purpose of our study is to characterize the neonatal pulmonary phenotype in affected and non-affected animals. In order to measure total lung volume, alveoli number, and alveolar airspace, two litters of pups from heterozygous matings were euthanized immediately post-birth. Lungs were harvested, fixed via perfusion inflation. Individual lung lobes were sectioned and processed for routine light microscopy and rigorous morphometric analyses. Whole blood was collected for MFN2 genotyping. We anticipate that the lungs from homozygous recessive pups will be developmentally arrested, exhibiting decreased lung airspace, fewer alveoli, and decreased overall lung volume, compared to heterozygous carriers and homozygous dominants. These data will be important in characterizing a potential experimental model of FNAD.

A MURINE MODEL OF ALLERGIC RHINITIS TO STUDY THE ADJUVANT EFFECTS OF INHALED SILICA NANOPARTICLES
Courtney Terrell
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Poster: 4
Mentor(s): Jack Harkema (Pathobiology & Diagnostic Investigation)
Ambient nanoparticles found in outdoor air pollution have been associated with increased morbidity of allergic rhinitis and asthma. With the increasing production and use of engineered nanoparticles (ENP), there is growing concern about similar health effects caused by airborne ENP in the workplace. Our laboratory has previously demonstrated that inhaled silica ENP (SiO_2; 90 nm) act as adjuvants to enhance allergic airway disease in the lungs of mice (animal model of human asthma). A similar adjuvant effect of ENP on the nasal airways of mice has not been examined (animal model of allergic rhinitis). We will test the hypothesis that inhaled silica ENP act as adjuvants to enhance allergic inflammation and epithelial remodeling in the nasal airways of mice. For our study, allergic airway inflammatory and epithelial responses (i.e., eosinophil influx and increased epithelial mucus) in the nose will be compared with those in the lung of BALB/c mice that were intranasally sensitized with 0.02% ovalbumin (OVA; allergen) or saline (vehicle control), and co-sensitized with 0, 10, 100, or 400 µg SiO_2. OVA-sensitized

mice were intranasally challenged with 0.5% OVA two weeks after sensitization. Numeric cell densities of eosinophils and volume densities of epithelial mucus in the nasal and bronchiolar airways of these OVA-sensitized/challenged mice will be determined using image analysis and standard morphometric techniques. We predict that silica ENPs will act as adjuvants to enhance the influx of eosinophils and the increase of epithelial mucus in the nasal airways of mice sensitized and challenged with OVA.

IDENTIFICATION OF STRESS-RESPONSIVE CIS-REGULATORY ELEMENTS IN CHLAMYDOMONAS REINHARDTII
Michael Veling
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Agriculture, Animal Science, Environmental and Natural Resources
Poster: 5
Mentor(s): Shin-Han Shiu (Plant Biology)
Identification of cis regulatory elements is a key part of understanding the way an organism controls gene expression under different conditions. To that end, we are combining all the expression data from Chlamydomonas reinhardtii, a microalgae species which produces excess triglycerides when under nutrient stress, with the intent of understanding how these elements relate to nutrient stress response. These data include one and two channel microarrays made from cDNA and synthesized oligonucleotides as well as RNA seq experiments. Once combined, genes will be clustered into co-expressed groups according to their expression patterns. Next, we will use six motif finding algorithms to search consensus motifs in each co-expressed cluster. The results of all these algorithms will be combined to produce robust sequence logos for each of the clusters. Those clusters which show strong differential expression under nutrient stress will be further examined with the hopes that they can help identify regulatory mechanism in response to stress.

Biological Sciences

Oral Presentations

OCCURRENCE OF SALMONELLA IN RECREATIONAL WATER SURFACES
Christian Beato – University of Puerto Rico-Humacao
Location: 307 Bessey Hall, 9:00 AM
Category: Biological Sciences
Mentor(s): Joan Rose (Fisheries and Wildlife)
The aim of this study is to investigate how well does the 1682 MPN method perform in water matrices, such as surface water and sewage, and in turn, determine the prevalence of Salmonella in different water bodies in Michigan (Lake Michigan, Lake Lansing, Red Cedar River [East Lansing], Grand River [East Lansing]) and Lansing Sewage Treatment Plant). In addition, the MPN method is going to be compared with the new alternative isothermal amplification method to determine which test is more sensitive.

TISSUE SPECIFIC ROLE OF PHYTOCROME IN ARABIDOPSIS THALIANA
Kristoff Gayle – Florida Agricultural and Mechanical University
Location: 307 Bessey Hall, 9:15 AM
Category: Biological Sciences
Mentor(s): Beronda Montgomery (Plant Biology)
It has long been shown that light has a particular effect on the daily function of plants. It is the most important non-biological factor used in the plant's development. However, how is this light used, and how do the plants recognize the light and use it as a signal for its growth and development? The answer to these questions reside in one cellular component; the pytochrome. The phytochrome is composed of two parts, the first component is an apoprotein and the second component is a chromophore. The two create an eznymatic cellular component that regulates the plants physiological response to the light that it is exposed to. The phytocrome is particularly involved in regulating responses such as cotyledon and leaf development, hypocotyl and internode elongation, root development, and finally flowering. It has been shown in studies done with phytochromes that each type of phytochromre regulates responses for different types of light. In this experiment one will be examining the effects of red and far red light on the development of the plant based on its effects on the phytochrome. The key to this elucidation and examination of the phytocromes mechanism is the use of transgenic plant lines. The transgenic line that will be specifically examined is one containing a gene called ZFP6. This gene is responsible for the production of phytochromomobilin which is a critical factor in the composition of the phytochrome. The gene will be altered which in turn will affect the phytochrome level. The goal of this research is to investigate the spatial specific effects the phytochrome has on the plant through the examination of its molecular mechanisms. First, a transgenic Arabidopsis line will be created to with two alterations. The first is a screening mechanism by the use of a herbicide called basta. The transgenic plants are have a basta resistance gene and based on that number the plants that survive will be selected for further study. The second experimental parameter involves the introduction of the BVR (biliverdin Ixα reductase) into the plant genome. This enzyme is responsible for the inactivation of photochomomobilin which is an important portion of the chromophore component of the phytochrome. In the course of the experiment various lines will be created from the T1 to the T4 generation. In each line the hypocotyl length will be measured as well as the cotyledon development. These experiments are done under red and far red light to observe the developmental pattern of Arabidopsis. After each measurement is taken, RT-PCR will be done to characterize the genes responsible for the abnormal plant activity. The expected result of this experiment is the characterization of the genes responsible for phytochrome function as well as the discovery and elucidation of the molecular mechanisms responsible for the function of the phytochrome's physiological effect on the plant. It is hoped that by figuring out the steps of phytochrome function that the basic knowledge of the molecular mechanism of plant growth and development can be attained for a better environment for all.

OPIATE DETECTION IN BLOWFLY LARVAE FOR FORENSIC INVESTIGATIONS
Chivonne Gammon – Oakland University
Location: 307 Bessey Hall, 9:30 AM
Category: Biological Sciences
Mentor(s): Richard Merritt (Entomology)
Forensic entomology is a branch of forensic science which seeks to determine the amount of time a body has been dead and the environmental conditions to which the corpse was subjected during that time. This is accomplished by examining insect evidence on and near the decedent. Entomotoxicology, a relatively new subset of this discipline, aims to identify drugs in the tissues of a decedent by analyzing the drug content of necrophagous insects. The purpose of this study is to determine whether

oxycodone, oxymorphone, hydrocodone, and hydromorphone can be reliably detected in blowfly larvae that have been reared on liver containing these opiates. Additionally, we intend to confirm that codeine and morphine can be reliably detected by this method as indicated in published literature. To test whether these drugs can be detected, we will raise Lucilia sericata larvae from eggs to third instar on one of three liver mediums; high drug concentration, low drug concentration, and a control without drugs. Once the larvae are removed, washed, and killed by freezing, they will be homogenized and screened for the 6 opiates using gas chromatography-mass spectrometry (GC/MS).

PRESENCE AND ACTIVITY OF TRANSGLUTAMINASES IN RAT UTERINE AND CERVICAL TISSUES
Lindsey Young
Location: 307 Bessey Hall, 9:45 AM
Category: Biological Sciences
Mentor(s): Stephanie Watts (Pharmacology and Toxicology)
Parturition, the act of giving birth, occurs when the uterine smooth muscle known as the myometrium stretches, causing rhythmic contractions. These myometrial contractions are dependent upon the proteins actin and myosin. Transglutaminase(TG) is a G-protein that modifies contractile proteins. It is hypothesized that the inhibition of TGs in the uterus and cervix will inhibit actin, thereby inhibiting contraction. Real-time RT-PCR was used to amplify mRNA from tissue samples. Immunohistochemistry(IHC) determines the presence of a protein in a sample by utilizing the properties of antibodies. It was determined by IHC and real-time RT-PCR that TGs 1 through 4 were present in viable quantities in uterine and cervical tissues. Mouse primary antibody and horse(anti-mouse) secondary antibody were used. ImmPACT DAB was used as a substrate for labeling the secondary antibody, and Nuclear Fast Red was used as a nuclear marker. Blocking serum was used as a control for both tissue sample types. FITC-labeled TG1 and TG2 peptides were also used in a Kiyo assay to determine if TG1 and TG2 proteins present in the tissue were active. For further experimentation, the effect of TG1 and TG2 inhibition on agonist-induced contractility will be examined in uterine and cervical tissues. Knowledge of the effect of TG-inhibition on uterine and cervical contractility, and knowing specifically which TGs promote inhibition, will provide a stepping-stone for the eventual development of a new drug that more effectively reduces the incidence of preterm labor.

USING BIOTECHNOLOGY TO CREATE AN ECONOMICAL ANTI-HIV DRUG
Andres Torres, Angel Mendoza, Hurley Riley
Location: 307 Bessey Hall, 10:00 AM
Category: Biological Sciences
Mentor(s): Mariam Sticklen (Crop and Soil Sciences)
With Michigan State University's college of Agriculture and Natural Resources faculty member Mariam Sticklen, three high school students are working with various crops to produce mass amounts of secretory leukocyte protease inhibitor (SLPI). SLPI is an anti-HIV and wound-healing drug that is naturally produced through the human body. SLPI is an incredibly expensive and difficult drug to create. Dr. Sticklen and her colleagues are currently working on previously unknown aspects of SLPI. As part of an exploratory investigation, three research assistants will explain how scientists have recreated this humanlike process in plants, in addition to the benefits of the economical HIV drug.

COMPENSATORY EVOLUTION IN SACCHAROMYCES CEREVISIAE: IDENTIFICATION OF SPECIATION
Shonkela Pittman – North Carolina A & T University
Location: 307 Bessey Hall, 10:30 AM
Category: Biological Sciences
Mentor(s): Barry Williams (Molecular Genetics)
The first experimentation studies how genetic variation sways rates of adaptive evolution. We will develop strains from three ecological slots, in duplicate, to a quantity of environmentally significant conditions, particular to each of the slots. Prospective differences in rates of adaptation among strains from diverse slots, will govern 'background' rates of original adaptations among strains in each evolution experiment, to determine how various infections and resource opposition mutate dynamics of adaptation. Finally, we will reproduce the evolution experiments with all feasible arrangements of strains evolving sexually, rather than the asexual evolution used above, to decide how recombination alters the subtleties of adaptations. The second experimentation that will be conducted studies in what way mutations within genes change protein stability. Several prior studies propose that protein stability, rather than protein function, may be the ultimate driving force that is controlling rates of evolution at the molecular level. To assess this hypothesis, we have generated hundreds of strains, each concealing a single amino acid change at a single gene. For each adjustment, the fitness effect across various environments will be established, changes in protein function through in vitro analyses will be observed, and protein stability through a sequence of in vitro cellular and biochemical analyses will also be measured.

PROTEIN EVOLUTION IN SACCHAROMYCES CEREVISIAE
Abibatu OjoAmoo – North Carolina A & T University
Location: 307 Bessey Hall, 10:45 AM
Category: Biological Sciences
Mentor(s): Barry Williams (Zoology and Microbiology & Molecular Genetics)
Protein evolution is the biological process of structural, functional and sequence change over time. All proteins evolve, but we also know that most mutations in proteins have deleterious effects, typically caused by protein misfolding. The purpose of this research is to determine which mutations cause proteins to misfold. Also, for those mutations that cause protein misfolding, I want to understand how proteins have managed to evolve despite those negative mutational effects. To determine the types and positions of mutations that cause protein misfolding, I created several mutant strains of yeast. Each strain has a unique, single mutation at the well studied GAL1 gene. The GAL1 gene was chosen because it is among the most well studied genes to date, its structure is known, and the expression of the gene is easily controlled by the presence or absence of the sugar galactose. For each mutation, I will determine the effect of the mutation on fitness by comparing growth rates among mutant and wild type strains of yeast. I will also determine the half-life of each mutant protein through WESTERN blots. For each mutation, I will determine the rate of evolution at that respective position in the protein. Finally, I determine if there is a clear correlation between the fitness effect of a mutation at a given position of a protein, the degree of misfolding due to the mutation, and the rate of evolution at that position. My hypothesis is that most mutations cause misfolding and are deleterious to fitness, but the effect of each mutation is dependant on other mutations found nearby in the protein structure. So the order of mutations is important in the effect of each mutation and influences rates of protein evolution.

ADAPTIVE EVOLUTIONARY FACTORS OF SPECIATION
Avery Williamson – North Carolina A & T University
Location: 307 Bessey Hall, 11:00 AM
Category: Biological Sciences
Mentor(s): Barry Williams (Zoology & Microbiology)
Adaptive evolution is a central aspect common to all of biology that is essential for an organism's survival and reproduction. In this study we will examine the genetic aspects of adaptive evolution. We will focus on how existing genetic variation in a population influences rates of adaptive evolution. Our plan is to evolve strains of yeast that were isolated from three different ecological niches. Each strain will be grown in particular environments, made to replicate each of their natural niches. Variation in rates of adaptation between strains from different niches and with different levels of variation in the populations will allow us to establish the background rates of new adaptations to each of the conditions. Subsequently, we will repeat the previous steps with combinations of yeast strains in each evolution experiment, to assess how the mechanisms of adaptation are affected by multiple infections and resource competition. Since we can manipulate whether the yeast populations evolve sexually versus asexually, we will be able to determine how recombination with standing variation versus competition alters the dynamics of adaptation.

INSULIN SIGNALING IN SELECTED MOTIFS
Frank Chestnut – Tuskegee University
Location: 307 Bessey Hall, 11:15 AM
Category: Biological Sciences
Mentor(s): David Arnosti (Biochemistry)
The first project is designed to identify further motifs and other currently unknown factors through bioinformatics. Bioinformatics work will include analyzing the region 1kb upstream, and 1 kb downstream of the promoter. The promotors of genes, which are Rbf Bound and Rbf Unbound will be analyzed. As a control, a random assortment of genes will also be analyzed. Once bioinformatics has been used to identify other genes that may play suppressor roles in transcription, biological hypotheses will be tested in Project 2. First, DNA sequencing analyses using MEME will be performed. Second, the bioinformatics tool, MAST will be employed to identify binding sites. Last, to identify transcription factors, the databases TRANSFACT and JASPER will be used.The second project, will involve using molecular biology and related physical lab techniques to transform DNA. The transformed DNA will correlate to the biological hypotheses that will come from Project 1. DNA fragments will be cloned for LacZ reporter genes. The clones will be assayed into transgenics Drosophila & cell cultures. Future research aims will depend on the results of this proposed work.

FAST PYROLYSIS OF BIOMASS
Pastor Hurtado—Western Michigan University
Location: 307 Bessey Hall, 11:30 AM
Category: Biological Sciences
Mentor(s): Christopher Saffron (Biosystems and Agricultural Engineering)
The development of a sustainable form of renewable energy has become of great importance due to the recent environmental concerns and possible energy crisis. Lignocellulosic biomass, a renewable feedstock, can be converted to liquid fuels using biological, chemical or thermochemical methods. Given the current cost of petroleum, pyrolysis technologies, a thermochemical method, offer a potentially less expensive route to hydrocarbon liquid fuels with minimal modifications required to the existing petroleum infrastructure. There is a great demand for producing high-value petrochemicals such as gasoline-range aromatics from biomass sources. Using solid catalysts, products of biomass fast pyrolysis may be converted to these chemicals using a process known as catalytic fast pyrolysis. In this research, a lab-scale catalyst reactor will be built to connect with the existing analytical pyrolysis-GC-MS equipment. Different types of catalysts will be synthesized in the lab. Various biomasses such as poplar, switch grass and algae will be pyrolyzed in the analytical pyrolysis unit. The pyrolysis products will be reacted over different catalysts (for e.g. ZSM5) in the catalyst reactor. The products of catalytic fast pyrolysis will be analyzed in the GC-MS for identification and quantification of aromatic chemicals. The best biomass-catalyst combination for production of desired chemicals will be identified.

EFFECTS OF CHRONIC EXPOSURE TO METHYLMERCURY ON THE EXPRESSION OF GABAA RECEPTOR SUBUNITS ON MOUSE FOREBRAIN
Dinayra Burgos – University of Puerto Rico-Cayey
Location: 310 Bessey Hall, 9:00 AM
Category: Biological Sciences
Mentor(s): William D Atchison (Pharmacology & Toxicology)
Methylmercury (MeHg) is an environmental neurotoxicant that affects the brain following acute and chronic exposure. Humans are exposed to MeHg through fish consumption, which makes it an environmental concern. MeHg neurotoxicity depends on the frequency of exposure, and the signs include sensory, visual and motor dysfunction. Previous studies have shown that several ion channels are affected by MeHg leading to those clinical signs; GABAA receptors are among the ones that are affected the most. In this study, gene expression at the mRNA level will be evaluated to determine how the expression of the GABAA receptors is affected in the forebrain (FB) of MeHg-exposed mice. We will measure the expression of the α1, β1, β3 and γ2 subunits of the GABAA receptor. Mice were exposed to .5 and 5ppm MeHg ad lib for 6 months, starting when they were 90 days old. RNA will be isolated from 10mg of FB, real time PCR will be made on the reverse transcript (cDNA) of the RNA isolated to measure the expression of the target protein genes and our results will be confirmed by Western Blots.

ANDROGEN EXPOSURE INDUCES DISEASE IN AR97Q FEMALES
Jay Jefferson – Florida International University
Location: 310 Bessey Hall, 9:15 AM
Category: Biological Sciences
Mentor(s): Cynthia Jordan (Neuroscience)
Spinal and Bulbar Muscular Atrophy is an x-linked recessive, neurodegenerative disease characterized by an expansion of the CAG repeat within the first exon of a mutant androgen receptor gene. Women are only carriers of SBMA and do not express any of the phenotypic manifestations of either neuromuscular or endocrine symptoms which characterize SBMA in men. Testosterone has been implicated as having a causal role in inducing disease once bound to a mutant androgen receptor, and as such, contributes largely to the sexual dimorphism in pathological expression of SBMA symptoms. Decreased testosterone levels led to amelioration of muscular atrophy and other deleterious phenotypes typical of SBMA to a level similar to that of transgenic females. The current study is designed to further investigate the androgen-dependence of SBMA by inducing disease in AR97Q females containing the full-length human androgen receptor with repeated polyglutamine tract. A time-release androgen capsule will be surgically implanted in transgenic females at 35 days of age. Testosterone levels will be compared to SHAM operated, Tg control, and wildtype (Wt) females. Behavioral assessment will include measures of body weight, performance on rotorad tasks, grip tests, and hang tests, as well as cage activity. It is predicted that T-treated transgenic females will exhibit progressive androgen induced motor dysfunction as a consequence of increased testosterone exposure. Additionally, it is subsequently predicted that development of the SBMA disease phenotype will be more profound in T-treated Tg females than compared to the non T-treated control groups.

EFFECTS OF METHYLMERCURY IN DIFFERENT VGCC ISOFORMS
Monica Rios – University of Puerto Rico-Cayey
Location: 310 Bessey Hall, 9:30 AM
Category: Biological Sciences
Mentor(s): William Atchison (Pharmacology and Toxicology)
Methylmercury (MeHg) is an organic environmental contaminant that is extremely bio-accumulative in aquatic foodchains. In vivo, MeHg is responsible for neurotoxicity, affecting the central and peripheral nervous systems, causing severe pathological effects, such as cerebellar ataxia and sensory disturbances, or death. MeHg intoxication may also contribute to the development of multiple neurodegenerative diseases. Cellular targets of MeHg include the voltage gated calcium channels (VGCCs), mitochondria, and endoplasmic reticulum. Calcium regulates a wide variety of intracellular processes including muscle contraction, synaptic transmission, and regulation of gene expression. These processes occur through activation of numerous enzymatic cascades, some of which are dependent upon calcium release from intracellular structures. Specialized cellular organelles, such as endoplasmic reticulum and mitochondria, buffer the overload of calcium entering the cytoplasm through the plasma membrane channels and they also provide an intracellular source of calcium. Interestingly, µM MeHg has been shown to block current through VGCCs while increasing intracellular calcium concentrations through cytosolic pathways in vitro. This increase in intracellular calcium has significant deleterious consequences, including disruptions in protein synthesis, neuronal excitability, ionic regulation and synaptic function; cerebellar granule cells (CGCs) are particularly sensitive to these effects. The dysregulation of the calcium homeostasis produced by MeHg has been shown to reduce CGCs viability quickly following in vitro exposure, an effect which may be a consequence of increased intracellular calcium. This study will determine whether the differential effects of MeHg on VGCC isoforms correspond to a concurrent difference in cell viability.

THE EFFECT OF CLOCK GENE REVERSAL ON THE PER 1 AND 2 PROTEIN EXPRESSION IN THE TUBEROMAMMILARY NUCLEUS
Kareem Abdelnabi – University of North Carolina at Charlotte
Location: 310 Bessey Hall, 9:45 AM
Category: Biological Sciences
Mentor(s): Tony Nunez (Neuroscience)
While most rodents display a nocturnal circadian rhythm, the Nile grass rat runs on an opposite cycle similar to the natural rhythm of humans. This control of natural sleep patterns stems from the master oscillator located in a region of the brain known as the suprachiasmatic nucleus (SCN). This 'master clock' of the (SCN) consists of clock genes that via their products represent a molecular oscillator that controls rhythms such as the sleep-wake cycle. Circadian neural signals control when the body stays awake or asleep and an important circadian signal for the support of wakefulness is histamine. These same clock genes found in the SCN are also expressed in secondary brain oscillators including the tubelomammilary nucleus (TMN). In the TMN, neurons with projections to many areas of the brain release histamine, where the release of histamine is typically elevated during the night in most rodent species. This diurnal pattern however, tends to reverse when administered a running wheel in the cage with the Nile grass rat. It is hypothesized that the reversal in wakefulness between diurnal and nocturnal species is due to a reversal of the pattern of clock gene expression in the TMN. The study will consist of two experiments. First, determining the pattern of expression of two clock-gene products (i.e., PER 1 and 2) in the TMN across a 24-hour day/night cycle. Second, determining if the voluntary shift in the active phase seen in wheel-running animals involves a reversed clock gene expression patterns in the TMN.

A NOVEL APPROACH TO MEASURING 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN ELICITED HUMAN B CELL IMMUNE SUPPRESSION
Marvin Harbour
Location: 310 Bessey Hall, 10:00 AM
Category: Biological Sciences
Mentor(s): Kaminski Norbert (CIT), Sky Pike (CIT)
Halogenated aromatic hydrocarbons such as polychlorinated dibenzo-p-dioxins, dibenzofurans and biphenyls are persistent environmental toxicants. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is the most potent of all the polychlorinated dibenzo-p-dioxins. TCDD is produced as a by-product during many industrial processes, many of which involve combustion of organics in the presence of chlorine. It has been shown that TCDD suppresses Ig secretion and maturation of B cell to plasma cell, both of which are essential in humoral immune response. The aryl hydrocarbon receptor (AhR) has been implicated to have some undefined role in TCDD elicited B cell immune response suppression. As of now, AhR's exact role in the effects seen upon treatment of TCDD hasn't been determined. However, a few molecular targets involved in mediating B-cell dysfunction by TCDD and other AhR ligands have been identified. Nonetheless, translating what's observed and understood in the mouse model to human B cells has been a challenge shared amongst researchers. Challenges very specific to our lab have been the inability to look at both, B-cell activation and B-cell humoral immune suppression simultaneously, elicited through the AhR/TCDD complex. In this study we approach this problem by engineering a plasmid that can be transfected into human B-cells that will enable us

to measure TCDD/AhR activity in B-cells while simultaneously measuring other parameters such as Ig secretion, and activation markers.

ANALYSIS OF THE GASTROINTESTINAL TRACT BACTERIAL COMMUNITY OF MICE WITH DIFFERENT DIETS
Albersy Armina-Rodriguez – University of Puerto Rico-Arecibo
Location: 312 Bessey Hall, 9:00 AM
Category: Biological Sciences
Mentor(s): Linda Mansfield (Microbiology and Molecular Biology)
The mammalian gastrointestinal (GI) tract has a complex ecosystem of microorganisms. The intestinal microbiota has an important role in supplying nutrients and vitamins, giving colonization resistance against pathogenic bacteria and interacting with the host immune system. This microbiota can be affected by external factors, such as the diet. Previous research found that obese humans and mice have a lower percentage of Bacteroides and high percentage of Firmicutes. Campylobacter jejuni infected C57 IL-10 -/- mice fed a lower fat, higher linoleic acid diet were sicker than infected mice fed a higher fat, lower linoleic acid diet. Our objective is to find if the difference in diet affects primarily the host response or primarily the microbiota. We hypothesized that the diet did affect the structure of the microbial community. Methods: We will isolate intestinal microbiota from mice with different diets: low fat and high fat, extract community DNA for quantitative PCR to determine ratio of Firmicutes and Bacteroides in microbial communities. Conclusion: If ratio is altered, we will conclude there is an effect of diet on microorganism ecosystem. Significance: If there is an effect of the diet on microbial community, we will study it in more detail. If not, we will focus further studies on host response only.

IMMUNOHISTOCHEMICAL ANALYSIS OF GAMMA-HISTONE 2A.X, A MARKER OF DNA DOUBLE-STRAND LESIONS, IN MICE TREATED WITH THE FLUORQUINOLONE ANTIBIOTIC TROVAFLOXACIN
Amarilys Lopez – University of Puerto Rico-Cayey
Location: 312 Bessey Hall, 9:15 AM
Category: Biological Sciences
Mentor(s): Robert Roth (Pharmacology and Toxicology)
Drug-induced liver injury (DILI) is the leading cause of acute liver failure in the United States. One subset of DILI is idiosyncratic drug-induced liver injury (IDILI). IDILI usually occurs in a small fraction of patients during drug therapy, is unrelated to the pharmacological actions of the drug and frequently occur at doses that are generally safe to the majority of patients. These responses represent a significant problem due to patient morbidity/mortality, withdrawl of otherwise safe drugs from the market as well as a loss in consumer confidence. These adverse responses are generally not reproducible in animals and there remains a lack of predictive animal models. Observations have revealed that a mild inflammatory episode can alter the toxic threshold for compounds which have idiosyncratic liability. This led to the inflammatory stress hypothesis which states that a modest inflammatory stress overlapping with drug exposure may result in a toxic response. Trovafloxacin (TVX), an inhibitor of bacterial topoisomerase, is a potent fluoroquinolone antibiotic that is linked with IDILI, A model of TVX coexposure with the inflammagen lipopolysaccharide (LPS) was established and remains the only model of severe TVX-dependent hepatotoxicity. It has been previously suggested that TVX-dependent toxicity is due to inhibition of eukaryotic topoisomerase. A marker of topoisomerase inhibition in cells is the phosphorylation of the histone variant H2A.X. This sensitive marker was increased in in vitro studies and for this project we will investigate whether TVX increases phosphorylation of H2A.X in mouse livers.

TIP30 REGULATES THE NUCLEAR LOCALIZATION OF EGFR IN ESTROGEN RECEPTOR BREAST CANCER CELLS
Lishann Ingram – Clark Atlanta University
Location: 312 Bessey Hall, 9:30 AM
Category: Biological Sciences
Mentor(s): Hua Xiao (Physiology)
The objective of this project is to investigate how TIP30 (Tat-Interacting Protein) regulates the nuclear localization of EGFR in estrogen receptor and progesterone positive (ER+/PR+) breast cancer cells and triple negative cancer cells (MDA 231 and MCF 7). Previous studies have demonstrated that TIP30 acts as a tumor suppressor to control the cell proliferation and development of the mammary gland partly through the regulation of EGFR intracellular trafficking. Loss of TIP30 promotes breast cancer development and progression. The hypothesis of this project is that inhibition of TIP30 increases the protein levels of nuclear EGFR in breast cancer cells. To test this hypothesis, three assays will be conducted on the investigation of the actions of TIP30 in growth of normal breast and breast cancer cells.

QUANTITATIVE ANALYSIS OF ELASTIN STRUCTURE IN THE THORACIC AORTA
Odera Mbanugo
Location: 312 Bessey Hall, 9:45 AM
Category: Biological Sciences
Mentor(s): Seungik Baek (Department of Mechanical Engineering)
The overall topic of my research is abdominal aortic aneurysms. The purpose of the abdominal aorta is to supply blood to the abdomen and legs. Aneurysms occur when the wall of an artery balloons until there is an eventual rupturing of the wall. My work will focus on finding a reason for the differing mechanical characteristics throughout the arterial wall. This wall is composed of collagen, elastin, and smooth muscles and can be separated into three layers. These layers include: the intimal, medial, and adventitial layers. I believe that there might be a correlation between the number of elastic fibers and the mechanical characteristics. Some parts of the wall are thicker than others and differ mechanically (elasticity, wall strength, etc.).

CALCIUM ACTIVATED POTASSIUM CHANNELS REGULATE COLONIC MOTILITY
Derick Huertas Alvarez – University of Puerto Rico-Arecibo
Location: 312 Bessey Hall, 10:00 AM
Category: Biological Sciences
Mentor(s): James Galligan (Pharmacology and Toxicology)
My research project will focus in the myenteric plexus and the relaxation of the muscle. These studies will focus on inhibitory neurotransmission to the muscle. These studies will test the role of Ca2+ channel types and BK channels in modulation of inhibitory neuromuscular transmission to the longitudinal and circular muscle of the mouse ileum and colon. These studies will be done in wild type and gene knockout mice. Nerve-muscle preparations will be used in vitro. We will also use intact segments of ileum and colon to study Ca2+ and BK channel regulation of the fluid distention induced peristalsis (ileum) and migrating motor complex (MMC; colon) in vitro. With this technique we expect to have a deeper understanding of how the relaxation of the smooth muscle is regulated and as a consequence how the motility of the GI tract is regulated.

WOUND-HEALING ASSAY AND BONE STRENGTH ANALYSIS
Javier Mella
Location: 312 Bessey Hall, 10:30 AM
Category: Biological Sciences
Mentor(s): Laura McCabe (Physiology)
Bone tissue is constantly reshaped by 1) osteoblasts, cells responsible for bone formation, and 2) osteoclasts, cells that remove bone mineralized matrix. When the cell activities are in balance bone density is maintained, but when osteoblast activity is decreased or osteoclast activity increased, bone density is decreased. A decrease in bone density, if significant enough, is called osteoporosis. This condition affects over 10 million people in the United States. It is of concern because it increases fracture risk. Understanding factors that regulate osteoblast and osteoclast activities is critical for developing new therapeutics to treat or prevent bone loss. My project is focused on examining how osteoblast and osteoclast activities are altered by disease and how to enhance osteoblast activity. Specifically, I will measure the amount of osteoblasts and osteoclasts in mouse femur sections. Histomorphometry, the quantitative assessment of bone turnover within a bone section, is an important assay used in the bone field. In addition to in vivo analyses, I will also be examining how osteoblasts function on hydroxyapatite (HA) versus plastic surfaces in vitro. Most in vitro studies using osteoblasts culture them on plastic surfaces. I will be comparing HA to plastic, past studies indicate that osteoblasts act differently on HA versus plastic. To further address this difference I will be using a wound-healing assay is a well-developed method to measure osteoblast migration in vitro.

PRENATAL SCREENING
Rahja Sharp – Savannah State University
Location: 312 Bessey Hall, 10:45 AM
Category: Biological Sciences
Mentor(s): Sainan Wei (Epidemiology and Genetics)
Prenatal screening is testing offered during pregnancy to find if a mother is at an increased risk to have a baby with a defect. Prenatal screening can find a number of conditions and problems in a pregnancy. Some screening tests require a small amount of blood from the mother, while others combine information from an early ultrasound with a blood sample(s) in either the first or first and second trimester. The laboratory tests the level of certain substances in the mother's blood. These levels may suggest a problem or provide reassurance. Prenatal screening tests can provide information that cannot always be detected on ultrasound scans. The major screening for this project is the Quadruple Test, Blood sample between 15 & 22 weeks 6 days. This test has four major biomarkers: AFP, hCG, uE3, and hormone Inhibin A. For this project I will breakdown the demographic data of the samples received and run in the MSU Clinical Genetics Laboratory, for example age range, ethnicity, diabetic status, IVF pregnancies, etc. for the years 2010-present. I will extract different variables from ALPHA and compare the test percentage

rates to the variables to see if any specific variable has a significant relationship to disease. Additionally, I will compare the previously and currently established screen positive rates for each test to those observed for the given time period to demonstrate accuracy of this data.

KINETIC ANALYSIS OF A TYROCIDINE SYNTHETASE A MUTANT FUNCTIONING AS A COA LIGASE
Ashley Wallace – Southern University
Location: 312 Bessey Hall, 11:00 AM
Category: Biological Sciences
Mentor(s): Kevin Walker (Department of Chemistry and Biochemistry)
The pharmaceutical paclitaxel (Taxol®) is a naturally occurring molecule made by Taxus plant cell cultures. This tubulin-stabilizer is currently used to treat heart disease and various cancers, and is also being developed for Alzheimer's regimens. Most of the genes on the multistep pathway to paclitaxel have been isolated and their enzymes characterized; yet, there remain a few unidentified enzymes. This project, therefore, focuses on identifying a catalyst that can biosynthesize B-phenylalanyl-coenzyme A (β-PheCoA), an intermediate occurring late on the pathway. In Taxus plants, the biosynthesis of paclitaxel includes the transfer of B-phenylalanine to a terpenoid acceptor molecule by an acyl CoA-dependent acyltransferase. Enzymic production of β-PheCoA likely proceeds by coupling a carboxylic acid to coenzyme A via an activated acyl-adenylate intermediate using an acyl CoA-ligase, which are typically used in thioesterification reactions. We have identified that a tyrocidine synthetase A mutant (mTycA), ordinarily a pantetheinylating enzyme, can function as CoA ligase. TycA activates β-phenylalanine to its adenosine 5'-monophosphate (β-Phe-AMP) intermediate, which then reacts with coenzyme A to form β-PheCoA as the final product. Other amino acids are converted similarly to their corresponding acyl CoAs. We hypothesized that this reaction can aid in the in vitro construction of paclitaxel and its analogues. Presently, our data on the mTycA is qualitative, and thus, our immediate goal is to calculate the kinetic parameters of mTycA with our substrates by quantitative liquid chromatography-mass spectrometry (LC-MS) analysis of the acyl CoA thioester products.

EFFECT OF ENVIRONMENTAL TOXICANTS IN THE RELEASE OF NEUROPEPTIDE SUBSTANCE P IN MOUSE OLFACTORY EPITHELIUM
Maria Elena Castello Toro – University of Puerto Rico-Cayey
Location: 312 Bessey Hall, 11:15 AM
Category: Biological Sciences
Mentor(s): Colleen Hegg (Pharmacology &Toxicology)
The olfactory epithelium (OE), associated with the sense of smell, is constantly exposed to airborne irritants and pollutants. By maintaining a population of immature neurons and basal progenitor cells, the OE has the ability to replace or regenerate damaged cells with new ones. When the OE is injured, the damaged cells trigger basal cell proliferation, neuronal cell maturation, and activation of glial cells and the immune system. Neuropeptide substance P has been associated with inflammatory processes. Substance P is released by the OE when irritated by capsaicin. We predict that the inflammatory response will activate cell regeneration in the OE. We hypothesize substance P will be released in response to toxicant-induced irritation. We also hypothesize that damage from environmental toxicants will activate release of substance P from trigeminal fibers in the OE. We must first identify if damage to the OE from the environmental toxicants satratoxin G and NiSO4 triggers the release of substance P by quantifying its presence using an enzyme-linked immunosorbent assay (ELISA). We predict that the release of substance P will activate tachykinin neurokinin receptors (NK-1, -2 or -3) on specific cells of the OE. We will use immunohistochemistry (IHC) to identify the cells expressing receptors for substance P. We hope the data obtained from these experiments will further advance us to reaching our ultimate goal to identify the factors involved in regeneration and recuperation of the olfactory epithelium following injury.

OPTIMIZING THE SENSITIVITY AND SELECTIVITY OF DIAMOND MICROELECTRODES FOR THE DETECTION OF NITRIC OXIDE
Jennifer Ocasio – University of Puerto Rico-Cayey
Location: 312 Bessey Hall, 11:30 AM
Category: Biological Sciences
Mentor(s): Greg Swain (Chemistry)
A novel way for the detection of these has only recently been employed: boron-doped diamond microelectrodes (BDDMEs). BDDMEs are useful in that they are more resistant, durable, selective and sensitive when utilized in these measurements. Specifically, the development of this microelectrode will be used to detect nitric oxide (NO), a soluble gas neurotransmitter that has functions in intestinal motility. The sensitivity and selectivity of the boron-doped diamond microelectrode in particular will be further improved to accurately detect NO levels, in hopefully, less than 10nM of concentration. This will be made by optimizing the coating of platinum of the microelectrode for sensitivity and also optimizing the coating of polymers for the selectivity. The coating of Pt over the BDDME is used to augment the sensitivity of the microelectrode, giving NO a metal with which to oxidize. This oxidation current will be what will be measured by the microelectrode to determine concentration levels. A coating of the polymers Nafion/o-phenylenediamine will be employed as well to be selective against other neurotransmitters

such as dopamine, ascorbic acid, and nitrite. In the future, this could be useful in developing treatments for conditions such as Irritable Bowel Syndrome (IBS), which is caused by problem in the relaxation of intestinal muscle, which NO regulates.

Poster Presentations

FURTHER ELUCIDATION OF THE TROPANE ALKALOID SYNTHESIS PATHWAY USING VIRUS INDUCED GENE SILENCING (VIGS) IN ATROPA BELLADONNA
Charles Allen
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 10
Mentor(s): Cornelius Barry (Horticulture)
Alkaloids are a diverse class of naturally occurring compounds that are synthesized in many plant species and have important roles as pharmacological agents. The tropane alkaloids, hyoscyamine and scopolamine, are synthesized by members of the Solanaceae family including Atropa belladonna. Hyoscyamine and scopolamine have broad uses as therapeutic agents and are used to alleviate the symptoms of many diseases including nausea, gastrointestinal disorders and pancreatitis. The biosynthesis of tropane alkaloids is not fully understood, limiting the ability to engineer the synthesis of these compounds. A transcriptome of A. belladonna has been assembled from diverse tissues. Measurement of transcript abundance indicated that genes known to be involved in hyoscyamine and scopolamine biosynthesis are preferentially expressed in secondary root tissues, the known site of tropane alkaloid biosynthesis. Using hierarchal clustering and data mining, an additional twenty two co-expressed genes were identified that encode enzymes that may be candidates for the missing steps in the pathway. Virus Induced Gene Silencing (VIGS) in A. belladonna coupled with liquid chromatography and tandem mass-spectrometry (LC-MS-MS) to measure alkaloid profiles is currently being utilized to assess the potential role of these candidate genes in tropane alkaloid biosynthesis.

IDENTIFICATION OF THE PHOSPHATIDIC ACID BINDING DOMAIN OF THE SUSPECTED LIPID TRANSPORT PROTEIN TGD4
Nicholas Anderson
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 11
Mentor(s): Zhen Wang (Biochemisty and Molecular Biology)
Two pathways are known to interact in the assembly of the chloroplast membrane. The plastid produces the main constituents of the membrane, MGDG and DGDG, and exports basic fatty acids to the endoplasmic reticulum (ER). In the ER, these fatty acids are converted into diacylglycerols that are readily incorporated back into the plastid pathway. However, the exact mechanism of lipid importation from the ER to the chloroplast remains unclear. We believe the TGD4 protein stands as a likely candidate involved in this mechanism, as it has been demonstrated to localize to the outer chloroplast envelope and to bind phosphatidic acid in vitro, a key metabolite between the plastid and ER pathways. Our project has focused on determining what region on the TGD4 protein binds phosphatidic acid, primarily utilizing molecular cloning techniques. We have amplified four different truncated sequences that each code for roughly 200 amino acid fragments out of the 473 AA protein. These sequences were ligated into a plasmid and transformed into the Eschericia coli strain BL21 (DE3) for expression. The tgd4 truncated proteins will then be purified using Qiagen's Ni-NTA kit, then a series of lipid binding assays will be performed to determine the affinity of these protein fragments for phosphatidic acid. Determining the phosphatidic acid domain of TGD4 would assist in elucidating the mechanism of lipid import from the ER to the chloroplast. Results are forthcoming.

IDENTIFICATION OF A GENE RESPONSIBLE FOR AN EARLY FLOWERING MUTATION IN ARABIDOPSIS THALIANA
Kyla Britson
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 12
Mentor(s): Steve van Nocker (Horticulture)
Flowering time in Arabidopsis thaliana is controlled by a diverse array of genes, one of which is FLOWERING LOCUS C (FLC). Promotion of flowering after an extended period of growth in cold temperatures, termed vernalization, involves an epigenetic mechanism that is associated with the transcriptional silencing of the FLC gene. Mutations in the VERNALIZATION INDEPENDENCE (VIP) gene class confer cold-independent flowering and suppression of FLC. These genes may also function in areas unrelated to flowering time, as indicated by the developmental pleiotrophy observed in these mutations, such as defects in floral morphology. VIP genes VIP3, VIP4, and VIP6/ELF8 encode proteins that are homologous to components of Paf1C, which is a conserved transcriptional regulator that plays a crucial role in the promotion of gene activity through histone modification. To broaden our understanding of how these genes repress FLC silencing we identified a novel member of the VIP gene class

designated VIP7. The position of the VIP7 gene was genetically mapped to a range of 240,000 bp on the end of chromosome V. Located within this range is a gene that encodes a protein component homologous to the COMPASS (SET1C) complex recruited by Paf1C during histone methylation. Due to the plausible functional association between this gene and other members of the VIP gene class, it was considered a strong candidate for the VIP7 gene. Further experimentation via sequencing reactions and quantitative PCR was used to investigate its responsibility for the vip7 phenotype.

INVESTIGATING PHENOTYPES ASSOCIATED WITH ARABIDOPSIS THALIANA MUTANTS FOR LINEAGE- SPECIFIC GENES
Terin Budine
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 13
Mentor(s): Lina Quesada (Plant Biology)
Arabidopsis thaliana is a member of the Brassicaceae, and it has been used extensively as a plant model species. A. thaliana was the first plant to have its genome sequenced. When the genome was published, 25,498 putative genes were identified and 69% were assigned a function based on homology with genes in other organisms. However, the genome still contains thousands of genes with characterized function. In a recent study using the TAIR8 A. thaliana genome release, it was found that many of the genes with unknown function are specific to Arabidopsis and the Brassicaceae. These genes are referred to as lineage-specific genes. The Brassicaceae include species of agricultural importance such as broccoli, cabbage, cauliflower, mustard and various other crops. Understanding the function of lineage-specific genes could provide useful information on adaptations unique to the Brassicaceae that could be used for breeding efforts. In this study, we used publicly available AT-TAX array expression data to identify lineage-specific genes that are highly expressed in reproductive tissues of A. thaliana. Knock-out mutations of approximately 160 genes were obtained from the Salk Institute and their growth phenotypes characterized. Genes that caused aberrant phenotypes were identified and their genotype was confirmed using molecular techniques. Information generated in this study will provide an additional layer of annotation of lineage-specific genes in the A. thaliana genomes and further our understanding of the full gene complement of A. thaliana.

AN ANALYSIS OF THE TcPAM MECHANISM USING REDOR NMR
Yvonne DePorre
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 14
Mentor(s): Udayanga Wanninayake (Chemistry)
Taxus candensis phenylalanine aminomutase (TcPAM) catalyzes the isomerization of a-phenylalanine to b-phenylalanine making (E)-cinnamate (10%) as a bi-product at steady-state reaction condition. TcPAM can also catalyze the addition of ammonia to (E)-arylacrylate to biosynthesize aromatic a- and b- amino acids in the reverse reaction. A currently accepted mechanism for TcPAM suggests that the amino group is transferred from the substrate to a specialized prosthetic group compromised of an amino acid triad in the active site. The amino group principally rebinds to the carbon skeleton of the presumed cinnamate intermediate to complete the a/b isomerization of phenylalanine. In contrast, when styryl-a-alanine is used as a substrate, TcPAM catalyzes styrylacrylate as the major product (>99%) and styryl-b-alanine (<1%). However, by comparing the kinetic parameters of TcPAM with its natural substrate phenylalanine and with styryl-a-alanine (kcat = 0.053 and 0.082 s-1 respectively), it was reasonable to assert that the amino group likely resides in the TcPAM active site longer than styrylacrylate. To demonstrate the hypothesis, inhibition constants (K1) of (E)-cinnamate, (E)-3-methylcinnamate, (E)-4-methylcinnamate, (E)-4-chlorocinnamate, (E)-4-fluorocinnamate and (E)-thienylcinnamate were calculated (23, 106, 1.7, 0.60, 12, and 47 uM respectively). All the tested acrylates has lower K1 values compared to that of styrylacrylate (250uM), which is the near exclusive product of the amino donor group. The inhibition constants of the acrylates in the TcPAM reaction were used to develop one-pot reaction conditions for an intermolecular transamination process. After a 12 h incubation of TcPAM (0.7 nmol) in the presence of styryl-a-alanine (1000 nmol)

8-OH-DPAT REVEALED A DISRUPTION OF $5HT_{1A}$ RECEPTOR IN SYMPATHETIC NERVE SUPPLYING MESENTERIC ARTERIES OF DOCA-SALT HYPERTENSIVE RATS

Carlos Font

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 15
Mentor(s): James Galligan (Pharmacology and Toxicology)

Hypertension (HT) is defined as a sustained systolic BP > 140mmHg, and/or diastolic BP > 90 mmHg. HT is a major public health problem since it affects one in three adults in the U.S. It has risk factor for stroke, kidney and heart disease. 60 percent of under-treatment patients did not have it controlled. Finding new mechanisms to control hypertension could lead us to find new drug treatments for all those unresponsive patients. In vitro preparation of mesenteric vessels along with video-based digital microscopy helps us study the 5-HT1A receptor on the sympathetic nerves supplying mesenteric blood vessels. Data showed that DOCA-salt arteries were less sensitive to 8 OH-DPAT, a 5-HT1A receptor agonist compared to control arteries indicating a disruption of 5-HT1A receptor function in sympathetic nerves innervating mesenteric arteries.

REGULATION OF GENE EXPRESSION IN RESPONSE TO IRON LIMITATION DURING COMPLEMENTARY CHROMATIC ADAPTATION OF FREMYELLA DIPLOSIPHON

Travis Halfmann

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 16
Mentor(s): Beronda Montgomery (Plant Research Laboratory)

The freshwater filamentous cyanobacterium Fremyella diplosiphon is a model organism to study the process of complementary chromatic adaptation (CCA). This acclimation process enables the cyanobacterium to adapt to the fluctuation of green light (GL) or red light (RL) intensity by restructuring its light-harvesting phycobilisome complexes to enhance photosynthesis. The photoreceptor, RcaE, along with its downstream regulators, RcaF and RcaC, regulate CCA. In addition to changing light quality, photosynthetic organisms are also known to acclimatize to the different nutrient availability in their natural habitat. Iron is a key functional element for electron transport. Thus, iron limitation can have a detrimental effect on cell growth and development. Recent studies on F. diplosiphon (SF33 wildtype strain) have shown specific physiological responses to iron limitation in GL and RL (Pattanaik and Montgomery, 2010). Preliminary results have shown an up-regulation of two crucial genes during iron-limiting conditions. The ferric uptake regulator encoded by fur is a prokaryotic transcriptional regulator, and is known to control many genes in iron metabolism. It is also found to be up-regulated during iron limitation. The up-regulation of nblA, leading to the degradation of the light-harvesting antennae, is characteristic during nutrient stress and is also observed in iron limitation. In order to gain a perspective on how iron stress-induced gene expression interacts with CCA, the analysis of gene expression of fur and nblA in the ΔcaE, ΔcaF, and ΔcaC mutant lines under iron limitation is currently in progress.

IDENTIFICATION OF POTENTIAL CLOCK GENES IN NANNOCHLOROPSIS

Rebecca Hopkins

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 17
Mentor(s): Eva Farre (Plant Biology)

Microalgae accumulate large quantities of oils and carbohydrates when they are nutrient deprived; therefore, Nannochloropsis is a potential new model organisms being studied for its use in the search for sustainable sources of biofuels. Understanding what governs storage compound accumulation in this organism is essential for any future plans towards improving its feedstock value. I explored and compared the genome of Nannochloropsis to other genomes, focusing on clock genes. Throughout this process, BLAST Basic Local Alignment Search Tool, was used to find regions of local similarity between sequences. Known clock proteins from Arabidopsis, Chlamydomonas, Neurospora, Drosophila, Mouse, Phaedactylum tricornutum and Synechococcus elongatus were used to search the Nannochloropsis genome to find similar proteins. Each clock gene that met the cut off with an E-value of less than 1E-4 was examined in more detail on the gbrowse. The genome browser shows a graphical representation of a section of a genome. I browsed the genome to see the exact region that corresponds to the clock genes in the Nannochloropsis. As a result of completing these procedures it has become apparent that Nannochloropsis shares similar genes with other organisms such as PRR9, TOC1, and CO that are present in Arabidopsis. With the knowledge gained about similar clock genes present in Nannochloropsis we can continue to build this biological foundation of information, which, in turn, will open up this organism for detailed molecular analysis.

RESTORATION OF ROOT HAIR PHENOTYPE IN ARABIDOPSIS RHD3 MUTANTS
Allison Jamieson-Lucy
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 18
Mentor(s): Federica Brandizzi (Plant Biology)
Disrupting the structure of the endoplasmic reticulum (ER) in plant cells leads to disruption of other functions, including the golgi body and the plant's overall phenotype. RHD3 (Root Hair Defective 3) is a protein necessary for normal ER morphology in plant cells. Arabidopsis plants with mutations in the RHD3 gene present with a short root hair phenotype. In order to better understand this mechanism, I am attempting to restore a wild type phenotype to Arabidopsis plants with mutations in RHD3 by overexpressing a specific gene in the plant. This gene was found using microarray and coexpression analysis. I hope that inserting this gene will have an effect on the root hair morphology of RHD3 plants, in particular in restoring long root hairs. I am also performing an enhancer/supressor screen of EMS mutagenized RHD3 plants to isolate additional mutations that increase the short root hair defect or return the roots to wild type.

CHARACTERIZATION OF GLYCOSYLATED SESQUITERPENES METABOLITES IN GLANDULAR TRICHOMES OF SOLANUM HABROCHAITES
Anna Noveroske
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 19
Mentor(s): Daniel Jones (Biochemistry)
Specialized compounds known as secondary, or “specialized”, metabolites are synthesized by many species of plants to aid in their survival and/or reproductive success. These compounds are extremely diverse, and most have yet to be fully characterized despite their potential usefulness in sustainable agricultural and in pharmaceutical development. One class of these secondary metabolites is the terpenoids which exist in great abundance in the glandular trichomes of the wild tomato (Solanum habrochaites) accession line LA1777. The objective of this study was to better characterize the structure of various sesquiterpene metabolites from a partially purified solution of glycosylated sesquiterpenes, all of which have a molecular mass of 360 Da and contain a malonate ester. This involved definitive identification of the sugar moiety using GC/MS and determination of the exact mass of the terpenoid core. To do this, multiple hydrolysis techniques (enzymatic and acid hydrolysis) were employed to remove the sugar components of the molecules so that the organic sesquiterpene cores and the sugar moieties could be separated into aqueous and organic phases. The sugar component was then analyzed using GC/MS after derivatization. Sugar standards were used for identifying the sugars present in the hydrolysis products. Furthermore, a comparison between the GC-MS analysis for the terpenoid cores from acid hydrolysis and enzymatic hydrolysis aided in identifying the different terpenoid cores present.

INTERACTIONS OF PARC6 WITH OTHER PLASTID DIVISION PROTEINS
Larissa Osterbaan
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 20
Mentor(s): Min Zhang (Biology)
Chloroplast division is a very important biological process in algae and plants to maintain the same size and number of chloroplasts in the cell of offspring. Many proteins have been reported to participate in this process and form an extraordinary complex at the division site via direct protein interaction. Recently, we have identified a novel membrane protein, PARC6, an inhibitor of FtsZ-ring polymerization and affecting the positioning of PDV1 to the chloroplast division site. However, the topology of PARC6 is still undetermined. Past studies predicted PARC6 to possess two transmembrane regions, with both of its termini oriented towards the stroma. A more recent model suggests that only one of these TM regions is actually viable, placing the C-terminus of PARC6 in the inner membrane space (IMS) and the N-terminus (including the region once assumed to loop into the IMS) in the stroma. We are extremely interested in how PARC6 inhibits FtsZ-ring formation and directs PDV1 positioning at the division site. In this study, constructs of the PARC6CT and (longer) PARC6NT regions will be tested for interactions with known IMS (PDV1) and stroma (ARC3, MinD, MinE, FtsZ1, and FtsZ2) plastid division proteins using yeast-two-hybrid assays, to understand whether PARC6 functions via direct interaction with some known chloroplast division proteins.

AIRWAY DISEASE
Chanel Redden
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 21
Mentor(s): Daven Jackson-Humbles (PDI), James Wagner (PDI)
Allergic airway diseases affect the airway from the nose to the lung. Asthma, a highly prevalent disease affects more than 300 million people worldwide. Studies indicate asthma symptoms can be exacerbated by airborne endotoxin (lipopolysaccharide; LPS) an inflammagen derived from gram negative bacteria. Using a murine asthma model, we will identify protential factors involved in the mechanism of asthma exacerbation by endotoxin. Male Balb/c mice are sensitized on Day (intraperitoneal, 20Âµg ovalbumin; OVA, with alum), boosted on Day 10 (i.p. and intranasal; IN, 0.5 % OVA) and challenged on Days 17 and 18 (IN. 0.5 % OVA). Non allergic mice were challenged with 0% OVA on Days 17 and 18 only. On Day 20 all groups of mice were treated IN with 0 or 3Âµg LPS. Changes in pulmonary function were determined and necropsy was performed on Day 21. To assess pulmonary function mice were intubated and ventilated using a flexiVent respiratory mechanics system (SCIREQ, Montreal, Quebec Canada) with passive expiration passively against a positive end- expiratory pressure (PEEP) of 2 cm H2O. A dose-responsive curve was generated with increasing doses of aerosolized methacholine. Total resistance(R), compliance (C), and elastance (E), tissue damplin (G) & tissue elastance (H) were determined. Lungs were lavaged with saline to collect bronchoalveolar lavage fluid (BALF) and processed for histological evaluation. Results are currently pending.

EXPRESSION LEVELS OF COLD-INDUCED GENES IN ARABIDOPSIS PLANTS SUPPRESSED IN THE CBF COLD-RESPONSE PATHWAY
Lindsay Rios
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 22
Mentor(s): Sarah Gilmour (MSU-DOE Plant Research Laboratory), Michael Thomashow (MSU-DOE Plant Research Laboratory)
Plants have the capability to adapt to changes in the environment. One such adaptation is the ability of some plants to increase freezing tolerance in response to low non-freezing temperatures, a process known as cold acclimation. At the molecular level, the C-REPEAT BINDING FACTOR (CBF) cold-response pathway has an important role in cold acclimation. The CBF pathway in Arabidopsis includes three extensively studied genes--CBF1, CBF2, and CBF3--that are rapidly induced in response to low temperature and encode AP2/ERF family transcription factors. Expression of CBF1, CBF2, and CBF3 results in subsequent induction of CBF-targeted cold-regulated (COR) genes designated the CBF regulon. Overexpression of CBF2Δc (a truncated dominant negative version of CBF2) suppresses the activity of the CBF transcription factors. Preliminary analysis has suggested that about 10 percent of the total cold-induced genes are dependent on action of the CBF transcription factors, 60 percent are independent, and 30 percent are co-regulated by the CBF pathway and other cold-response pathways. To test this possibility further, wild-type Arabidopsis plants and transgenic Arabidopsis plants overexpressing the CBF2Δc transgene were transferred to low temperature for various lengths of time, total RNA was isolated, and the transcript levels of specific putative CBF-dependent, CBF-independent, and CBF-coregulated cold-induced genes are currently being determined by quantitative RT-PCR. The results from these experiments will further our understanding of the role of the CBF cold response pathway in cold-regulated gene expression.

IDENTIFYING COMPONENTS OF CYCLIC ELECTRON FLOW USING HIGH-THROUGHPUT SCREENING METHODS
Andrew Tomes
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biological Sciences
Poster: 23
Mentor(s): Jeffrey Cruz (Plant Biology), David Kramer (Plant Biology), Deserah Strand (Plant Biology)
The light reactions of photosynthesis produce the energy-storing compounds ATP and NADPH for use in cellular metabolism. Maintaining the balance of these compounds is important to protect against the formation of reactive intermediates that can potentially cause photoinhibition. To balance their energy budgets, plants may employ cyclic electron flow around photosystem I (CEF1), a mechanism by which electrons from PSI are returned to the plastoquinone pool and used to drive additional protons into the lumen, where they are used to produce ATP without net $NADP^+$ reduction. This process also has a photoprotective role by increasing the ΔpH component of the proton motive force, which activates the pH-sensitive elements of the non-photochemical quenching (NPQ) apparatus, thus dissipating excess excitation energy. Currently, little is known about how this process is initiated and regulated; however, mutants displaying high levels of CEF1 have been previously isolated using a high-throughput video imaging system that probed for elevated levels of fluorescence quenching. In this project, we use an updated method of imaging to conduct a suppressor screen of a high CEF1 mutant in order to identify additional factors involved in CEF1 regulation.

REGULATION OF PHOTOSYNTHESIS BY THE PROTON MOTIVE FORCE AND ATP SYNTHASE

Jennifer Yang

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM

Category: Biological Sciences

Poster: 24

Mentor(s): Thomas Sharkey (Biochemistry and Molecular Biology)

In photosynthesis, light energy is harnessed through electron transport and proton flux to produce high-energy molecules, ATP and NADPH, which enable the synthesis of organic compounds. Plants must maintain these light-driven and light-independent reactions in strict balance, and one potential source of regulation is the proton motive force, the electrochemical potential generated from photolysis of water and light-driven proton flux into the thylakoid lumen. ATP synthases draw on the proton efflux to synthesize ATP, using inorganic phosphate released during the production of starch and sucrose from triose phosphates. To investigate this scheme of regulation, the proton motive force and ATP synthase activity were characterized under a range of carbon dioxide concentrations and temperatures in Arabidopsis and tobacco plants. These conditions differentially limit rates of photosynthesis via carboxylation, electron transport, and triose phosphate utilization, and also impose large changes in starch and sucrose production. Mutant Arabidopsis and tobacco plants lacking the ability to produce starch or sucrose were used to study the role of end product synthesis in this process, and to contribute to a better understanding of regulatory pathways in photosynthesis.

Biosystems and Agricultural Engineering

Poster Presentations

IMPROVING ANAEROBIC XYLOSE TO ETHANOL FERMENTATION THROUGH THE ADDITION OF FURFURAL TO SACCHAROMYCES CERVEVISIAE
Serena Brodsky
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 30
Mentor(s): David Hodge (Chemical and Biosystems Engineering)
As fossil fuels become scarce and pricey, it is of ever-increasing importance that we turn our focus to renewable forms of energy, such as ethanol from biomass. Biomass is composed of hemicelluloses, among other components. The sugar found in greatest capacity in hemicelluse is xylose. One of the greatest challenges that halts the progress of producing ethanol from biomass is the low product yield when fermenting xylose to ethanol. The purpose of this study is to test the effect of external electron acceptors, namely furfural, on fermentation of xylose. This will be studied by taking two genetically modified Saccharomyces cerevisiae yeast strains that take different pathways to produce ethanol. Each batch will be "spiked" with furfural part of the way through the fermentation and sampled periodically over the course of five days. The expected result will be to find that for one yeast strain there will be a lower yield of xylitol due to greater amount of NAD^+ being available for utilization, while the other strain will not have as great, if any drop in xylitol production. Samples will be taken and analyzed for contents of xylose, xylitol, acetate, glucose, ethanol, and furfural to determine changes in the products yielded.

COMPUTATIONAL ANALYSIS OF SEDIMENT DELIVERY RATIOS FOR THE PIGEON RIVER AND RIVER RAISIN WATERSHEDS
Emily Campbell
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 31
Mentor(s): Amirpouyan Nejadhashemi (Biosystems and Agriculture Engineering)
Sediment is loose soil or other solid substances that move through a watershed. Sediment can degrade water quality, have detrimental effects on aquatic wildlife, damage pumps and turbines, transport and release toxic chemicals, deplete available water in dams, and cause flooding and navigational issues. The Sediment Delivery Ratio (SDR) refers to the fraction of gross sediment that reaches a certain point (such as an outlet of a watershed) in a given time frame. Empirical formulas to determine the SDR are in use, but they are critiqued for lacking insight to the physical processes involved in sediment transport, and for not taking into consideration the effects of climate and catchment characteristics. The computer model used in this project is able to simulate the dozens of factors and complex interactions involved in sediment transport including hydrological inputs, watershed properties, and landuse and other management issues. This leads to a more accurate and detailed computation of SDR, which can effectively pin down areas of high priority for best management practices to reduce sediment input. Further, an economic analysis may be done to determine the sediment reduction costs for each subbasin so that money on conservation practices may be spent efficiently.

METABOLIC REGULATION OF PLANT ROOT DEVELOPMENT
Emily Gould
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 32
Mentor(s): Hideki Takahashi (Biochemistry)
Nitrogen is an essential nutrient in plant development, and various nitrogen environments are known to induce different root architectures. For instance, localized supply of ammonium may increase lateral root density, while nitrate stimulates lateral root elongation. We investigated the metabolic basis for such relationships, focusing on three key enzymes in the nitrogen assimilation pathway: glutamine synthetase (GS), glutamate synthase (GOGAT), and glutamate dehydrogenase (GDH). Arabidopsis thaliana T-DNA insertional mutants were prepared such that for each experimental group, the function of one of the three enzymes was knocked out. These mutants and the ecotype Columbia wild type were grown on split media to investigate the localized effects of nitrogen source and its metabolic conversion on lateral root development. The primary root was grown on one half of the media that was N-deficient, and one lateral root initially elongated from the primary root was placed on the other half, supplemented with ammonium or nitrate. Seedlings were subsequently transferred to media containing 15N-ammonium, and metabolite assays were performed by gas chromatography-mass spectrometry (GC-MS). Root

phenotypic responses were compared with the metabolic responses to each treatment for each mutant. The ammonium response varied among mutants: in the GS mutants, ammonium was less effective at stimulating lateral root length or density than it was in the wild type; the GDH mutation did not drastically influence root phenotypes; Fd-GOGAT mutants produced fewer second-order lateral roots; and NADH-GOGAT mutants produced shorter first-order lateral roots, with a high second-order lateral root density.

SAND ASSIMILATION COLUMNS
Benjamin Hesskamp, Jena Laur, Ethan Nussdorfer
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 33
Mentor(s): Steve Safferman (Biosystems and Agricultural Engineering)
Land application is a common method used by food processors to treat wastewater. Anaerobic conditions can result from inappropriate hydraulic and organic loadings, thereby causing reduction and mobilization of naturally occurring metals in the soil. The objective of this research is to determine the feasibility of using moisture and oxygen sensors to predict changes in the soil environment resulting from the addition of wastewater that leads to anaerobic conditions. Eight 46-cm diameter, 97-cm tall columns were built, filled with clean sand. Oxygen and volumetric water content sensors were installed at three depths, 10.2-, 30.5- and 50.8-cm and continuously monitored with readings taken every 10 minutes. Synthetic wastewater was applied with different instantaneous, but the same average daily loading. The water was delivered using peristaltic pumps controlled by timers. Sensor data, in addition to laboratory testing, was analyzed to form general recommendations regarding hydraulic and organic loading of wastewater as well as to determine the necessity of a rest period between loadings. Further research is currently underway to determine the effectiveness of oxidation-reduction probes constructed at Michigan State University to predict metal reduction and mobilization in the soil columns.

PHOSPHORUS REMOVAL FROM ONSITE GENERATED WASTEWATER
Jena Laur, Benjamin Hesskamp, Ethan Nussdorfer
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 34
Mentor(s): Steve Safferman (Biosystems and Agricultural Engineering)
An abundance of phosphorus in fresh surface waters leads to eutrophication. Excess phosphorus is caused by sources such as septic tanks and agricultural runoff. In this case, residential wastewater is being studied as the source of phosphorus. Active and passive solutions to this problem have been tested using biological uptake by plants and chemical precipitation. Previously, iron activated alumina media has been tested and showed a removal rate of 9.4 to 11.0 mg/cm^3 for 50 days before the media became exhausted. In this experiment, new media developed by MetaMateria is a highly porous (>80% porosity) alumino-silicate ceramic made with iron containing compounds that serves as a substrate for phosphorous sorbing nano-iron materials. The high porosity of this material gives it an extremely high surface area (ranging from 1 m^2/g to 200 m^2/g) and allows the maximum area for phosphorus to adsorb to the media. In lab testing, partially treated wastewater has been pumped through PVC columns containing this media while measuring the influent and the effluent levels of phosphorus entering and exiting the columns. The results of this experiment have shown excellent removal rates of 42.8 milligram phosphorus per gram media, average effluent phosphorus concentration of less than 2 mg/L, and no media exhaustion during the study. The suggested mechanism is an equilibrium driven first order equation and is further corroborated by lack of effect by change in hydraulic loading. Further research has been recommended including a field test of the study.

LAND APPLICATION OF FOOD PROCESSING WASTEWATER IN MICHIGAN
Ethan Nussdorfer, Benjamin Hesskamp, Jena Laur
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 35
Mentor(s): Steve Safferman (Biosystems and Agricultural Engineering)
Land application of food processing wastewater is a common practice in Michigan. Carbon-rich water is applied to fields, allowing biodegradation by soil microbe populations. Excessive land application can result in anaerobic conditions in soil leading to metal mobilization and groundwater contamination. Metal mobilization can be predicted by constant monitoring of oxygen levels in soil, but installation of oxygen sensors is costly. Analysis of groundwater samples for metals requires some time and is also quite expensive. This study hopes to draw correlations between metal mobilizing conditions, soil factors, such as moisture content and oxygen concentration, and wastewater application factors including hydraulic and carbon loading. Three land application fields were chosen for analysis and characterized by soil characteristics and geography. Oxygen sensors and volumetric moisture content (VMC) sensors were installed in one location in each field at depths of 1', 2', and 3'. Data loggers

allowed constant monitoring and recording of soil conditions. BOD and hydraulic loading per application of wastewater was provided by the land owner. Monitoring wells into the surrounding groundwater provided sampling for metals analysis upstream, at, and downstream of the application sites. After one year of data acquisition, data was analyzed for trends and relationships between factors. Correlation was noted between hydraulic loading and percent oxygen in soil and consequently to metal leaching in groundwater. BOD had little or no effect on oxygen level in soil. Further study and historical data may help reveal more effects of land application factors as well as environmental conditions.

PILOT-SCALE VALIDATION OF A SALMONELLA THERMAL INACTIVATION MODEL APPLIED TO WHOLE-MUSCLE MEAT AND POULTRY PRODUCTS COOKED IN A MOIST-AIR IMPINGEMENT OVEN
Ian Hildebrandt
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 36
Mentor(s): Bradley Marks (Biosystems and Agricultural Engineering)
Microbial inactivation models can be used to evaluate the lethality of meat cooking processes. Typically, such models are based on data from laboratory-scale experiments and are rarely validated for industrial application. The objective of this study was to quantify accuracy and uncertainty of Salmonella inactivation models via pilot-scale tests in a moist-air impingement cooking system. Whole-muscle beef, pork, or chicken samples were inoculated in a salt-phosphate marinade containing an eight-serovar Salmonella cocktail. Inoculated samples containing >7 log(CFU/g) were cooked in a pilot-scale, moist-air impingement oven under commercially relevant conditions. Process variables included humidity, air temperature, and fan speed, with triplicate samples analyzed at each condition. Internal and surface temperatures were recorded real-time during processing. Salmonella inactivation was calculated by previously reported activation models. Samples were removed from the oven at a target computed lethality, rapidly cooled to an internal temperature of 50°C in liquid nitrogen and then immediately sliced into three layers, with a core removed from the center layer. All samples were stomached, serially diluted, and plated on modified tryptic soy agar plates (37°C, 48 h) to enumerate surviving salmonellae. Lethality error was defined as the difference between the experimental and predicted log reductions. The root mean squared errors for the computed lethalities for whole-muscle beef, pork, and chicken were 1.30, 1.54, and 1.43 log CFU/g, respectively. Mean errors (biases) were -0.13, 0.18, and -0.72 for whole muscle beef, pork, and chicken, respectively. Therefore, such models should account for the inherent uncertainty when applied to industrial systems.

BIOSAND FILTER WATER PURIFICATION STUDY
Joseph Horbatch
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 37
Mentor(s): Ted Loudon (Biosystems and Agricultural Engineering)
Biosand filters are used throughout the world as a tool to provide cheap and clean water to rural and underdeveloped communities. The way that the biosand filters are built controls how well water can be purified as well as the effluent flow rates. Aqua Clara, as an organization, works to create the best biosand filter on the market to provide the cheapest and cleanest water. Through previous testing and gathered information, bronze was added to their biosand filtration design because of copper's effect as a biocide. Our research focuses on the placement of a bronze alloy, in different amounts, within several biosand filters. The hope is that as more bronze is spread throughout the biosand filters, the retention time required to purify the drinking water can be reduced significantly. In addition, a comprehensive study of the Aqua Clara filters in comparison to other biosand filters was run to test whether the filters developed by Aqua Clara are at least as good, if not better, than others in the field. In order to test that hypothesis, three Aqua Clara filters are being tested along side three concrete filters and three HydAide filters. Over the course of a few months, each of the biosand filters will have unclean water pumped through it three times a day. The performance of each filter will be measured by checking the flow rates along with influent and effluent concentrations of coliform and E. coli bacteria.

L(+)-LACTIC ACID PRODUCTION USING PELLETIZED RHIZOPUS ORYZAE ON DIFFERENT CARBON SOURCES
Robert Kraemer
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Biosystems and Agricultural Engineering
Poster: 38
Mentor(s): Wei Liao (Biosystems and Agricultural Engineering)
Lactic acid is widely employed in a growing plethora of applications. It is used as an acidulant and as a preservative in the food industry and can also be used to synthesize polylactic acid for biodegradable plastics. Synthesizing lactic acid using chemical production is possible but results in a mixture of L(+) and D(-); while L(+)-lactic acid is highly desirable. The filamentous fungi

Rhizopus oryzae is a good producer of L(+)-lactic acid. The objective of this study is to investigate L(+)-lactic acid production using Rhizopus oryzae with different carbon sources, glucose and xylose. A Completely Randomized Experimental Design (CRD) will be adopted to optimize culture conditions of inoculum, sugar concentration, and nitrogen concentration in terms of L(+)-lactic acid production. Fungal fermentation performance on both carbon sources will be evaluated by a pair-wise comparison. The optimal conditions of L(+)-lactic acid production will be concluded.

APPLICATION AND ANALYSIS OF MANURE-TREATED DUCKWEED AS A GREEN ALTERNATIVE FOR THE FERTILIZATION OF AGRICULTURAL CROPS

Jinsha Li, Alyse Waldhorn

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM

Category: Biosystems and Agricultural Engineering

Poster: 39

Mentor(s): Dawn Reinhold (Biosystems and Agricultural Engineering)

Land application of manure is an inexpensive practice commonly used for the fertilization of agricultural fields. Leachate from manure-applied fields can contain pathogen and nutrient concentrations far above water quality standards. The aim of the Green Manure Project is to utilize duckweed grown in a manure-based constructed treatment wetland and later apply it to agricultural fields as a "greener" alternative. This is a "greener" approach in the sense that a duckweed application (Green Manure) contains far less pathogens and a more appropriate concentration of nutrients as compared to traditional fertilization methods. Previous studies have indicated the ability of the Green Manure wetland to remove near 97% E. coli, 60% total nitrogen, 25% total phosphorous and 63% COD. The current study focuses on a comparison between ryegrass grown with Green Manure, chemical fertilizer and a traditional manure application. Soil columns were constructed to best reflect the conditions of a Michigan agricultural field. After planting the ryegrass, specific concentrations of Green Manure, chemical fertilizer and manure were normalized based on the nitrogen requirement of the soil and crop. Chemical concentrations in the leachate were analyzed using an ion chromatograph while E. coli was measured via an EPA-approved cultivated based method. Physical characteristics of the crop were also measured in order to assess growth over time. The Green Manure Project is a novel approach for not only wastewater remediation but also nutrient recycling.

STABILIZATION AND UPGRADING OF BIO-OIL

Arthy Muthukumarappan

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM

Category: Biosystems and Agricultural Engineering

Poster: 40

Mentor(s): Christopher Saffron (Biosystems and Agricultural Engineering)

Fast pyrolysis of biomass produces three different products: bio-oil, bio-char and non-condensable syn-gas. The main product, bio-oil, can be used as a liquid transportation fuel source. Due to the presence of aldehydes, ketones and phenols bio-oil is an unstable and reactive mixture. To utilize the bio-oil as a valuable drop-in fuel, stabilization and upgrading of the bio-oil is required before end use. By using electrocatalytic hydrogenation (ECH) at mild conditions bio-oil can be upgraded to drop-in fuel. ECH of several pure compounds were analyzed to determine that ECH could be used on many organic compounds found in bio-oil. The upgrading of several mixtures was then carried out to study the selectivity while changing the catalyst loading, pH, and temperature. Upgrading of bio-oil by ECH was followed to show that the process is advantageous through the conversion rate and stability of the oil. Additionally, by comparing the products from ECH of bio-oil to the ECH of the individual bio-oil components the pathway of the reaction can be found. This pathway is used to study the selectivity of each hydrogenation reaction done during the bio-oil upgrade. Lastly, the stabilized bio-oil can be upgraded further to reduce the alcohols to combustible hydrocarbons. The final upgrading is done through catalytic reduction in a Parr reactor using high temperature and pressure. These results can be used for further research in the upgrading of bio-fuel to produce alternative renewable drop-in fuels.

Chemical Engineering and Materials Science

Poster Presentations

DYNAMIC MECHANICAL THERMAL ANALYSIS OF LEAD-FREE SOLDER JOINTS SUBJECTED TO REPEATED THERMAL SHOCK
Stephanie Bergman
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 50
Mentor(s): Andre Lee and KN Subramanian (Chemical Engineering and Materials Science)
Dynamic mechanical thermal analysis (DMTA) is a potential characterization method to detect internal damage within materials. Due to their highly viscoelastic nature, polymeric materials are routinely characterized by this method. Although internal friction studies on metals have been reported in the past using similar methodologies, they were not emphasized due to limited sensitivity of equipment. Improvements in the sensitivity of modern DMTA enable such studies on metallic materials with sufficient accuracy. The proposed project is aimed at damage characterization of solder interconnects subjected to repeated thermal shock. The purpose of thermal shock is to introduce damage within the solder joints occurring as a consequence of thermal stresses from coefficient of thermal expansion mismatches between entities present in the electronic interconnects. DMTA testing on lead-free solder samples will be carried out in small oscillatory strain amplitudes at various temperatures and frequencies. Small amplitudes will be used to avoid additional destruction of the tested material. This test methodology allows the same sample to be examined throughout various stages of thermal shock cycling, while avoiding specimen variability problems. By analyzing the phase angle and loss modulus it is seen that increased thermal cycling increases the loss modulus and phase angle. These increases can be attributed to the absorption of stresses by internal dislocations and cracks. It is also believed that the length scale of damage can be characterized by isothermal frequency sweeps. It is anticipated that the findings of this study will develop a non-destructive mechanical characterization strategy of damage within metallic materials.

IMPROVING BATTERIES: EFFECT OF PARTICLE SIZE ON INTER-PARTICLE ADHESION, STRENGTH, AND CONDUCTIVITY
Isabel David
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 51
Mentor(s): Ryan Maloney and Jeff Sakamoto (Chemical Engineering and Materials Science)
Lithium ion technology is the heart of the current generation of rechargeable batteries. Currently, lithium ion batteries depend on a liquid electrolyte to transfer ionic charges across a permeable membrane. A good battery electrolyte is ionically but not electrically conductive. It is promising to replace the combustible organic liquid electrolyte with a chemically stable, non-flammable, higher-performance, and air-insensitive solid state electrolyte. This research intends to replace this liquid electrolyte with a solid (3D porous) structure. The key characteristic of the solid state electrolyte is the ability of particles to adhere to each other under electric charge and residual stresses. Therefore the particular question under study is the effect of both particle size and uniformity on inter-particle adhesion (sintering) and conductivity. Experimental method is a controlled comparison of two powders of cubic garnet structure. The two powders are manufactured by different processes. In this experiment, each powder (greater than 10 microns) is reduced in size by planetary ball milling to small particles (less than 1 micron). The experiment is controlled by the following features: initial quantity of powder, solvent to powder ratio, and milling conditions (size of milling container, amount of solvent, number of agate balls that mill the powder, and milling times). Observations employ Variable Pressure Scanning Electron Microscopy (VP-SEM). Particles are to be evaluated on their ability to sinter into small pucks. The expected findings are to ascertain which of the two powders ends up--after milling--in a uniform small size that increases adhesion, strength, and conductivity.

PERFECTING THE INSULATION METHOD OF MICROELECTRODES FOR NEUROTRANSMITTER DETECTION
Eric Foster
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 52
Mentor(s): Greg Swain (Chemistry)
The application of small-size electrodes was further enhanced by increasing demands from analytical chemistry (e.g., the need for electrodes in miniature cells in detection for high-performance separations or in electrochemical sensors) and biochemistry (in situ, in vivo, and in vitro analytical measurements on living organisms). Theoretically, an electrode of only a few microns will

be small enough to fit into the synapses of neurons to measure chemical signaling. There are electrodes for commercial use available; however these electrodes are too outsized and oxidize after one to few uses. Oxidation of the carbon fiber decreases sensitivity which makes them useless after little experimentation. Experimental methods will be used to reproducibly create properly insulated carbon-fiber microelectrodes that are stable and can sensitively measure neurotransmitters secreted from individual cells. Carbon fibers will be inserted into 1.2mm x .68mm A-M Systems capillaries and pulled using a Sutter Instrument P-30 Vertical Micropipette Puller. The electrodes will be sealed with epoxy, cured, polished, and tested using cyclic votlammogram to ensure a working condition. The overall goal of the project was to prepare insulated carbon fiber microelectrodes that can reproducibly, sensitively, and stably measure neurotransmitters. These microelectrodes can then be chemically etched and thus salvaged due to its low oxidation over time.

INFLUENCE OF GRINDING AND PRETREATMENT TEMPERATURE ON SUGAR YIELDS OF AMMONIA PRETREATED RICE STRAW
Brandon Guthrie
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 53
Mentor(s): Bryan Bals (Chemical Engineering and Materials Science)
Ethanol produced from renewable lignocellulosic biomass could provide a cost effective form of alternate energy that would support the world's growing energy demand. Treating biomass at a high temperature and pressure through ammonia fiber expansion (AFEX) increases the porosity of the cell wall and brings lignin to the surface, both of which increase the effectiveness of enzymatic hydrolysis. The increased enzymatic activity from AFEX improves sugar yields and lowers the production cost of ethanol. This study analyzes the effects that grinding rice straw before AFEX has on sugar yields. Past research has shown that, at high enough pretreatment temperatures, sugar yields from ground and non-ground biomass are about the same. Four AFEX conditions were tested: ground and non-ground rice straw at high and low temperatures. The four pretreated samples were washed in ammonia and acetone solutions to extract the lignin from the pretreated matter. The lignin content was quantified using Prussian blue phenol analysis and the porosity of the biomass was calculated from a nitrogen adsorption analysis. We determined how enzyme binding varied among the samples. We expect to extract more lignin and observe a greater porosity in the high temperature and ground samples.

ANALYSIS OF SIRNA DELIVERY IN 3-DIMENSIONAL COLLAGEN MATRICES
Elizabeth Hinds
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 54
Mentor(s): S. Patrick Walton (Chemical Engineering and Materials Science)
The delivery of short, interfering RNAs (siRNAs) for RNA interference (RNAi) is a potentially promising method of drug therapy. In the laboratory, studies of siRNA delivery are typically completed using two-dimensional (2D) cell cultures, whereas a three-dimensional (3D) model would more accurately mimic the in vivo environment. Therefore, this research aims to transfect cells in 3D collagen cultures with siRNA. The cellular uptake and efficiencies of siRNAs traveling through 3D collagen matrices were analyzed using flow cytometry and multicolor confocal microscopy. It was found that commercially available transfection reagents proven to successfully transfect cells in 2D, such as Lipofectamine 2000, interact with the 3D collagen matrices and do not transfect cells in the gel suspension. A commercial transfection reagent created for cells in 3D hydrogels, 3D-FectIN, can successfully transfect cells in 3D if added while the collagen is still in liquid form. When added after gel formation, all transfection reagents have been seen to accumulate on top of the collagen gel, with minimal siRNA movement through the gel even after longer transfection times (e.g., 72h). Additionally, this halt of siRNA movement does not seem to be relieved by PEGylation of the collagen gel, but studies are still being completed to confirm this. Using an alternative hydrogel to collagen has been discussed, as has using a different cell line in order to obtain a successful transfection.

CERAMIDE IS UPREGULATED THROUGH SMASES IN PRIMARY NEURONS UPON PALMITATE-ASTROCYTE CONDITIONED MEDIA TREATMENT
Rebecca Martin
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 55
Mentor(s): Christina Chan (Chemical Engineering and Materials Science)
Previous epidemiological studies demonstrate that diets high in fat significantly increase the risk of developing Alzheimer's disease (AD), an age-related neurodegenerative disease which is primarily characterized by a buildup of an insoluble, toxic protein called amyloid beta (Aβ) in senile plaques. Amyloid beta is formed in neurons by the protease BACE 1 which is upregulated by ceramide. The free fatty acid (FFA) palmitate has been shown in previous studies to increase de-novo synthesis

of ceramide in astrocytes whereas direct palmitate treatment does not cause an increased ceramide levels in neurons. However, upon treatment with palmitate-astrocyte conditioned media (CM-P), cortical neurons have been shown to have increased levels of ceramide and amyloid beta. In the present study we investigated the two potential processes of ceramide synthesis in neuronal cells after treatment with palmitate-astrocyte conditioned media: de-novo synthesis and sphingomyelinase facilitated production. We found that in addition to increased levels of ceramide in neurons, there were also significant increases in sphingomyelinase, indicating that palmitate-astrocyte conditioned media mediates the activation of sphingomyelinase in neurons, inhibition studies further confirmed it. This study demonstrates that ceramide is increased in neurons upon palmitate-astrocyte conditioned media treatment through the sphingomyelinase pathway, not de-novo synthesis.

IBT PRODUCTION FROM IMMOBILIZED MICROBIAL CATALYST WITH IN SITU RECOVERY
Derek Montgomery
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 56
Mentor(s): R. Mark Worden (Chemical Engineering and Materials Science)
Due to the rapidly increasing consumption and prices of gasoline, biofuels have been a subject of interest to many researchers. Currently biofuel production is plagued by problems such as the large areas of land required for biomass and economic problems associated with conversion of farm land. To bypass the problem of requiring biomass, solar derived H_2 can be utilized to convert CO_2 into liquid fuel through a microbial catalyst. The fuel produced, isobutanol (IBT), is a promising alternative to ethanol. IBT's advantages include having a 30% higher energy content than ethanol (similar to gasoline) and ability to be mixed in any proportion with gasoline for use in unmodified engines. The microbial host can be immobilized in a hollow fiber reactor for continuous IBT production. Due to the toxic nature of IBT to the microbial catalyst, an in situ recovery system for IBT is also being developed in order to maximize production. This research will focus on creating a suitable bioreactor and recovery system that can be scaled for industry. The recovery system involves combining silicalite, a zeolite with high affinity for butanol, and various binders to form pellets for an adsorbent column that can be reused.

PLA-PGA AS A RETINOID DELIVERY DEVICE FOR TREATMENT OF LEBERS CONGENITAL AMAUROSIS
Craig Pearson
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 57
Mentor(s): Melissa Baumann (Chemical Engineering and Materials Science), Simon Petersen-Jones (Small Animal Clinical Sciences)
Leber's Congenital Amaurosis (LCA) is a heritable, retinal degenerative disease. Some forms of LCA result from mutations of genes involved in the retinoid cycle responsible for supply of 11-cis-retinal to the photoreceptors. A lack of 11-cis-retinal means that the rod and cone visual pigments do not form, causing severe visual impairment. Studies of dogs lacking in 11-cis-retinal formation due to mutation in a gene called RPE65 have shown that direct, intravitreal injections of a synthetic version of 11-cis-retinal result in improved vision with no harmful side effects. However, the injections are only effective for a limited amount of time, meaning they have to be regularly repeated. This makes them impractical for long-term treatment. The present study sought to develop an injectable device to release the therapeutic retinoid gradually, over a period of several months, for continuous treatment of LCA. The copolymer poly-DL-lactide-co-glycolide (PLA/PGA) is known for its biocompatible properties and gradual degradation, making it an ideal vehicle for intravitreal drug release. PLA/PGA and the therapeutic retinoid were dissolved together in acetone, and the solution was poured into a silicone rubber mold. Solvent evaporation yielded small PLA/PGA pegs with the retinoid incorporated. These samples were immersed in complete media to mimic the vitreal environment, and the release of retinoid into solution upon polymer degradation quantified by determining the retinoid concentration in aliquots removed at designated time intervals. By analyzing the release rate, the effectiveness of this release mechanism for treating LCA in canine and human subjects will be evaluated.

DEVELOPMENT OF A PROTEIN-TETHERED BILAYER LIPID MEMBRANE FOR ION TRANSPORT
Cristina Ramos-Gonzalez, David Raegen
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 58
Mentor(s): Robert Ofoli (Chemical Engineering and Materials Science)
The objective of our research is to self-assemble a high-impedance bilayer lipid membrane (BLM) into which Cytochrome C. Oxidase (CcO) has been incorporated to serve as a proton pump. In brief, the interface is assembled by first immersing a clean gold electrode in a solution of dithiobis (N-succinimidyl propionate) (DTSP) and dithiobis (propionic acid) (DTP) in a 1:5 molar

ratio. Interaction of DTSP with an engineered His-tag on CcO enables tethering of the protein to the gold substrate. In this scheme, DTP serves as a spacing molecule to control the density of CcO at the interface. To reconstitute the protein-tethered BLM, the bound protein is incubated in a buffer solution containing solubilized diphytanoylphosphatidylcholine (DiPhyPC) at a concentration of 0.05 mg/ml. The integrity of the BLM is assessed by interrogating the interface by cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The eventual goal is to conjugate this assembly with a water-splitting photosynthetic mimic to produce hydrogen on demand.

MICROSTRUCTURAL AND MECHANICAL ANALYSIS OF NITI-NB MULTILAYER THIN FILMS AS BRAZE MEDIA FOR NITI
Scott Sutton
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 59
Mentor(s): David Grummon (Chemical Engineering and Materials Science)
Nickel-titanium is a common shape memory alloy with a wide range of applications. For precise applications and high-temperature applications, advanced bonding techniques are needed to join NiTi. Niobium has been determined to form a quasi-binary eutectic with NiTi in the ternary Ni-Ti-Nb system, and thus has been used as a braze compound for NiTi. Recently, NiTi-Nb multilayer thin films have been shown to successfully join NiTi. The focus of this research is to investigate the properties of NiTi-Nb multilayer films as brazing compounds. By varying the relative thicknesses of NiTi and Nb layers in multilayer braze films, we were able to achieve specific compositions of eutectic liquid in order to produce braze joints with different characteristics. Braze joints were produced with multilayer films of several compositions and were analyzed with SEM. For selected compositions, brazed butt joints were made and tensile tested.

IDENTIFICATION OF THE KINETIC PARAMETERS OF THE ENZYME MALATE DEHYDROGENSE FOR USE IN ENZYMATIC BIOFUEL CELL MODELING
Kathryn Worley
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Chemical Engineering and Materials Science
Poster: 60
Mentor(s): Scott Calabrese Barton (Chemical Engineering and Materials Science)
Enzymatic biofuel cells involve the use of enzymes as catalysts as opposed to the precious metal platinum, commonly used in the hydrogen fuel cell. The use of enzymes can be a less expensive alternative to the use of a platinum catalyst. However, the electrical output of the enzymatic biofuel cell is currently much lower than that of the platinum catalyzed fuel cell. Collaborators' research indicates that the power output can be increased by using enzymes in a cycle such as the TCA cycle. This study covers the procedure of data acquisition and the subsequent analysis resulting in the determination of kinetic parameters for the forward and reverse reactions based on an ordered bi-bi mechanism for the enzyme malate dehydrogenase. These parameters can then be integrated into a model which will be able to predict the environment for optimum electron output via the production of the cofactor nicotinamide adenine dinucleotide hydride (NADH). The ultimate goal of this research is the incorporation of TCA cycle enzymes into working electrodes that will be used in biofuel cells.

EVALUATION OF HIGH PERFORMANCE STRUCTURAL MATERIALS UNDER THE EFFECT OF FIRE
Haihua Gu
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Civil and Environmental Engineering
Poster: 70
Mentor(s): Venkatesh Kodur (Civil Engineering)
The evaluation of structural behaviors under the effect of fire can be simulated by high temperature testing. Typical structural materials, such as concrete and steel, exhibit different thermal and mechanical properties under different temperatures. High Strength Concrete (HSC), Self-consolidated Concrete (SCC) and Light weight Aggregate Concrete (LWAC) is especially in demand for finding their properties under high temperature environment. In this study, thermal analysis focuses on thermal conductivity, specific heat, and thermal expansion. These three parameters are first calculated via Hot Disk Analyzer, and then are used to determine internal activities of concrete and steel in terms of dimension change and heat transfer. Mechanical analysis includes various strength tests as well as stress-strain behavior. The results of those tests are then compared against different levels of temperature and various types of reinforcement fibers. By combining both mechanical and thermal analysis, failure patterns of a structure at various levels temperature can be determined.
This research was conducted under the guidance of Professor Venkatesh Kodur in Civil Engineering.

Civil and Environmental Engineering

Poster Presentations

EVALUATION OF HIGH PERFORMANCE STRUCTURAL MATERIALS UNDER THE EFFECT OF FIRE
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POST-BUCKLING BEHAVIOR OF LAMINATED COMPOSITE CYLINDRICAL SHELLS
Annelise Heeringa
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Civil and Environmental Engineering
Poster: 71
Mentor(s): Rigoberto Burgueno (Civil and Environmental Engineering)
Thin elastic structures subject to compressive stresses may attain multiple buckling modes, each of which exhibit structurally stable configurations, as long as lateral restraint is provided to limit out-of-plane deformations. Cylindrical shells offer the unique geometrical condition of a constant radial restraint on the increasing transverse deformations of a buckling mode, thus allowing the structure to “jump” from one stable buckled configuration to another as in the case of a “snap-through” response. It is hypothesized that the anisotropic behavior that can be present in laminated composite shells can allow for control of the post-buckling behavior. The objective of this research project is thus to demonstrate that multi-stable buckling behavior can be attained in cylindrical shells and that this behavior may be controlled using laminated composite materials. The study is being done through large-deformation post-buckling analyses with the finite element program ABAQUS. The models are being created by defining initial geometrical imperfections based on buckling analyses and the snap-through post-buckling analyses will be conducted using a line-search algorithm. The effect in which the laminate composite’s design parameters influence the model’s multi-stable configurations will be evaluated by comparing results from different case studies. Special attention will be given to assess the ways in which the “snap-through” behavior of these cylinders can be optimized as it releases strain energy jumping from one stable configuration to another. Understanding and control of such behavior can provide new opportunities for pseudo-active structures.

MICROBIOLOGICAL WATER QUALITY IN TWO SAGINAW BAY BEACHES
Emily Sokol
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Civil and Environmental Engineering
Poster: 72
Mentor(s): Irene Xagoraraki (Civil and Environmental Engineering)
The quality of freshwater is critical for human survival. By identifying viral and bacterial contaminants and locating the source, these pollutants can be eliminated from water sources. In the case of this research project, water, sediment and filtration samples were acquired from two sources of water in the Saginaw Bay area. Indicators, different filtration methods, and real-time PCR were used in order to identify specific viruses and bacteria in the samples that could harm humans. In order to find where the contaminant originated, samples were taken from multiple locations at both sites. Due to state regulations, only bacterial contamination could be reported for source elimination because viral identification is not entirely accurate in counting only the active viruses.

SULFATE REDUCING BACTERIA DETECTION IN OIL FIELDS USING LOOP-MEDIATED ISOTHERMAL AMPLIFICATION (LAMP)
Gregory Waite
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Civil and Environmental Engineering
Poster: 73
Mentor(s): Syed Hashsham (Civil and Environmental Engineering)
Sulfate Reducing bacteria (SRB) pose both an economical and health threat to the oil industry and its workers. The metabolic process of SRB leads to the souring of oil drums and the corrosion of oil pipelines. Detection of such bacteria is routinely conducted by culturing (MPN) technique, and has more recently been tested using DGGE. Culturing is time consuming, and DGGE is expensive. It has been determined that there is a need for a low cost, quick approach for detection of SOB contamination. Loop-mediated isothermal amplification (LAMP) is both low cost and has visually detectable results in 60 minutes. The goal of this project is to design LAMP detection primers to encompass a broad range of the 800 known SRB DNA sequences. This is being done by targeting the dsrA and dsrB genes which are in direct causal association to the metabolic sulfate reduction process. Due to the broad genetic nature of sulfate reducing bacteria, feasibility studies are ongoing.

EFFECT OF PLASTIC HINGE MODELING IN THE SEISMIC DESIGN OF SLENDER REINFORCED CONCRETE COLUMNS
Caroline Williams
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Civil and Environmental Engineering
Poster: 74
Mentor(s): Rigoberto Burgueno (Civil and Environmental Engineering)
Slender reinforced concrete columns under seismic conditions are not believed to accurately satisfy the principles of Performance Based Seismic Design (PBSD). While global parameters can be calculated and designed for with little difficulty, PBSD requires the structure to reach a pre-determined level of performance, namely damage, for a given level of seismic risk. Damage in a reinforced concrete element is a result of the inelastic behavior of the steel and concrete materials in the column, and is best measured in terms of local deformation values such as strain or section curvatures. The region over which the inelastic demands are assumed to be concentrated is named the plastic hinge region. The models created to predict damage levels of the columns are based on the length of the plastic hinge region and are believed to be over-simplified. Analyses of experimental data for circular columns from the Pacific Earthquake Engineering Research database are being made to evaluate the performance of current plastic hinge models. Finite element modeling is also being used to study the adequacy of simplified plastic hinge modeling compared to predicted spread of plasticity in columns with varying slenderness. The performance of existing plastic hinge models will be presented to highlight their effect in the calculation of local and global structural response measures. This knowledge will contribute to an improved model that will satisfy the goals of Performance Based Seismic Design for slender reinforced concrete columns.

Computer Science and Engineering

Poster Presentations

COLLAPSING MULTIPLE mRNA SEQUENCE READS
Meghan Donahue
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Computer Science and Engineering
Poster: 80
Mentor(s): Titus Brown (Computer Science and Engineering)
Assembly is one way to work with and produce mRNA sequences. An assembler is able to produce thousands of sequence reads, so my research focuses on collapsing multiple mRNA sequence reads. The number of sequence reads to work with will reduce and it will allow for sequence reads to be clustered together. Clustering reads is beneficial for data analysis; it is simpler to analyze a cluster of sequence reads rather than analyzing numerous sequence reads with little to nothing in common. The results can be used as a starting point to further study how to handle the thousands of sequence reads an assembler produces.

NUMERICAL SIMULATION OF CORE COLLAPSE SUPERNOVAE
Rodney Pickett
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Computer Science and Engineering
Poster: 81
Mentor(s): Dirk Colbry (Institute for Cyber-Enabled Research (iCER))
Core collapse supernovae remains an unsolved problem in astrophysics due to the substantial amount of different phenomena that occurs during the process. The project, KineticSN, uses numerical simulations that model the core collapse and explosion of certain stars. The current simulation code is written in C and tested on the HPC system here at MSU. Ultimately, the simulation code will run on a large sized system such as Blue Waters. While it is now widely believed that neutrinos play a critical role in the generation of the supernova explosion, the precise contribution of neutrinos remains to be determined by numerical analysis. With the help of numerical analysis the code simulates intermediate and high energy nuclear collisions to model particle production, shock wave formations, collective deflections, and various dynamics. The project uses kinetic theory equations to aid in modeling core collapse supernovae because it allows our team to handle propagations and interactions in a very general manner.

MEASURING THE COMPLEXITY OF A GENOME USING INFORMATION THEORY
David Rogers
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Computer Science and Engineering
Poster: 82
Mentor(s): Charles Ofria and Anu Pakanati (Computer Science and Engineering)
The field of information theory originally dealt with the process of transmitting messages error free across wires but has been extended to many other areas beyond communication networks. One of those areas, evolution, deals with the analysis of the frequencies of alleles within a population. The appearance of certain alleles in the genome of an organism correspond to a fitness level and ultimately the ability of the organism to reproduce. Information theory is useful to examine the relationship between a genome and its fitness as well as provide the ability to quantify the genome in terms of complexity as evolution progresses. Processes such as point-by-point mutations and Bayesian analysis of allele distribution are two ways in which to quantify the complexity of a genome. We are exploring these and other information theoretic methods to examine the process of accumulating complexity through evolution at the genomic level.

THE EVOLUTION OF EMBODIED INTELLIGENCE
Jacob Walker
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Computer Science and Engineering
Poster: 83
Mentor(s): Charles Ofria (Computer Science and Engineering), Robert Pennock (Philosophy)
For the last two decades, the field of artificial life has brought advances in the fields of biology, artificial intelligence, and neuroscience. Here we focus on the evolution of embodied intelligence in a three dimensional environment. Following Karl Sim's celebrated paper published in 1994, we evolve both the behavior and morphology of virtual organisms through the use of

genetic algorithms. The computer program used for these experiments was EVO developed by Nicolas Chaumont. Organisms were selected based on their ability to complete various cognitive tasks such as swimming and light chasing. We show that many biologically plausible strategies and morphologies emerge similar to worms and fish. This project was sponsored by the BEACON Evolving Intelligence Group.

COMPRESSING MULTI-DIMENSIONAL ACCESS CONTROL LISTS (ACLs) BY OPTIMALLY RESOLVING DIFFERENCE
Lingyong Wang
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Computer Science and Engineering
Poster: 84
Mentor(s): Eric Torng (Computer Science and Engineering)
Access Control Lists (ACLs) only allow rectangles, where each rectangle side corresponds to an IP prefix. ACL compression is very useful in network routers for canceling out unwanted traffic. We have a new approach to compress the original ACL list to a shortest possible ACL list by using Hyper-ACL-Diplomat. It divides the original pattern into 1-dimensional rows, then compress two rows into one row by adding rules to specify parts where two rows are different. We keep doing this until we end up with only one row, then diplomat resolves this one row by using an optimal 1-dimensional compression algorithm. In both the original rule list and the compressed rule list, the earlier rule has a higher priority than the later rule. We make sure that the compressed rule list makes the same decision as the original rule list. The result is actually the compression ratio, which is the ratio between the number of rules before and after the compression. The result depends on the original rule list, and we may expand the one original rule to many rules to fix the prefix requirement.

VISUALIZATION OF SCIENTIFIC DATA
Peng Xu
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Computer Science and Engineering
Poster: 85
Mentor(s): Dirk Colbry (Institute for Cyber-Enabled Research (iCER))
The focus of my project is to research methods and software packages for visualizing scientific data and develop a program to automatically render three-dimensional data on a High Performance Computing System. I will present my results for using software called “Paraview.” Paraview is an open-source, multi-platform data analysis and visualization application, which is designed to analyze large scale datasets. Paraview users can quickly build visualizations to analyze their data and the data can be viewed interactively in 3D. The final result of my study is to automatically generate a 3D movie for the explosion of a simulated supernova while the simulation is running. Researchers developing the simulation code will use the movie to visually validate the simulation and give insight into research questions that cannot be gained from tables of data alone.

Electrical and Computer Engineering

Poster Presentations

REMOTELY FEEL A SWIMMING ROBOTIC FISH
Osama En-Nasr
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Electrical and Computer Engineering
Poster: 90
Mentor(s): Xiaobo Tan (Electrical and Computer Engineering)
Sometimes, when it is not desired to have an automated robot, the user might require a controller to navigate the robot and move it around. Having a simple controller (e.g., joystick) to achieve this task is an ideal solution. However, most traditional joysticks lack any sense of feedback to inform the user about any obstacles in front of the robot or the forces that are acting on it. The objective of this research is to create a device for the user to control a robotic fish, while getting feedback about the forces acting on the fish. The forces are then rendered on the user's side to be felt while navigating the robot. This summer a device was created to sense the acceleration of an object in order to calculate the forces acting on it. The device was able to sense acceleration on all 3 axes, and then send the data to be rendered as forces on the user's side. In the future, more features can be added to the device so that rotation can be rendered as well.

WIRELESS STRUCTURAL HEALTH MONITORING
Ryan Lattrel
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Electrical and Computer Engineering
Poster: 92
Mentor(s): Lalita Udpa (Electrical and Computer Engineering)
Wireless structural health monitoring aims to provide an efficient and effective method of determining the integrity and state of materials used in critical applications. This method of non-destructive evaluation is potentially cheaper, faster, and more versatile than conventional damage detection methods. Propagating energy such as electromagnetic or acoustic waves through these materials can reveal abnormalities, such as cracks and wear, in a manner very similar to biomedical images using ultrasound probes. A major challenge is to determine strategic locations for placing the wireless sensors that will enable accurate detection and locating of these defects. The waves can be produced via an actuating sensor system which controls when and where a signal pulse is generated. The goal of the health monitoring system is i) to detect an event such as impact damage on a structure, ii) determine the location of the damage and iii) characterize the extent of the damage in the structure. One approach for achieving this goal is to collect multiple sets of data from parts that are known to be in ideal condition, and also from parts where there is known damage in the material. Using these results, algorithms can be designed to determine when fatigue damage is developing in the structure and also predict important measures such as remaining useful life and time to failure of the part.

SYSTEM PLATFORM DESIGN FOR AUTONOMOUS ELECTROCHEMICAL GAS DETECTION MICROSYSTEM IN MINE SAFETY
Stephen Yanqing Li
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Electrical and Computer Engineering
Poster: 93
Mentor(s): Andrew Mason (Electrical and Computer Engineering)
Despite continued safety improvements and increased regulations, underground mines remain a very dangerous work environment. We propose to develop key sensor, instrumentation and data analysis technologies that will be integrated to form a miniaturized intelligent electrochemical gas analysis system (iEGAS). The autonomous iEGAS system will measure all gases linked to fires and explosions (CH4, CO, CO2, O2) as well as hazardous exhaust gases (NO, NO2, SO2). This system can be deployed with miners or at fixed locations within a mine for long-term monitoring without user input or training. It will utilize a standard interface to communicate with existing mine infrastructure or with wireless mine communication handsets to realize a highly distributed, mobile, multi-gas monitoring network. The system platform includes a MSP430 microcontroller, a rechargeable 3.7v Li-Polymer battery and charging circuit, External 1Mb Memory and a communication module. The programmed MSP430 microcontroller will control gas detection sensor array, collect data from the sensor and send it back to control center. The system will be integrated on a single PCB board to minimized size.

INVESTIGATION OF IPMC IN SENSING APPLICATION

ChaiYong Lim
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Electrical and Computer Engineering
Poster: 94
Mentor(s): Xiaobo Tan (Electrical and Computer Engineering)
Ionic Polymer-Metal Composite (IPMC) is a class of Electroactive polymers (EAPs), also known as artificial muscles, that are a class of smart materials that show strong coupling between the applied electric field and their mechanical strains. The latter property enables us to use these materials as excellent actuators and sensors. In this project, we are exploring the sensing capabilities of IPMC in various application, such as underwater acoustic and underwater localization. Moreover, we also fabricated a 2-D IPMC which will have two directional sensing capability.

BIOLOGICALLY INSPIRED STRUCTURES
Nicholas Miller
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Electrical and Computer Engineering
Poster: 95
Mentor(s): Shanker Balasubramaniam (Electrical and Computer Engineering)
In the electromagnetics and optics community, the analysis of wave propagation in intricate periodic structures called photonic crystals has become increasingly important. Photonic crystals are used in a number of contexts, ranging from filters and polarizers, to substrates for optical devices or the inhibition of spontaneous emission in atomic physics experiments. Computer simulations are extremely important as they provide a physical insight for these complex structures which lie outside the realm of engineering intuition. In the Computational Electromagnetics Laboratory, our work concerns the development of software that efficiently and accurately analyzes these structures. We are currently using these codes to study biomimetic structures, i.e., designs inspired by nature. Certain species of butterflies and beetles have been found to naturally create photonic crystals within their anatomy. In this presentation, I will focus on modeling the optical response of these elegant biological structures with highly complex geometries. One such geometry used for modeling is the gyroid (space group Ia3d). While gyroids do not naturally occur within the wings of butterflies, they have been found to elicit the same optical characteristics. The information generated from the simulation will include the resulting reflection and transmission of the electromagnetic waves, among various other data. With this data, the final goal is the optimization of reflection or transmission to achieve a desired response. I have employed several different tactics to reach the optimizations, including reshaping the geometry and manipulating the material constants.

TUNABLE PATCH ANTENNAS

Leon Voskov

Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM

Category: Electrical and Computer Engineering

Poster: 96

Mentor(s): Edward Rothwell (Electrical and Computer Engineering)

Advancements in antenna technology have opened up a new world of possibilities. The miniaturization of antennas has enabled the design of compact wireless devices such as phones, laptops, and tablets. New techniques need to be applied to antenna designs, however, in order to keep decreasing size while retaining functionality. This becomes difficult since antennas radiate properly at quarter to half wavelength. Changing the dimensions of the antenna can vary the resonant frequency which makes the device very flexible. This can be accomplished by using different physical structures and placing varying capacitances into the object therefore changing the impedance. A varactor is a component that changes its capacitance with change in the bias voltage and is very useful in the design of tunable antennas. The value of this capacitance and locations of the components completely changes the structure and moves the frequency of resonance in a desired direction. It's also possible to make the antenna smaller by increasing the effective permittivity. This is done by placing an additional structure inside the antenna. The difficulty with projects like this lies in creating the right structure and knowing where to place components inside that arrangement. Optimization methods need to be utilized to find solutions for an antenna which will meet desired specifications. My project includes finding the right layout of an antenna by varying physical aspects and the right location and value of components that will adjust the properties to our liking.

Mechanical Engineering

Poster Presentations

QUASI-THREE DIMENSIONAL QUASI-ISOTROPIC WOVEN COMPOSITES
Corey Anderson
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 100
Mentor(s): Dahsin Liu (Mechanical Engineering)
Modern composite materials are often used in applications that demand high specific stiffness, specific strength, and impact resistance. While composites have been used in these demanding roles quite successfully, a problem arises in that the properties of composite materials vary with the orientation of the composite. This is to say that a fiberglass composite stretched along the direction of its fibers will react differently than a fiberglass composite stretched perpendicular to the fiber direction. With the goal of reducing the anisotropy of current composite materials, a novel tri-axial, quasi-three-dimensional weave was developed. "Tri-axial" indicates that each woven layer contains fibers which follow axes that are sixty-degrees apart. Quasi-three-dimensional (Q3D) weaves are weaves in which fibers from every layer are woven such that they are intertwined with the layers situated directly above and below. This pattern is repeated through every fiber layer, resulting in a specimen that is both many layers thick, and a physically interwoven, single specimen. Using E-glass roving and SC-15 epoxy, composite specimens in unwoven, woven layered, and Q3D arrangements were created. Through dynamic testing, these three styles of composites will be compared to determine the weave's effects on the physical properties of the specimens. Finally, the experimental results will be compared with previous studies into the physical properties of bi-axial Q3D weaves. Using the information gathered, the strengths and weaknesses of the weave can be evaluated and considered for applications in industry.

CONTROL OF A QUADROTOR HELICOPTER WITH HAPTIC FEEDBACK
David Crouse
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 101
Mentor(s): Ranjan Mukherjee (Mechanical Engineering)
The remote control of physical systems is made inherently difficult by the lack of physical feedback. Haptic controllers attempt to remedy this shortcoming by generating forces to replicate the desired feedback. This project attempts to interface a haptic controller with a quadrotor helicopter. Distance sensors on the helicopter enable the control software to detect the distance to obstacles. Virtual buffer zones are constructed around these obstacles. When the helicopter enters one such zone, a virtual force is exerted on the helicopter. These virtual forces are physically replicated by the hand controller. The system is capable of making these force calculations whether the controller output is mapped to the position or the velocity of the helicopter. This system is expected to improve user piloting accuracy and reduce the number of crashes when operating in enclosed areas. The data obtained will be used to design an improved controller to enhance the user experience.

COUNTERFLOW BURNER AND LIMITING OXYGEN INDEX CALORIMETER FOR FLAME AND MATERIAL COMBUSTION STUDIES
Monica Derris
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 102
Mentor(s): Indrek Wichman (Mechanical Engineering)
Fire and combustion can be destructive, but also have many useful applications. Hence, it is important to understand flames and material combustion. A counterflow burner and a Limiting Oxygen Index (LOI) calorimeter are used to study the behavior of flames and the flammability of materials, respectively. Changes were made on the counterflow burner to improve the flame quality. Modifications will be made to the counterflow burner to include a pulsating spray droplet fuel injector. This will allow behaviors such as flame recovery to be examined. The LOI calorimeter will be established to measure the flammability of paper, plastics, and wood through mass flow measurement and a LabVIEW interface. An oxygen sensor will be added to measure the amount of heat given off during combustion. These experimental setups are simple, yet they offer a variety of ways to study flames and material combustion.

HYBRID POWERTRAIN SIMULATIONS USING TRUCKSIM
Peter Dolce
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 103
Mentor(s): Guoming Zhu (Mechanical Engineering)
Hybrid vehicles utilize complex control strategies to provide desired power with the best fuel economy. Simulink vehicle and powertrain models are used to accurately describe the vehicle system dynamics, and model-based control strategies can be developed and validated based upon the vehicle/powertrain model. For this project, the Trucksim vehicle model was used as a tool to obtain the vehicle model with the target hybrid powertrain system and used to simulate the driving behavior on a specific course to study the fuel economy benefits. Integrating the Simulink powertrain model into the Trucksim vehicle model allows us to study a wide range vehicle configurations and driving courses. The initial study will concentrate on the off-line simulations and the further simulations will involve real-time control on the MSU chassis dynamometer.

SUBJECT SPECIFIC COMPUTATIONAL MODELING OF THE FOOT-ANKLE COMPLEX
Kathleen Fitzsimons
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 104
Mentor(s): Jerrod Braman, Roger Haut and Feng Wei (Mechanical Engineering)
Syndesmotic sprains are thought to occur from an external rotation mechanism and may involve substantial damage to the anterior and posterior tibiofibular ligaments and the interosseus ligament. Syndesmotic injury is less common than inversion injuries to the lateral ligaments, but requires longer recovery periods. Studies of force and strain in ligaments have been performed using buckle transducers and strain gauges. However, the accuracy of the gauges at failure strain levels was unreliable. In order to approximate ligament strains at or near failure levels, a multibody rigid computational modeling approach was used. Computerized Tomography (CT) scans of six cadaver ankles were used with Materialise's Interactive Medical Imaging Control System (MIMICS 14.1) to create 3-dimensional surface models of each bone from each specimen and import them into SolidWorks. Twenty Ligaments were represented as linear springs with stiffnesses from the literature. The tibia was fixed in space, while the remaining bones could move freely, leaving motions dependent on geometry of bones, 3-D contact conditions, and ligament behavior. In a previous experiment, external rotation was applied to six cadaver feet until gross ligamentous injuries were diagnosed. Talus motion relative to the tibia was determined using a Vicon motion capture system that tracked marker sets placed on the talus and tibia based on an established joint coordinate system for the ankle. This data was used in the model to determine ligament stains. These models could be used to represent the physical constraints of shoes and orthotic devices to evaluate their effectiveness in preventing ligamentous injuries.

CHARACTERIZATION OF RESIN TRANSFER MOLDED AGY S-GLASS FIBER REINFORCED SC-15 RESIN COMPOSITES
Scott Hall
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 105
Mentor(s): Alfred Loos (Mechanical Engineering)
When a new material is developed, it is important to characterize its various properties before it can be fully implemented. Studying the various strengths and loads gathered from testing, as well as the actual mode of failure in the material, lends insight both toward how the material will perform and ways to improve it further. Composite materials offer a light-but-strong alternative to steels or other metals. The material investigated was developed with the intention of being used in light weight, high strength applications. It is formed using a technique called resin transfer molding. Resin transfer molding utilizes pressurized air to force resin through the dry fibers, which is then allowed to cure under increased pressure and temperature. The characterization performed included four different material property tests, each investigating a different material property. Tensile, compression, flexural, and shear tests were all conducted. This data can be compared to similar composite materials, as well as metals or other materials, to compare both strengths and strength-to-weight ratios. This study only characterizes this particular material, but applications stemming from analysis of both the results and the test specimens themselves include ways to improve manufacturing of both this specific material and other composite materials manufactured through resin transfer molding.

THE MEASURE AND MODELING OF RIFT PROPAGATION IN THE FIMBUL AND ROSS ICE SHELVES, ANTARCTICA
Scott Hall
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 106
Mentor(s): Jeremy Bassis (Atmospheric, Oceanic, and Space Sciences)
Glaciology is a scientific field that has come into the spotlight in recent years due to the increasing concern over the consequences of global warming. Understanding how the ice moves and how cracks propagate through the ice and form icebergs is important to understanding how the climate of our planet is changing. Surprisingly, much of the actual mechanics of rift propagation are unknown. To help study this, two rift systems, one in the Fimbul Ice Shelf and one in the Ross Ice Shelf, were measured over a period of 10 years. The measurement was done remotely by using images collected from the Moderate Resolution Imaging Radio-spectrometer (MODIS) on NASA's Terra and Aqua satellites, in orbit around Earth. The rifts were measured in pixels, then converted to meters. This data was collected for the entire 10 year period and trends were investigated. Along with the measurement of these rifts, a finite element analysis computer program was developed in MATLAB to model the stress and strain in an entire ice shelf. With this, further insight should be provided into possible causes of rift propagation. Being able to study the stress and strain across an entire ice shelf can help to understand the forces involved in a moving rift.

DYNAMICALLY LOADED BOLTED JOINTS
Nick Lannes
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 107
Mentor(s): Srinivasan Tekalur (Mechanical Engineering)
The objective of this project is to explore the strength of dynamically loaded bolted joints of dissimilar materials. There are a multitude of journal papers that can be found on bolted joints, however, when you delve into the dynamic realm, the selection significantly decreases. And in the subcategory of dynamic testing, when it comes to the materials being tested in this project, aluminum to composite, the selection is nonexistent. In this experiment, a drop tower impact machine was used to dynamically load bolted joints of dissimilar materials. The tests were conducted from low to high velocity, keeping ratios of l/d, w/d, and d/t constant, while varying the e/d looking for the asymptotic value where there was a concrete change in failure mode. The strength and failure properties of the bolted joints were sought after, including the failure loads, failure modes, and energy transfer into the specimen. A further understanding of the mechanical properties of low and high rate impacted dissimilar material bolted joints will be of use to many industries and help to further advance both safety and weight conservation of any structure needing to connect the two dissimilar materials using a bolting technique.

DESIGN AND PROCESSING OF ADVANCED MATERIALS FOR PERSPIRABLE SKIN
Matthew Lempke
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 108
Mentor(s): Patrick Kwon (Mechanical Engineering)
Due to the extreme heating of the surface of space shuttles upon reentry, a Thermal Protection System (TPS) is needed for the safety of the vessel and crew. A TPS utilizing designed ceramic matrix composite structures attributed with complex functional gradiencies and a self-cooling capability is the proposed solution. This self-cooling capability is simply a skin-like structure that, once heated, produces a passage in the skin, much like the human body does during perspiration. Currently, using various ceramic powders with various Coefficients of Thermal Expansion (CTE), we are manipulating the global CTE of our designed structures in order to produce a deforming action, open up a gap in this perspirable skin, and allow cooling gasses on board the vessel to be forced over its surface. Several deforming actions are currently being considered, including a hinged rotation action and a buckling action. All proposed designs are first validated by Finite Element Analysis using COMSOL, and then produced, barring any processing issues. Prior research has shown that a design solely utilizing variable CTE differentials provides a passage much too small for cooling purposes, with a maximum passage about 100 micrometers wide. The team is also researching various processing techniques, including triaxial compression and hot isostatic pressing, to produce green compacts, in order to reduce the number of sample failures during the sintering process. Our current goal is to have a working structure by summer's end.

WIND TURBINE VIBRATION
Evan McCune
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 109
Mentor(s): Brian Feeny (Mechanical Engineering)
Over the past several decades, wind power has become an increasingly large source of energy in the United States. The wind industry is on the rise, but faces many challenges moving forward. For example, large wind turbine blades will experience vibration and oscillation while rotating, causing adverse effects. Not only do these vibrations decrease the efficiency of the turbine, but apply stress and strain on the blades, decreasing their lifetime. In addition, vibrations within the turbine itself cause a loud humming sound to escape the turbine, making wind farms unpopular near residential areas. If the true potential of wind power is to be realized, these obstacles must be overcome. This study aims to further explore ways in which we may achieve that goal. Using a small, home style wind turbine, vibration both on the blades and within the hub are to be measured. These results will shed some light on the behavior of these vibrations under various conditions.

CLASSIFICATION OF GAUSSIAN-MARKOV RANDOM FIELDS USING CLASS OBSERVATIONS
Justin Mrkva
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 110
Mentor(s): Jongeun Choi (Mechanical Engineering)
This work explores a unique method for the computational classification of two-dimensional Gaussian-Markov random fields based on two class observations. The output of the algorithm is the probability of a class observation for a given location on an occupancy grid. Additionally, the prediction error variance at each grid point is utilized to provide input for navigation algorithms to choose an optimized search path to produce the best results with the least distance traveled. The computational feasibility of this approach is evaluated using simulated and real-world data sets.

OPTIMIZATION OF A SMALL-SCALE ENGINE USING PLASMA-ENHANCED IGNITION
Adam Sajdak
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 111
Mentor(s): Tonghun Lee (Mechanical Engineering)
This project investigates the effects of plasma ignition systems in small four-stroke internal combustion engines. Combining electromagnetic radiation with combustion can create faster and more intense combustion, greater stability in lean flammability limits, reduction of toxic emissions, improved fuel efficiency, and more reliable and rapid ignition and fuel reformation. This investigation required the construction of a new test rig at Michigan State University's Energy and Automotive Research Laboratory to measure torque, power, fuel consumption, emissions, ignition timing, and in-cylinder pressure for a Fuji Imvac BF-34EI engine. Flexible plasma discharge systems for various degrees of non-equilibrium discharges are being developed. Efforts are being made to optimize the engine with the plasma ignition systems both for maximum power and fuel economy. The results of this project will provide greater knowledge about plasma ignition systems, which will aid progress toward the miniaturization of combustion systems for Unmanned Aerial Systems, reduction in harmful byproducts, expansion of a single fuel policy in the Department of Defense, and greater flame stabilization for scramjet applications.

MECHANICAL PROPERTIES OF COMPOSITE MATERIALS
Corey Silvis
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 112
Mentor(s): Andrew Conway and Xinran Xiao (Mechanical Engineering)
The field of composite materials is large and has many possibilities, but has remained largely unexplored due to their relative complexity compared to metals and ceramics. This research involves the determination of the mechanical properties of glass fiber composites to be put to use by the United States Army through tensile, impact and mixed mode bending testing. The composite consists of sheets of woven glass fibers, held together by a resin known as SC-15. Panels are made using vacuum assisted resin transfusion molding (VARTM), with the number of sheets varying depending on the testing being done. The idea behind this research is to determine the viability of using glass fiber composites to protect military vehicles and their holdings safe from harm, while still being fairly light in weight. This can be somewhat quantified by determining such mechanical properties as Young's Modulus, Poisson's ratio and ultimate tensile strength. These properties are needed so that simulations

can be done to analyze the performance of composites under various loading conditions. A good balance between weight and those properties will have to be found so that this research can be put to good use, as a slow and incredibly strong vehicle may not be as useful and a weaker, but faster vehicle. Overall, it is expected that this research will yield results that would give the Army many good options for their armored vehicles.

TIME DEPENDENT PARAMETERIZATION OF PATIENT SPECIFIC ABDOMINAL AORTIC ANEURYSMS
Paul Snyder
Location: 1st Floor Bessey Hall, 9:00 AM - 11:00 AM
Category: Mechanical Engineering
Poster: 113
Mentor(s): Seungik Baek (Mechanical Engineering)
Cardiovascular disease remains the leading cause of death in the United States with abdominal aortic aneurysms ranking thirteenth. Abdominal aortic aneurysm (AAA) is the progressive local weakening of the abdominal aortic arterial wall that causes the vessel to dilate. Current clinical practice is to perform elective repair surgery if the maximum diameter of the vessel exceeds 5.0 cm. However 23% of small aneurysms (<5.0 cm) still rupture, an occurrence that is associated with a 85-95% mortality rate. Because elective surgery carries a mortality rate up to 6% a better method is needed to determine which small AAA patients should consider surgery. The focus of this research is to explore the local expansion of the vessel over several points in time to better understand where expansion is most critical and what parameters it is associated with. Mimics software was used to extract point cloud information about the inner surface of the lumen and the centerline from 3D CT images. MATLAB was used to fit a fourth order base function approximation X(s) of the centerline and obtain unit tangent vectors at each longitudinal distance s along the centerline. Perpendicular cross sections were taken at each tangent vector along X(s) and the radius r was parametrically graphed as a function of s and $\hat{I}_{,}$ then fit using another base function approximation. Statistical analysis was performed on the different parameters in the r(s, $\hat{I}_{,}$) function to determine which parameters correlated to increased rate of expansion.

Natural Science and Engineering

Oral Presentations

CONVERGENCE OF MODIFIED FIBONACCI POLYNOMIALS
Thiago Szymanski
Location: 313 Bessey Hall, 9:00 AM
Category: Natural Science and Engineering
Mentor(s): Aklilu Zeleke (Statistics)
Mathematicians have studied the Fibonacci sequence and Fibonacci polynomials for multiple centuries, but have yet to unveil all of their mysteries. Although experts have discovered many different properties, endless possibilities of changes to the original function could potentially result in an infinite amount of different results. A modification as simple as multiplying the original sequence by x affects the overall properties of the original Fibonacci Polynomials. This paper analyzes different characteristics of the new produced function, but most importantly the convergence of the function's maximum root. Three different characteristics will be focused on for this paper, the initial conditions, a leading coefficient of xk, as well as creating a Tribonacci Polynomial by adding an additional initial condition. By using an arbitrary constant a to denote all integers, the initial conditions of F0=a, F1=x+a result in a maximum root of f_n=((-a+1)^2-1)/((-a+1)), ∀a≤0. By adding a leading coefficient of xk such that G_n=x^k [F_n],where k denotes any real number and Fn is the original Fibonacci Polynomial sequence, results in a monotonic increase in the maximum root to the golden ratio. Even though the Tribonacci sequence has not yet been explored, similar characteristics and trends are expected to be found as well as a connection between the maximum root of the golden ratio with the original sequence.

CANTOR SET VS TENT MAP
Kelly Montgomery
Location: 313 Bessey Hall, 9:15 AM
Category: Natural Science and Engineering
Mentor(s): Aklilu Zeleke (Mathematics)
My research involves relating two ideas in mathematics, The Cantor Set that was coined by Georg Ludwig Phillip Cantor in 1883 and the dynamics of the Tent Map. The various iterations of the Tent Map at each stage duplicate the removed open intervals of the Cantor Set at each of the Cantors Set's corresponding iterations. My job requires altering the Tent Map's dynamical system and applying function iterations within the given boundaries. The question proposed is, will other Cantor like, or other more intriguing fractal shapes arise because of the alterations that will be done on the Tent Map's piecewise function? If so, I will examine the fractal dimension of the new fractal structures and compare them to the fractal dimension of the original Cantor Set. I will examine the similarities as well as the differences between the two, and explore the benefits of the creation of the new sets.

DETERMINING THE IMPACT PARAMETER AND CROSS SECTION OF LOW DENSITY, HEAVY ION COLLISIONS
Andira Ramos – Florida International University
Location: 313 Bessey Hall, 9:30 AM
Category: Natural Science and Engineering
Mentor(s): William Lynch (Physics and Astronomy)
Nuclear physics looks to explain and predict the behavior and properties of nuclei. Years of study have led us to have a basic understanding of every day matter at the nuclear level. However, in high and low density cases nuclear matter behavior is still not predictable or completely understood. In order to predict the behavior and properties of these extreme cases, an equation of state needs to be obtained. An Equation of State (EOS) is an expression that shows the relationship between pressure, energy, temperature, density and volume, the ideal gas law being an example. In the nuclear scale, the binding energy expression for any given nucleus is the EOS. The Liquid-Drop model gives us the following binding energy expression: Eb = ...-(asym)[(N-Z)^(2)/A] For normal density matter, Ï□o, the symmetry constant, asym, is known [3] but it is not for the extreme cases of low and high density. The ultimate goal of this experiment is to find the asymmetry energy constant that will complete the EOS given by the Liquid-Drop model for cases that depart from the regular density. Finding this constant will enable us to determine the binding energy of any nucleus, which in turn would allow us to predict the size of the nucleus. In a larger scale, it can help us know the exact radius, thickness of the crust and other important parameters of Neutron stars [5] - very dense stars with a neutron abundance - which can be considered an example of high density nuclei [2].

DOCUMENT COMPARISON AND REAL TIME COLLABORATIVE EDITOR
Tina Isaac
Location: 313 Bessey Hall, 9:45 AM
Category: Natural Science and Engineering
Mentor(s): Eric Torng (Computer Science and Engineering)
In today's time, it is very easy for an individual to take one's work and make it his or her own. People manipulate the copied work in little ways with hopes of not getting caught, commonly known as plagiarism. However, scientists are working with computer programs and algorithms that will be able to detect even the most cleverly disguised pieces of copied work. Finding two documents, programs, or sources that appear to be similar does not serve as sufficient evidence of plagiarism. Instead algorithms are created that run the document through analyzers and are converted to token sequences to find similarities. A strong, powerful program is GPlag, which works with both document text and program source code. This program can find the common and sneaky disguises. It can turn the code into strings, tokens, and sub trees. By using components of this program and integrating time into the equation, a document comparison algorithm can be created. Having time play a factor during document comparison would be very helpful because now scientists can keep track of the individual's work. Scientists are now able to keep track of the writer's progress. A project like this requires a lot of time, effort, and planning. The student was given a time frame of ten weeks to conduct this research, which is not sufficient time for physically conducting an experiment and coming up with results.

SOLAR-POWERED CONNECT-ON-DEMAND SATELLITE-RADIO LINK FOR TANZANIAN SCHOOLS
Josephine Kilde – University of Wisconsin
Location: 313 Bessey Hall, 10:00 AM
Category: Natural Science and Engineering
Mentor(s): Erik Goodman (Electrical and Computer Engineering)
In rural Africa, MSU has a small network of three schools in Tanzania sharing an Internet connection. The Internet networking equipment is centrally located at one of the schools, called the host school, which subsequently routes the Internet connection to other schools, called remote schools, via WiFi and WiMAX. Electricity is non-existent to most areas and where it exists, it is not dependable, therefore solar panels are used to power the host network. As a result the power usage of the networking equipment has to be configured to allow the expansion of the network and allow Internet access in the evening, when the source of solar power (the sun) is no longer available. A system has been developed that powers on networking equipment when an end user is attempting to access a website. When the Internet connection is idle, the equipment is turned off. The networking equipment can be turned on and off from schools up to 5 miles away through the use of a low power FM radio. This system has been tested to ensure it is power efficient and requires little to no user interaction. This system allows for adding other schools to the network without a significant increase of the solar power demand, and students will have more access to the Internet, in terms of the time of day.

DOCUMENT COMPARISON AND REAL-TIME COLLABORATIVE EDITORS
James Estell
Location: 313 Bessey Hall, 10:45 AM
Category: Natural Science and Engineering
Mentor(s): Eric Torng (Computer Science and Engineering)
Plagiarism is a pervasive issue across all fields. There are currently several programs that are very adept at recognizing plagiarism, such as JPlag, TurnItIn, and MOSS. Many of them utilize some innovative techniques such as the Kolmogorov complexity and lexical analysis. The Kolmogorov complexity measures the amount of absolute information a sequence string contains. Lexical analysis, which is mainly used when reviewing computer programs, is a function that compresses a statement or string of characters into a series of tokens. A token is a string of characters that are labeled by their token types. Recently software developers have created Real-Time Collaborative Editing (RTCE) programs, such as the EtherPad, which allow multiple users to edit or view documents at the same time, while also keeping track of when and who made each alteration. This is extremely beneficial for educational purposes because it allows students to work together either with other students or with the instructor on a project, but anytime the ease of knowledge sharing and collaboration increases, there is always an increase in the risk of intellectual property theft. We will be determining whether to slightly alter currently used techniques or if we have to completely engineer a new program. We believe that the combination of RTCE software and the software we are developing we will be able to revolutionize plagiarism detection.

CHARACTERIZATION OF VORTICAL PATTERNS IN THE WAKE OF AN AIRFOIL

Stephen Jones

Location: 313 Bessey Hall, 11:00 AM

Category: Natural Science and Engineering

Mentor(s): Bruno Monnier (Mechanical Engineering)

The research is to characterize vortices as they pass a NACA 0012 airfoil suspended in a water tank. The purpose of such research is to possibly improve flight patterns of Micro Air Vehicles (MAVs) and ostensibly to larger-scale aircraft. We have captured visual images with a frame-by-frame camera of hydrogen bubbles created using hydrolysis of water molecules as they pass over the NACA 0012 airfoil as they produce visible vortices. We hope to distinguish a discernible pattern in the vortex characteristics under various parameters to reflect real-world scenarios.

Social Sciences

Oral Presentations

EXAMINING THE EFFECTS OF PAST DISCRIMINATION ON JOB SEARCHING BEHAVIORS AMONG ARABS
Abdifatah Ali – San Diego State
Location: 316 Bessey Hall, 9:00 AM
Category: Social Sciences
Mentor(s): Ann Marie Ryan (Psychology)
My summer research project will be examining how prospective employees manage the job search process. Of particular interest to this project is the extent to which belonging to a minority group, mainly Arab-American or Arab-immigrants, affects the likelihood of attaining employment. We contend that perceived discrimination will play a significant role in the job search process, such that those individuals who report higher experiences of discrimination will be less confident in their ability to find a job. We will further examine several factors that could potentially moderate the relationship between perceived discrimination and job search behaviors. Data collection will happen through a non-profit organization that caters to a large Arab population among other ethnicities. Independent sample t-test, correlations, and hierarchical linear regression will be used to analyze our data. If our hypotheses are supported, we would be contributing to the literature in a unique way because these relationships have not been investigated with an Arab population. Furthermore, these findings can be of benefit to organizations, employment and training agencies who can create seminars/workshops that address ways to reduce the detrimental effects of perceived discrimination on job search behavior.

WAS IT GENOCIDE: EXAMINING STATE SANCTIONED VIOLENCE IN THE DEMOCRATIC REPUBLIC OF CONGO 1996-7
Etienne Mashuli – North Central College
Location: 316 Bessey Hall, 9:15 AM
Category: Social Sciences
Mentor(s): Rita Edozie (James Madison College)
In the aftermath of the 1994 Rwandan genocide, about 2 million Rwandan Hutus fled to the Democratic Republic of Congo (DRC). Two years later, in November 1996, Rwanda (and its allies) invaded the DRC amid reports that their army was directly targeting members of the Hutu ethnic group for possible extermination (Emizet Kisangani 2000, Beatrice Umutesi 2004, Filip Reytjens 2009, and Rene Lemarchand 2009). Despite journalistic and Human Rights sources decrying the violence as genocide, the conflict remains largely understudied (Scott Campbell 1997). As a result, many questions pertaining to the conflict are yet to gain adequate appreciation. My research is the first scholarly attempt to address questions of genocide while employing the DRC as a case study. On broad level, I address two main questions, namely: Do states use their militaries to commit transnational genocide? And, when does state violence amount to genocide? I use the 1948 Geneva Convention definition of genocide as articulated by Raphael Lemkin. However, for the narrow scope of my research, genocide is defined only as "any acts committed with the intent to destroy, in whole or in part, a national, ethnical, racial or religious group" (Songolo 2005:111). The conclusions to emerge show that states, and in this particular case Rwanda, can use their militaries to advance a policy of genocide when the conflict at hand is ethnic in nature. Similarly, state violence becomes genocide and hence illegitimate when unarmed members of a certain group are singled out for elimination.

SUPERMARKET INVESTMENT IN URBAN FOOD DESERTS: SUSTAINABLE ENTRY
Marie Steele – University of Maryland-Baltimore
Location: 316 Bessey Hall, 9:30 AM
Category: Social Sciences
Mentor(s): Dave Weatherspoon (Agricultural, Food, and Resource Economics)
A food desert is an area with insufficient access to healthy foods. A usual characteristic of food deserts is few small grocers and no full-service supermarkets, so a significant change is needed in the retail landscape in the food scene. Given the severity of this problem, there is little to no data available to study the nature of supply and demand for healthy and affordable foods. There is a plethora of reasons why supermarket chains are reluctant to locate in food deserts. Using game theory, this study seeks to evaluate the supermarket decision making process as well as determine the likelihood of profit in a food desert. This evaluation will be through a two stage game, with the first stage being an entry or no entry game and the second stage being a price competition game.

CHILDREN'S TEMPERAMENT TRAITS: EXPRESSION ACROSS FAMILIAR AND UNFAMILIAR CONTEXTS
Nancy Nneka Nwaifejokwu – Winston-Salem State
Location: 316 Bessey Hall, 9:45 AM
Category: Social Sciences
Mentor(s): Catherine Durbin (Psychology)
Child temperament traits have been linked to risk for different forms of psychopathology. However, this research has been limited by the use of parent questionnaires to measure child temperament, which have been shown to be subject to bias. An important alternative to questionnaires is observational measures of temperament. In this study, I compared two observational measures of child temperament: 1) scheduled, laboratory tasks designed to elicit different emotional reactions; 2) parent-child interaction tasks. 135 aged 3 to 6 years old children completed both, which measured the following traits: Positive Emotionality (positive mood and sociability), Negative Emotionality (fear, sadness, anger, activity level, impulsivity, initiative and compliance). The same traits were measured in both observational contexts. In the first, children interacted with an unfamiliar female experimenter, and in the second, with their mother and father. Traits were coded from videotape by trained raters. We conducted correlation analysis to quantify how individual differences in these traits were related across the two contexts. We expected correlations to be moderate in size and average. Next, we conducted paired t-test to test whether children differed in their mean level of each trait within the two contexts. We expect ratings of sociability and initiative to be higher in the parent-child interaction than in the unfamiliar context, while rates of compliance and negative emotionality would be higher in the unfamiliar context.

THE CULTURAL ADAPTATION OF YOUNG ADULT BURUNDIAN REFUGEES IN MICHIGAN
Dialika Sall – Pomona College
Location: 316 Bessey Hall, 10:00 AM
Category: Social Sciences
Mentor(s): Stephanie Nawyn (Sociology)
The fabric of American society is becoming increasingly multicultural so that 11.1% of the population is foreign-born and one in five children is born to immigrants (Portes and Rumbaut, xvi). While many believe that the success of an ethnic group in the United States lies in the immigrant adults' success, it is the successful incorporation of the children born to immigrants, be they immigrants themselves or second-generation immigrants, which will considerably determine the groups' future economic, political, and social success in the U.S. In an effort to illuminate the adaptation experiences of the children of African immigrants, we will conduct focus groups with the children of Burundian refugees recently settled in Lansing, Michigan and Grand Rapids, Michigan. Specifically, we will talk to the 1.5 generation defined by Ruben Rumbaut as "contemporary immigrant children who have arrived in the United States before they reach adulthood" (Zhou, 65). These 1.5 generation Burundian immigrants are expected to express difficulties navigating the liminal space they occupy in which they are neither young enough to primarily identify culturally as American nor old enough to resist a considerable American influence on their identity. In looking at the adaptation experiences of this population, policies and programs can be put into place that effectively help Burundians and other African-born immigrant groups garner the social and economic capital necessary for success in the United States.

RELATIONSHIP SATISFACTION AMONG PREGNANT BATTERED WOMEN
Maritza Soto – Florida AM University
Location: 316 Bessey Hall, 10:45 AM
Category: Social Sciences
Mentor(s): Alytia Levendosky (Psychology)
About 30% of the dating partners who have experienced violence in the relationship interpret the violence as an act of love (Cate et al., 1982; Henton et. al., 1983; Roscoe & Benaske, 1985). Social learning theory (Bandura, 1977) and attachment theory (Bowlby, 1969) can explain how negative early experiences may increase women's vulnerability to partner violence. Prior researchers found that battered women who reported greater levels of psychological violence reported lower satisfaction and commitment in their relationships (Rhatigan and Axsom, 2006). However, presence of violence alone does not significantly decrease satisfaction and commitment levels (Rhatigan and Street, 2005). Research aims: Does relationship satisfaction differ between battered pregnant women and non-battered pregnant women? What factors predict relationship satisfaction among pregnant battered women? Is relationship satisfaction in battered women related to their mental health? The sample consisted of 122 battered and 84 non-battered women. 61% identified themselves as Caucasian and 28% African American. Measures included Severity of Violence Against Women Scale (Marshall, 1992), Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh 1961), Self Esteem Scale (Rosenberg, 1965), the Brief Symptom Inventory-Anxiety Scale (Derogatis & Melisaratos, 1983), and the Dyadic Adjustment scale (Spanier, 1976). The inclusion criteria included: pregnant women in their last trimester, age between 18-40, and had an intimate relationship for at least 6 weeks during the pregnancy. Participants were paid $50 for their participation. I anticipate finding that battered women with high relationship satisfaction will be associated mental health.

EVALUATION OF FACEBOOK AND TRADITIONAL CAMPAIGN CHANNELS FOR CAMPUS CHALLENGE ORGAN DONATION CAMPAIGN

Rebecca Gidley

Location: 316 Bessey Hall, 11:00 AM

Category: Social Sciences

Mentor(s): Sandi Smith (Communication)

To improve Michigan's ranking as the state with the second lowest percentage of residents signed up as organ donors, the Campus Challenge campaign was used to increase organ donation registration among students ages 18-24 through competition among 19 colleges and universities in Michigan. Due to the impact of social media on this age group, Facebook ads and fan pages targeting students were used in addition to an existing yearly campaign through the Gift of Life Michigan which uses traditional print materials for the Campus Challenge. Facebook ads, Facebook fan pages, and traditional campaign materials all directed students to a unique URL for their school where they could sign the registry and score a point for their school. To evaluate the campaign, it is important to learn about the different ways students visited the State of Michigan Organ Donor Web Registry sign-up page for their school. To estimate which route had a bigger impact on drawing students to the sign up page we will use Google Analytics data to compare daily means of direct visits to the sites (meaning students typed the address into their search bar, presumably from seeing print material), against those who came to the site through Facebook. We will then compare the mean daily direct and Facebook visits for each of the 19 schools. To understand variation in the number of direct visits we will examine activity logs showing what promotional activities were used on each campus.

THE EFFECTIVENESS OF AVIDA-ED

Alphonzo Kilgo – North Carolina A & T University

Location: 316 Bessey Hall, 11:15 AM

Category: Social Sciences

Mentor(s): Louise Mead (BEACON Center for the Study of Evolution in Action)

Thanks to a recently developing technology at Michigan State called Avida-Ed, there may be a solution to the problem of students learning evolutionary concepts. Avida-Ed is a computational biology program that allows users to view digital evolution. The nature of the program gives users they feel like they are playing a game, but learning at the same time. Given this technology I will develop exercises that shows how Founders Effect occurs and teach it to volunteer participants to help them gain a better understanding. My projected population is students that are having trouble in their classes and having a hard time understanding the material they are given.

CLINICIAN PERCEPTIONS OF RACE AND GENETICS IN THE DIAGNOSIS AND TREATMENT OF HYPERTENSION

Tich Jones – University of Arizona

Location: 316 Bessey Hall, 11:30 AM

Category: Social Sciences

Mentor(s): Linda Hunt (Anthropology)

Our research was an exploratory study examining clinicians' concepts of racial difference in the management of hypertension. We performed qualitative content analysis on interview data from a group of 58 Michigan clinicians, to examine the range of beliefs they held regarding the role of genetics in racial difference in the prevalence, diagnosis and treatment of hypertension. We then systematically converted naturalistic categories based on the clinician responses into quantitative variables using the statistical software SPSS. These variables were then analyzed for possible relationships with clinician and practice demographic data, in order to find patterns which could guide future research.

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Guoming Zhu, *Mechanical Engineering*

Index