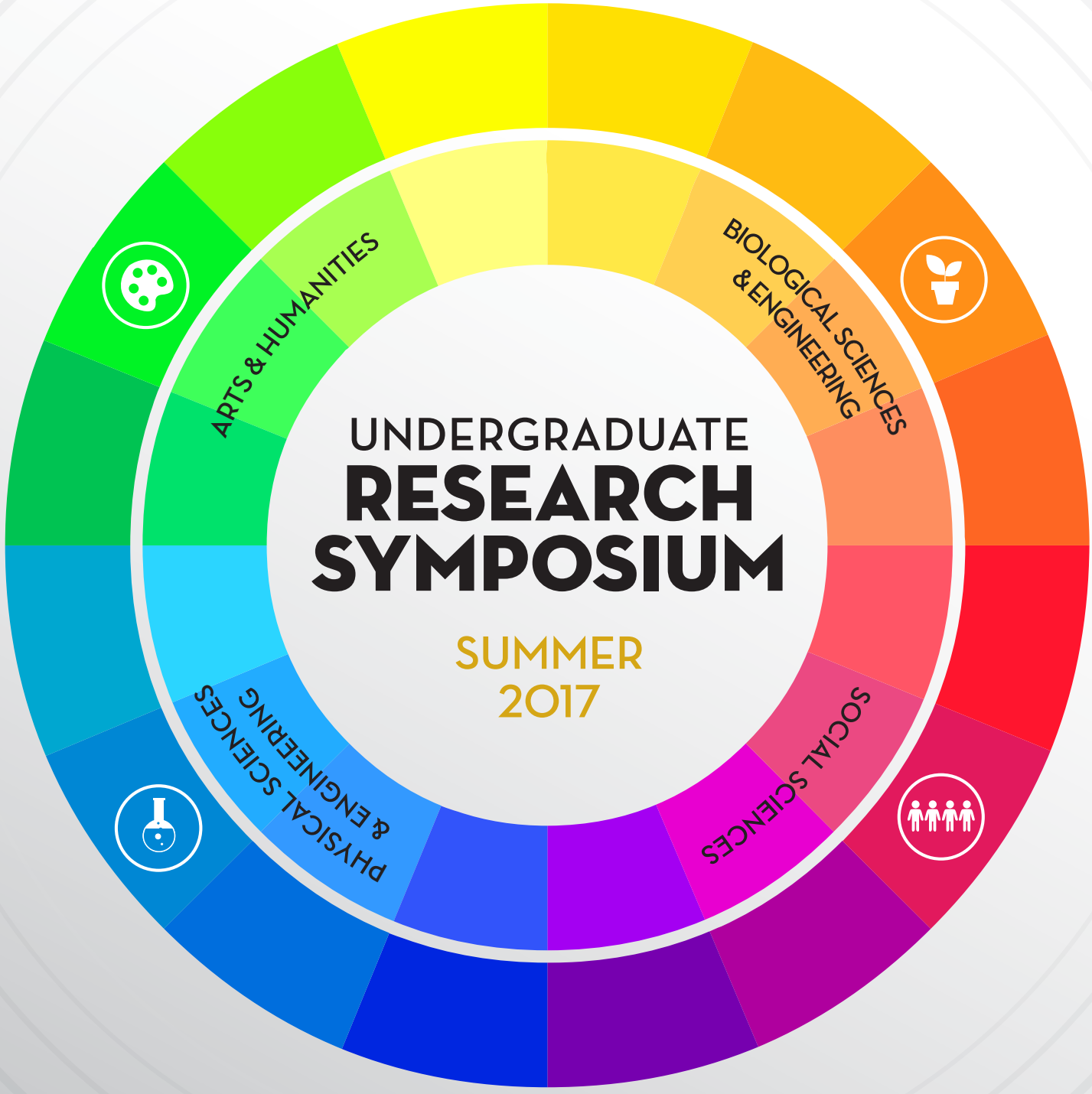


UNDERGRADUATE RESEARCH SYMPOSIUM

SUMMER 2017

FRIDAY

JULY 28, 2017

GRIFFIS HALL

MISSISSIPPI STATE UNIVERSITY

JUDY AND BOBBY SHACKOULS HONORS COLLEGE

MISSISSIPPI STATE UNIVERSITY™
JUDY AND BOBBY SHACKOULS
HONORS COLLEGE

WELCOME

The Shackouls Honors College is pleased to sponsor the spring 2017 Mississippi State University Undergraduate Research Symposium. Prizes for academic areas are being partially supported by Phi Kappa Phi. The Shackouls Honors College has provided summer research support to some of the students presenting with additional funding from the Mississippi State University Office of Research and The National Strategic Planning & Analysis Research Center (nSPARC). Other students are being supported by the National Science Foundation and the National Institutes of Health.

We view the encouragement and support of undergraduate research for all students to be part of our core mission. Just as a good liberal education broadens the mind, provides students with a common core of knowledge, and familiarizes them with the basic methodologies of the various academic disciplines, undergraduate research allows students to dive deeply into important ideas and topics in a rigorous and creative way, paving the way for future intellectual work and exploration whether in the academy, business, or other life arena. Enjoy the student posters and presentations and come away knowing more than when you entered our doors.

Dr. Seth F. Oppenheimer
Professor of Mathematics
Director of Undergraduate Research
Shackouls Honors College

MISSISSIPPI STATE UNIVERSITY™

Mississippi State University: Our State's Land-Grant Research Flagship

We are honored to welcome you to Mississippi State University's 2017 Undergraduate Research Symposium. Undergraduate students are an integral part of the multi-faceted research underway at Mississippi State.

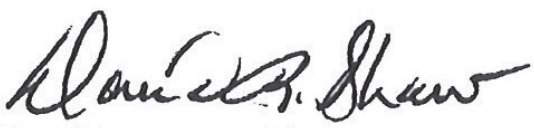
Every day, our faculty, staff, and students are conducting fundamental to applied research that provide innovative solutions, creative works, and new scholarship that address pressing local, state, regional, national, and global needs.

As a result of this work, MSU is the flagship institution in our state for research that falls within its land-grant mission. Strengths across all colleges and research centers have led to our institution being categorized by the Carnegie Foundation as a "high research activity" institution. The Carnegie Foundation has also recognized Mississippi State with its Community Engagement Classification.

Pursuing research opportunities is a critical part of academic life on our campus, and our students are recognized for their commitment to discovery, creation, and exploration in our labs, studios, library, research farms, and beyond. We are pleased that members of our faculty are committed to providing undergraduates with meaningful roles in the overall research enterprise, and promoting interdisciplinary research as an important component of scholarly activity.

Undergraduate research gives our students opportunities to apply classroom knowledge to new areas of interest, and helps them develop skills, collaborate with faculty and peers, and gain confidence. It is exciting to see the results of their efforts on display at today's symposium.

Again, welcome to the symposium, and thank you for your contributions to and interest in research at Mississippi State University.



David R. Shaw, Ph.D.
Vice President for Research and Economic Development

THE HONOR SOCIETY OF
PHI KAPPA PHI

The Honor Society of Phi Kappa Phi (PKP) has a long and distinguished history. Currently, there are over 300 chapters of PKP scattered all across the world, from Maine to Hawaii and the Philippines, and from Alaska to Puerto Rico and beyond. During the 1996-97 academic year, PKP celebrated the 100th anniversary of the founding of The Honor Society of Phi Kappa Phi, and we are now in the second century of its recognition of - and service to - learning. The MSU chapter is in its 66th year of membership. Due to PKP's prestigious recognition and support of learning, the MSU Chapter is proud to also financially support the Summer 2017 Undergraduate Research Symposium in Griffis Hall at Mississippi State University. As President, I am honored that Phi Kappa Phi has been asked and is able to support this event as I have tremendous respect for undergraduate research at MSU. This symposium displays that research at its best!

Thanks,

Dr. Jessica Tegt, President

Spring 2017 Undergraduate

Research Symposium

Event Schedule

Poster Session

Griffis Hall (1st and 3rd Floors)

1:00 pm - 3:30 pm

3:45 pm: Award Ceremony

Griffis Hall (4th Floor, Forum, Room C401)

Moderator: Dr. Seth F. Oppenheimer

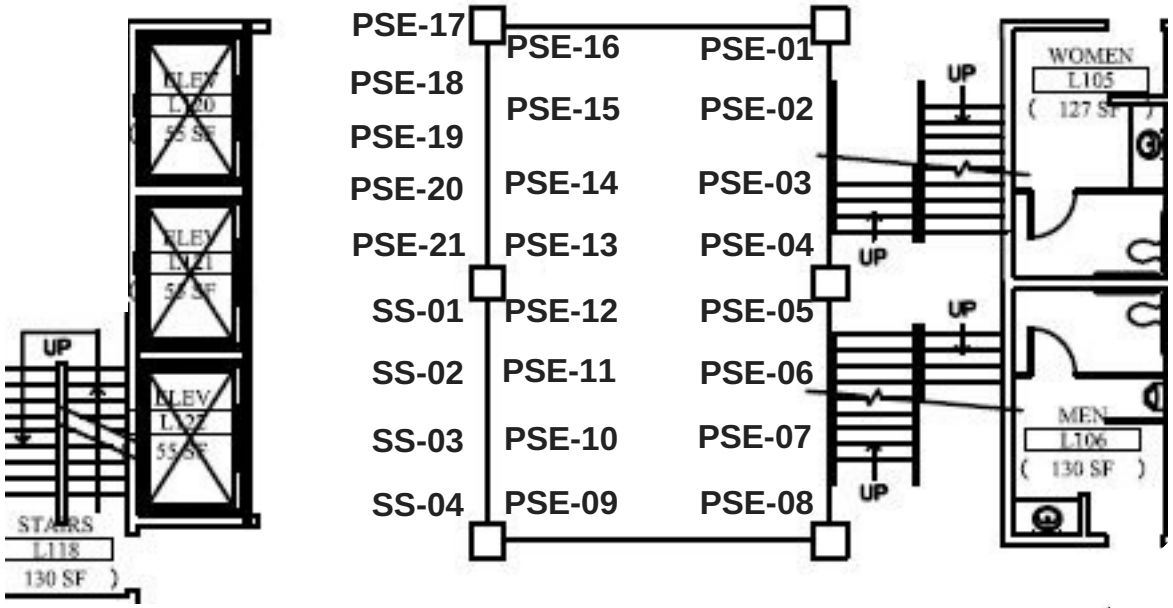
Featured speaker: Dr. Donna Gordon, Associate Professor, Biological Sciences

Subject Area Awards: Phi Kappa Phi Representative

This symposium would not be possible without the hard work of the judges who work under time pressure to try to determine which excellent project is just a bit more excellent than the others. If you see a judge, thank him or her.

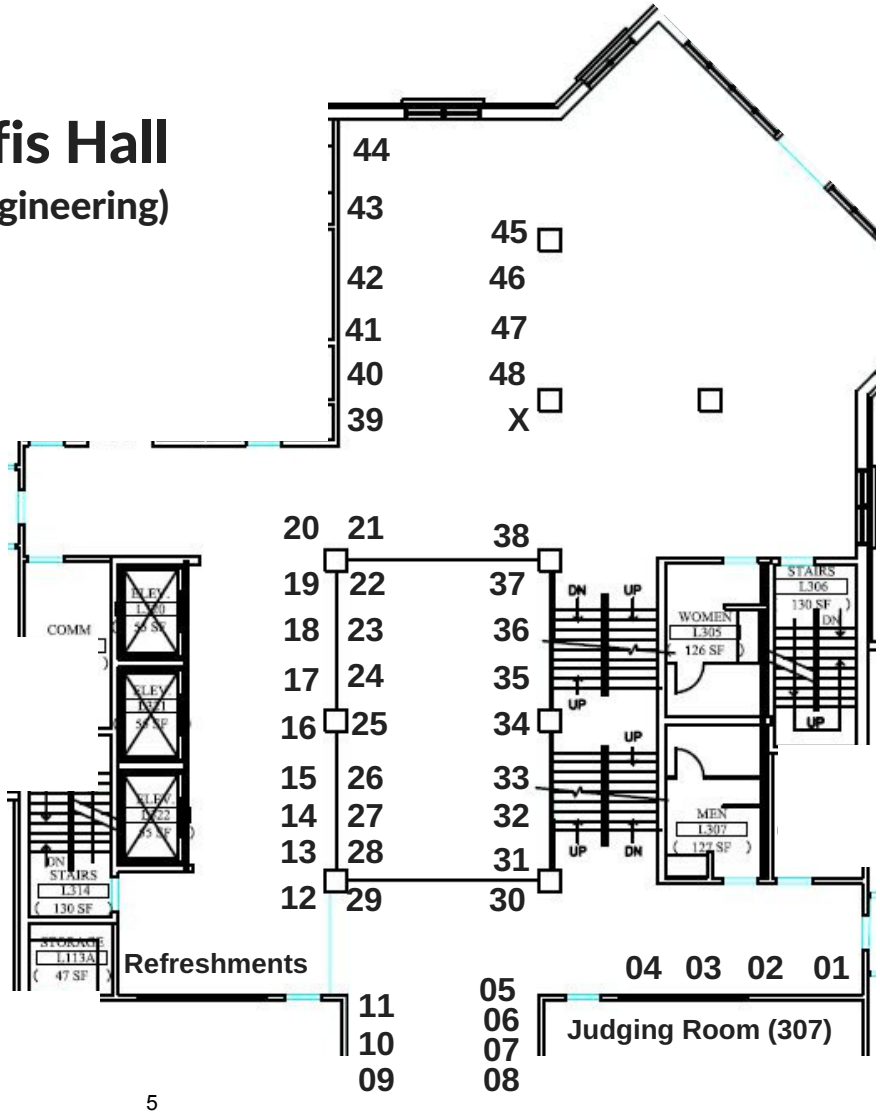
Poster Locations

First Floor, Griffis Hall



Third Floor, Griffis Hall

(Biological Sciences & Engineering)



Location Key

First Floor

Physical Sciences & Engineering

Social Sciences

Third Floor

Biological Sciences & Engineering

Fourth Floor

Award Ceremony

Student Presenters

Student Presenter		Research Category	Poster Number
Amelia	Andersson	Biological Sciences and Engineering	BSE-01
Thomas	Arana	Biological Sciences and Engineering	BSE-02
Shannon	Ballard	Biological Sciences and Engineering	BSE-03
Jaclyn	Barnett	Physical Sciences and Engineering	PSE-01
Zoe'	Beckworth	Physical Sciences and Engineering	PSE-02
Charles	Boyd	Physical Sciences and Engineering	PSE-03
Meagan	Bratton	Biological Sciences and Engineering	BSE-04
David	Bridges	Physical Sciences and Engineering	PSE-04
Jaunna	Bryson	Biological Sciences and Engineering	BSE-05
Ayla	Burton	Social Sciences	SS-01
Christian	Bush	Physical Sciences and Engineering	PSE-05
Hudson	Chenault	Biological Sciences and Engineering	BSE-06
Sarah	Claxton	Biological Sciences and Engineering	BSE-07
Albert	Cudjoe	Biological Sciences and Engineering	BSE-08
David	Cuevas	Biological Sciences and Engineering	BSE-09
Roger	Davis, Jr.	Biological Sciences and Engineering	BSE-10
Amber	Dedeaux	Social Sciences	SS-02
Martha Ann	Ellard	Biological Sciences and Engineering	BSE-11
Jasmine	Ferrell	Biological Sciences and Engineering	BSE-12
Jennifer	Fisher	Biological Sciences and Engineering	BSE-13
Katy	Franks	Biological Sciences and Engineering	BSE-14
Paul	Gloth	Biological Sciences and Engineering	BSE-15
John	Gwin	Biological Sciences and Engineering	BSE-16
Adrianne	Harris	Biological Sciences and Engineering	BSE-17
Sarah	Hartung	Biological Sciences and Engineering	BSE-18
Taylor	Henry	Physical Sciences and Engineering	PSE-06
Hunter	Hessler	Physical Sciences and Engineering	PSE-07
Anna	Hinton	Biological Sciences and Engineering	BSE-19
John	Hunt	Biological Sciences and Engineering	BSE-20
Kenya	Johnson	Biological Sciences and Engineering	BSE-21
Shameria	Jones	Physical Sciences and Engineering	PSE-08
Chase	Kayrouz	Biological Sciences and Engineering	BSE-22
Steven	Killough	Biological Sciences and Engineering	BSE-23
Mark	Lewis	Biological Sciences and Engineering	BSE-24
Christina	Loftin	Biological Sciences and Engineering	BSE-25
Justin	Martin	Biological Sciences and Engineering	BSE-26
Cary	McCraine	Biological Sciences and Engineering	BSE-27
Erin	McDevitt	Biological Sciences and Engineering	BSE-28
Sam	Mckinnon	Physical Sciences and Engineering	PSE-09
Madeline	Milholland	Physical Sciences and Engineering	PSE-10
Jesse	Mitchell	Biological Sciences and Engineering	BSE-29
Marc	Moore	Biological Sciences and Engineering	BSE-30
Jenna	Mosier	Biological Sciences and Engineering	BSE-31

Student Presenters

Student Presenter		Research Category	Poster Number
Virginia	Mullins	Biological Sciences and Engineering	BSE-32
Gaurav	Nag	Biological Sciences and Engineering	BSE-33
Brooke	Nash	Biological Sciences and Engineering	BSE-34
Nancy	Nguyen	Biological Sciences and Engineering	BSE-35
Hannah	Nichols	Biological Sciences and Engineering	BSE-36
Randall	Niffenegger	Physical Sciences and Engineering	PSE-11
Amber	Owen	Biological Sciences and Engineering	BSE-37
Brianna	Palmer	Biological Sciences and Engineering	BSE-38
Kendall	Pargot	Biological Sciences and Engineering	BSE-39
Kadie	Parker	Biological Sciences and Engineering	BSE-40
Reid	Pearlman	Biological Sciences and Engineering	BSE-41
Maggie	Powell	Physical Sciences and Engineering	PSE-12
Garrett	Prater	Physical Sciences and Engineering	PSE-13
Nathaniel	Prine	Biological Sciences and Engineering	BSE-42
Shanterell	Redd	Physical Sciences and Engineering	PSE-14
Rebekah	Ruiz	Physical Sciences and Engineering	PSE-15
Samantha	Rushing	Biological Sciences and Engineering	BSE-43
Erik	S. Antonio	Physical Sciences and Engineering	PSE-16
Emily	Sanders	Biological Sciences and Engineering	BSE-44
Avery	Smith	Physical Sciences and Engineering	PSE-17
Katelyn	Swiderski	Social Sciences	SS-03
Allison	Taylor	Biological Sciences and Engineering	BSE-45
Kevin	Trinh	Physical Sciences and Engineering	PSE-18
Carol	Twilley	Biological Sciences and Engineering	BSE-46
Kimberly	Waggoner	Physical Sciences and Engineering	PSE-19
JaCynto	Walker	Biological Sciences and Engineering	BSE-47
Alexandra	Wedderstrand	Social Sciences	SS-04
Kristina	Wielgosz	Biological Sciences and Engineering	BSE-48
Peyton	Williamson	Physical Sciences and Engineering	PSE-20
Tyler	Woodby	Physical Sciences and Engineering	PSE-21

Abstracts

BSE-01
Name, Major: Amelia Andersson, Biological Sciences
Project Title: *Salt Marsh Rescue: Identifying populations of Spartina alterniflora that provide appropriate genetic stock for the restoration of Mississippi Gulf Coast wetlands*
Faculty Advisor, Department: Dr. Mark Welch, Department of Biological Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Natural disasters and human interactions are stressors that have resulted in the loss of diversity in the Gulf coast wetland communities. Many recent conservation efforts have focused on reestablishing these salt marsh communities by using nursery stocks that are genetically invariant and potentially inadequately adapted to local conditions. However, examining local populations with life history characteristics and genetic variation that aid adaptation of Gulf coast habitat should prove more successful. Naturally rich in smooth cordgrass, *Spartina alterniflora,* these intertidal species serve as habitat for a number of species in addition to playing a crucial role in petroleum resistance; thus, these species act as important barriers in mediating effects of natural and anthropogenic disasters. Because these cordgrasses are significant in maintaining these communities, it is critical to restore coastal habitats. Here, we attempt to select native stock populations to enhance the probability and rate of success for restoration attempts by examining both mating systems and genetic variation. Using microsatellite markers we can identify outcrossing populations of *S. alterniflora* to act as stock populations that are genetically diverse and therefore more fit for their environment. A total of 160 *S. alterniflora* individuals from eight populations (20 individuals per population) were collected and DNA extracted using polymerase chain reaction (PCR) amplification protocols. All samples were genotyped at 21 polymorphic microsatellite loci to estimate allele and genotype frequencies. Furthermore, data from genotype scoring using Peak Scanner v1.0 will be used to link heterozygosity to genetic variation to better predict native species with the highest chances of longevity and reproductive success. Preliminary analysis reveals significant variability in heterozygosity values among populations, which demonstrates that specific native populations of *S. alterniflora* are better suited for restoration and promotion of healthy coastal wetlands.

BSE-02
Name, Major: Thomas Arana, Chemical Engineering
Project Title: *Microbial Desalination – A Novel Scheme for Water Resource Recovery Facilities*
Faculty Advisor, Department: Dr. Veera Gnaneswar Gude, Department of Civil and Environmental Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Increasing populations and higher living standards increase wastewater production across the world. Current wastewater treatment schemes are merely targeted towards environmental protection through energy-intensive processes. This research develops a novel platform for an energy-yielding wastewater treatment and desalination scheme in which the organic matter present in wastewater is purposely fed to the exoelectrogenic bacteria which produce electricity in a three-compartment bioelectrochemical system called a photosynthetic microbial desalination cell (PMDC). The three compartments hold wastewater (anolyte), salt water and a microalgae suspension (catholyte) respectively. The electron generating process in the anode compartment is augmented by the electron accepting mechanism provided by the photosynthetic microalgae species, *Chlorella Vulgaris,* in the biocathode compartment. The ionic imbalance generated within the system allows for exchange of salt ions (i.e., Na+ and Cl-) from the saline waters between the anode and cathode chambers thus achieving desalination in the middle chamber of PMDCs.

The specific aim of this research is to study the role of inorganic carbon source in the biocathode chamber. The conventional method of supplying carbon dioxide to the microalgae suspension is by pumping the atmospheric CO2 in the form of air which is a very inefficient route due to lower concentration of CO2 in the atmosphere and the poor solubility of CO2 in water. The alternative method is to supply sodium bicarbonate which is highly soluble in water. Addition of sodium bicarbonate provides several benefits including higher microalgae growth and lipids content suitable for biofuel production. This presentation will discuss the effect of sodium bicarbonate concentration on the performance of PMDCs which is evaluated through COD removal rates, desalination rates, microalgae growth and electricity production. The power density, maximum and cumulative voltage profiles, coulombic efficiency and other electrochemical characteristics of the PMDCs will be discussed along with energy and water recovery benefits.

BSE-03
Name, Major: Shannon Ballard, Biological Sciences/Microbiology
Project Title: *The impact of AGE-RAGE signaling on mitochondrial function in an aging mouse model*
Faculty Advisor, Department: Donna M. Gordon, Biological Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Over time, elevated blood glucose levels lead to the accumulation of advanced glycation-end products, or AGEs. These non-enzymatic modifications of proteins and lipids contribute to cellular dysfunction. Of particular importance to the heart, the covalent modification of extracellular matrix proteins reduces their overall elasticity contributing to myocardial dysfunction. In addition, extracellular AGEs are recognized by RAGE, a transmembrane receptor whose activation leads to increased RAGE expression, further contributing to cellular stress. Observational data from our labs suggest that mice harboring a deletion of RAGE (R-/-) have a longer lifespan than their wild type (WT) littermates. Microarray data found these mice had elevated transcript levels of genes involved in mitochondrial biogenesis. Given the association between cellular aging and mitochondrial function, the aim of this project is to compare the levels of mitochondrial and stress-related proteins in heart tissue isolated from WT and R-/- mice. Based on our preliminary data, we hypothesize that knocking out RAGE will stop downstream signaling activities resulting in higher mitochondrial activity relative to wild type littermates. To test this hypothesis, total RNA from heart tissue will be isolated using TRIzol for use in real-time qPCR to identify differences in mRNA transcript levels for select mitochondrial proteins. In parallel, samples will be processed for protein extraction for Western blot analysis using antibodies directed against mitochondrial proteins as well as proteins known to be involved in cellular stress. Identifying differences between WT and R-/- may shed light on a potential role for AGE/RAGE signaling in organismal aging.

This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences (NIGMS) of the National Institutes of Health (NIH) under grant number P20GM103476.

PSE-01
Name, Major: Jaclyn Barnett, Chemical Engineering
Project Title: *Possible Causes and Detection Methods for Induced Seismicity*
Faculty Advisor, Department: Dr. Amin Amirlatifi, Dave C. Swalm School of Chemical Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: This study serves as an analysis to propose a fundamental understanding of the role that the oil and gas industry plays in influencing fluid injection induced earthquakes. The study suggests that induced seismicity is primarily attributable to disposal well operations and has the objective of providing detection methods and solutions that could benefit petroleum operations without the risk of inducing seismicity and correctly address all hazards. The exact cause of this increasing strength in hydraulic induced seismicity is not known, however there are several factors that are believed to be contributing to this trend. As petroleum engineers, it is important that we understand the impact we have on the environment when drilling into the subsurface. This study focused on the specific factors that were thought to increase seismicity. The factors that were studied are injection rates, cumulative injected volume, degree of fault development, earthquake mainshock, frictional slip, rock type, depth, and temperature. By determining which factors correlate to increased seismicity, petroleum engineers can make safer and better informed decisions in the work field. As the number of hydraulic induced earthquakes increase across the nation as hydraulic fracturing gains in popularity, it is imperative that the factors that directly correlate to greater seismicity are known as to prevent the next extreme disaster.

PSE-02
Name, Major: Zoe' Beckworth, Biological Sciences
Project Title: *Fracking water remediation using surface modified ground rubber tire (GRT) as an adsorbent, development of duel function proppant*
Faculty Advisor, Department: Dennis W. Smith, Jr., Department of Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Fracking is the process of injecting fracking fluid, mixture of water, proppant, and other chemicals underground at high pressure into subterranean rocks, boreholes, etc., so as to force open existing fissures and extract oil and gas. After the water is injected at high pressures, flowback water (a mixture of fracking fluid and formation water) is released back into the water supply. Fracking contaminates both surface and ground water since it releases massive amounts of salts, toxic heavy metals, and organic compounds. Our mission is to find a way to clean fracking water by developing a duel function proppant using recycled ground rubber tire (GRT) particles which acts as both adsorbent and proppant. Commercially available recycled ground rbber tire (GRT) particles were obtained from Lehigh Technologies. The GRT particles were fully characterized by Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR), Scanning Electron Microscopy (SEM), Thermal Gravimetric Analysis (TGA), and Energy Dispersive X-ray Spectroscopy (EDXS). GRT particle surface was grafted with chitosan then the surface chemistry and composition of modified GRT particles were investigated by ATR-FTIR, SEM, TGA, and surface area. Adsorption of heavy metals and aromatic organic compounds on both raw GRT and surface modified GRT particles were investigated.

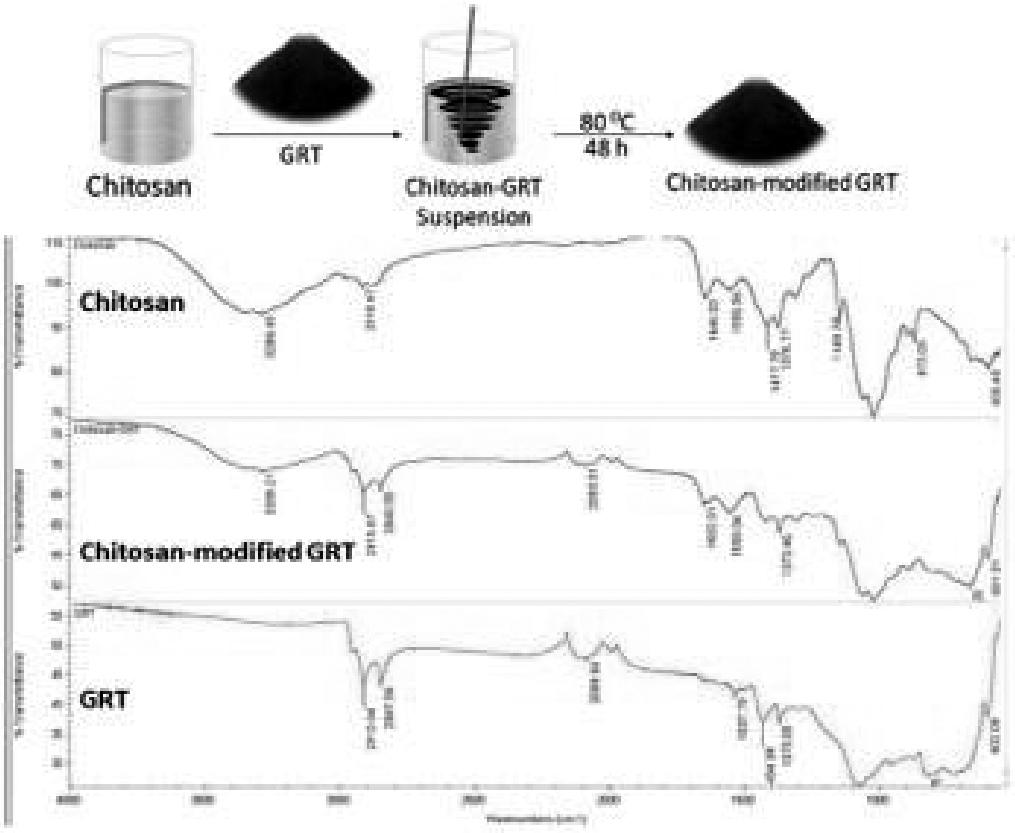


Figure 1. Preparation of chitosan-modified GRT

PSE-03
Name, Major: Charles Boyd, Biochemistry
Project Title: *Natural gas reforming with carbon dioxide to produce syngas over Ni/SBA-15 catalysts.*
Faculty Advisor, Department: Fei Yu, Department of Agricultural and Biological Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Using carbon dioxide to reform methane into syngas could be an essential step in alternative fuel production. Due to their prevalence as greenhouse gasses, using methane and carbon dioxide to produce syngas could provide a large source of energy. Syngas is made up of H 2 /CO mixture with a molar ratio of one. Syngas is then used to synthesize larger hydrocarbons through the Fischer-Tropsch process. Using this method, methane reforming with carbon dioxide could provide an ample source of clean energy. The catalyst used in the dry reforming of methane are mainly nickel-based and noble metal catalysts. While noble metals are expensive nickel-based catalyst are much more available. However, nickel-based catalysts are less stable and have higher affinity for carbon deposition.

Here, Nickel/SBA-15 supported catalysts were investigated for dry reforming of methane from various carbon sources. The Nickel/SBA-15 catalysts were prepared using an excess wetness impregnation method. The catalysts were then characterized by N 2 adsorption-desorption method to measure the surface areas, pore size distribution, and total pore volume. Hydrogen temperature programmed reduction determined optimal reduction temperature to be around 650°C (Figure 1). The methane dry reforming was carried out in a tubular fix-bed reactor at atmospheric pressure with temperatures ranging from 650°C-800°C. Methane and carbon dioxide conversion was measured using gas chromatography (Agilent 7890).

BSE-04
Name, Major: Meagan Bratton, Biological Sciences
Project Title: *Equine Pasture Asthma*
Faculty Advisor, Department: Dr. Andy Perkins, Computer Science and Engineering and Dr. Cyprianna Swiderski, CVM Clinical Science Department
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Asthma is a chronic disease effected by specific genes as well as environmental stimuli and affects nearly 9% of the United States population. We studied equine pasture asthma (EPA) which presents asthma-like symptoms and is a naturally occurring model of severe human asthma. The objective of our research is to identify genes involved in airway hyperresponsiveness and remodeling that are differentially expressed during the seasonal exacerbation of EPA. Data for this experiment was previously collected and observed by the Department of Clinical Sciences at Mississippi State University. We used FastQC in order to check the quality of our raw data. We then used Trimmomatic on the same data in order to trim it using certain parameters, a process that will eliminate low quality data. Once the inadequate data is illuminated we can again use FastQC to recheck the quality of the data. We then chose to use HISAT and StringTie to align our collected RNA-seq reads along the genome and qualify our results. EdgeR, the last program that we used, identified the differentially expressed transcripts. In conclusion, this approach identifies differentially expressed gene products and pathways that have the potential to provide new therapies for asthma.

PSE-04
Name, Major: David Bridges, Chemical Engineering
Project Title: *Copper and cadmium removal with chitosan coated gasifier biochar*
Faculty Advisor, Department: Todd Mlsna, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Biochar has a variety of applications due to its ability to adsorb molecules. This ability can become more pronounced through addition of chitosan, an alkaline deacetylated product of chitin, obtained from the exoskeleton of crustaceans after treatment with an alkaline substance. In this study, biochar infused with chitosan was used to absorb a series of ions under conditions which varied in pH, temperature, and kinetics. Chitosan was chosen because of its affinity for biomacromolecules and because its amino groups could be used as chelating agents.

The development of polymer-metal complexes has become a major objective of environmental research because of the need for materials which can remove harmful metals from aqueous solutions. Most of these heavy metals are toxic and are not biodegradable. While there are several common methods employed for the removal of heavy metals at high to moderate concentrations from the effluent streams of plants, there is a shortage of cost-effective methods for the removal of heavy metals at dilute concentrations. The adsorption of these toxic metals with biopolymers has proven to be highly effective, and chitosan is one of the most popular biopolymers currently under investigation. It has several unique features which make it particularly amenable to environmental applications. It is abundant, non-toxic, biodegradable, biocompatible, and has antibacterial properties.

The strength of the interactions between the polymer and the metal ions it adsorbs is largely dependent on the conditions under which the reaction is occurring, and the binding mechanism itself is not yet fully understood. It is the goal of this study to gain a better understanding of how this binding occurs and under what set of conditions it can be strengthened.

BSE-05
Name, Major: Juanna Bryson, Biological Engineering
Project Title: *PullOut Testing of 3D Polymer Implant screws*
Faculty Advisor, Department: Lauren Proddy, Ph.D, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Throughout the years the incorporation of metallic screws have been an orthopedic surgeon's accustomed choice of material. From procedures as big as spinal surgeries to a procedure as small as a dental implant, surgeons tend to rely on metallic implants due to their profound ability in relation to being biodegradable, and biocompatible. However, compared to stainless steel and other metals, the use of polymer implants may be beneficial due to their biodegradability. While there are many benefits to implementing the use of polymers, there are a few limitations that must be overcome. For example, the ability to produce a screw via a 3D printer is limited by the resolution of the printer. Additionally, the material mismatch of polylactic acid (PLA) may prevent it from being able to be screwed into bone. Current approaches to address the previous stated complications involve the production of two U-clamps (which is the needed piece in order to stabilize the bone during the pull-out test) , and the modifications to the screw in order to obtain not only a precise fit, but to receive an appropriate printing resolution as well. Due to the current limitations of PLA and the availability of stainless steel, we will first perform mechanical pull-out tests of stainless steel screws in porcine tibias. This method provides a measure of the force required to remove an implant from bone and allows for the development of the protocol that will be used to test novel, 3D printed PLA screws. There are three steps necessary to execute the pull-out test: the insertion, extraction, and the conversion phase. The ultimate goal is to not only proceed into testing implants in rat tibias, but to observe remodeling of the implant so that we can assess the biological implications of implant porosity.
Keywords: Biocompatible, 3D printing, Polylactic acid

SS-01
Name, Major: Ayla Burton, Psychology
Project Title: *Effects of Childhood Maltreatment on Key Neurological Structures and Potential Significance*
Faculty Advisor, Department: Dr. Arazais Oliveros, Psychology
Project Type, Category: Poster, Social Sciences

Abstract: College students face many challenges with the usual academic pressures and financial responsibilities weighing on them, but some students may face even greater challenges. Research shows that around one-third of children in the United States fall victim to child maltreatment at some point during their lives. Whether the maltreatment is physical abuse, emotional abuse, sexual abuse, or neglect, there can be enduring effects on the victim, especially if they develop Post Traumatic Stress Disorder. Children who experience maltreatment may develop abnormalities in key areas of the brain. Areas commonly affected by maltreatment are the Hippocampus, the Amygdala, and the Prefrontal Cortex. Impairments in these areas of the brain make learning, emotion regulation, problem solving, decision making, and daily life difficult. Abnormalities in these areas of the brain may be even more detrimental to college students who are expected to learn quickly under excessive amounts of stress. Universities can provide assistance to students who suffer with these effects by providing psychoeducational information, and offering them help through supportive services and counselling. Students and Universities would likely benefit from a universal screening such as the Computer Assisted Maltreatment Inventory test which screens students for a history of maltreatment. Channeling support to those students who most need it may yield improved retention and graduation rates as students with Post Traumatic Stress Disorder are more likely to drop out of college.

PSE-05
Name, Major: Christian Bush, Computer Engineering
Project Title: *Designing Functionality for Instant Literate Programming within Common Text Editors*
Faculty Advisor, Department: Dr. Bryan A. Jones, Electrical and Computer Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Literate Programming is the mindset of a developer to write human-readable source code, not just for compilation by computer but also for the organization and flow of thought between self and others. There are only a few tools that extract documentation directly from source code and they each exhibit limitations. However, CodeChat, a 'programmer's word processor', addresses these limitations by producing a document directly from the source code simply and instantly. Currently, CodeChat uses a unique and discontinued development environment to edit source code and preview documentation. This project separates CodeChat's functionality from its outdated environment and creates portability through plugins for popular editors like Sublime and Atom. As a developer writes a program in Sublime or Atom, their actions are sent to a server via a TCP/IP connection. The server then invokes CodeChat to transform the program into a web page, producing a beautiful and descriptive HTML output. This client/server separation allows for cloud development, compartmentalized support, and versatile GUI output.

BSE-06
Name, Major: Hudson Chenault, Biological Engineering
Project Title: *Translation Potential of Osteochondral Xenografts*
Faculty Advisor, Department: Steve Elder, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Osteochondral xenografts have been developed in an attempt to repair articular cartilage lesions in the human distal femur. The objective of this study is to increase the translational potential of porcine osteochondral xenografts by mapping regional variations in cartilage mechanical properties within the pig knee and by investigating the effect of graft size on the efficiency of antigen removal. 120 full-thickness cartilage discs of 5mm diameter were collected from specific regions of the distal femur: medial trochlea, lateral trochlea, medial condyle, and lateral condyle. Discs were subjected to stress-relaxation testing on a stepper motor-driven micromechanical testing machine. Prior to the mechanical testing, each cartilage sample thickness was recorded to provide a regional cartilage thickness map of the pig's distal femur. Instantaneous and equilibrium moduli derived from the stress relaxation test were also examined in terms of the sites from which the tissue was harvested. Results indicated highest cartilage thickness on the medial side of the trochlea at 2.01 +/- 1.07 mm and lowest thickness on the condyles around 1.44 +/- 0.14 mm. Instantaneous modulus values ranged from 0.98 +/- 0.17 MPa to .69 +/- 0.38 MPa, and equilibrium modulus values ranged from 0.14 +/- 0.03 MPa to 0.21 +/- 0.04 MPa. In order to investigate the effect of graft size on efficiency of antigen removal, previously developed and published decellularization techniques were used on 5mm and 8mm diameter porcine osteochondral plugs. DNA and glycosaminoglycan content are currently being quantified to assess the efficiency of antigen removal.

BSE-07
Name, Major: Sarah Claxton, Biochemistry/Pre-Vet
Project Title: *Investigation of various soil amendments to combat eutrophication via phosphate retention*
Faculty Advisor, Department: Deb Mlsna, Chemistry
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Phosphate contamination within groundwater sources of agricultural fields has proven to be an ongoing problem. In part, this issue stems from the leaching of phosphate fertilizers through coarse texture (often alluvial) soils. Plants have three major nutrient requirements: nitrogen, phosphorus, and potassium. Phosphate is a common source of phosphorus in many agricultural fertilizers and is mandatory for energy transfer and cell division. Excess ions that escape uptake into the plant pose a threat of infiltrating the groundwater system in well-draining soils. Reintroduction of phosphate-rich groundwater into surface water can result in eutrophication and significant loss of biodiversity. This project is aimed at designing an undergraduate lab that illustrates two techniques farmers currently use to slow the leaching process of phosphate through agricultural soils. Phosphate is leached through problem soil in a column and analyzed using a known literature procedure which utilizes UV-VIS spectroscopy. The problem soils are amended using lime ($CaCO_3$) or biochar. The two additives address the situation in different ways; farmers add lime in order to the raise the pH of their soil while organic materials and/or biochar can be used to help retain water which slows the leaching process of phosphate through the problem soil.

BSE-08
Name, Major: Albert Cudjoe, Biological Sciences
Project Title: *Investigation of the Effect of Mycolactone on Staphylococcus aureus Hemolytic activity.*
Faculty Advisor, Department: Heather Jordan, Biological Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: *Mycobacterium ulcerans* (MU) is a slow-growing environmental pathogen that infects the skin leading to necrosis of the skin cells and tissues in the absence of inflammation. The bacterium is the causative agent of the Buruli Ulcer Disease (BUD). The major virulence factor of MU is the lipid toxin, mycolactone. Studies have revealed that BUD is colonized by other pathogenic bacteria such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* without exhibiting typical pathology associated with those pathogens' colonization. This raises the question whether mycolactone plays any role in suppressing the virulence of other colonizing bacteria. We conducted a study to understand whether mycolactone plays a role in suppression of virulence by other colonizing bacteria during infection. The central hypothesis of the experiment is that mycolactone effects *S. aureus* hemolytic activity. In order to test our hypothesis, mycolactone (40ng/mL) was added to the *S. aureus* culture at lag phase and incubated at 370C for 6 hours. At 6 hours and 18 hours of incubation, the culture was serially diluted and plated on blood agar. After 24 hours, the hemolysis for *S. aureus* cultured with mycolactone was compared to hemolysis for *S. aureus* containing ethanol (solvent control). The study will aid to understand the interaction of MU with other bacteria during infection. In future, the effect of mycolactone on virulence gene expression of *S. aureus* will be studied to understand the relationship of MU with other bacteria and the role of mycolactone in providing fitness to outcompete other bacteria in the environment and during infection.

BSE-09
Name, Major: David Cuevas, Biological Engineering
Project Title: *Draining Pleural Effusion*
Faculty Advisor, Department: Steven Elder, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: A major health problem is the buildup of pleural fluid in the lungs. This buildup causes the person to have problems breathing, and needs to be drained. The draining is done by inserting a tube directly into the lungs, and pulling a pressure on it to drain the fluid out. This experiment tests two different chest tubes against each other to see which one is more efficient. The first tube has several small holes towards the end of the tube. The other tube has four indentions that run the length of the tube. To test the tubes against each other, an apparatus had to be built. This apparatus consisted of a vacuum chamber with the chest tube in it. This chamber is connected to another vacuum chamber, which is then connected to the lab vacuum. The test would then be able to be carried out. The tubes were tested on how fast each one could pull three liters of water from the first chamber to the other chamber. Another test would then be commenced to compare them against each other. Glycerol would be added to the water to make it more viscous to imitate pleural fluid. The two tubes would then be tested the same way as before with the new liquid. A balloon was then added to the first chamber to imitate a lung filling with air. The tubes were then tested again against each other in the same way as before. This experiment allowed a better chest tube to be revealed.

BSE-10
Name, Major: Roger Davis, Jr., Biochemistry
Project Title: *Mapping QTL for Insect Resistance on Chromosome 9 in Corn*
Faculty Advisor, Department: Marilyn Warburton, USDA-ARS and Plant and Soil Science
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Corn is the most economically important crop in the United States. Pests and environmental factors affect the growth of all field crops, including corn. Particularly, corn is negatively affected by the fall armyworm, *Spodoptera frugiperda*. The fall armyworm can damage the whorl, which causes the whole plant to stop growing and never produce ears at all, or it may burrow into and damage an ear. Because it hides under the cornhusk, the fall armyworm is one of the most difficult insect pests to control, but there are many possible control measures. Insecticides are widely used in crops, but they can harm plants, animals, non-target insects, and humans who come into contact with the crop or its produce. Transgenic technology is used to create genetically modified organisms (GMO) to control pests and has been used successfully, but GMOs are not always publicly accepted, and resistance to the transgenic corn has been found in some fall armyworm populations. Many researchers use host plant resistance, which is an economically and environmentally secure and effective method of reducing insect and disease damage to plants. Quantitative trait loci, or QTL, are regions of the chromosome affecting a trait, and mapping these QTL may be used to identify candidate genes that increase fall armyworm leaf feeding resistance. QTL that confer resistance to fall armyworm leaf feeding damage have been identified in multiple studies. One QTL identified on chromosome 9 has been found in several resistant corn lines, and is therefore of particular interest for further investigation. The objective of this study was to fine map the QTL on chromosome 9. A narrower QTL window contains fewer genes; fewer candidates make resistance studies easier and fewer non-target genes makes breeding more efficient, as other traits will not be affected.

SS-02
Name, Major: Amber Dedeaux, Psychology
Project Title: *Relational Aggression and Cognitive Jealousy in Women Moderated by Relationship Satisfaction*
Faculty Advisor, Department: Eric Dahlen, USM Counseling Psychology
Project Type, Category: Poster, Social Sciences

Abstract: Past research has demonstrated a relationship between romantic relational aggression and jealousy, particularly among women (e.g., Wright, 2017); however, additional research is needed to more fully understand the nature of this relationship. The present study examined relationship satisfaction as a potential moderator of the predicted relationship between the cognitive component of jealousy (i.e., how one perceives real or imagined attraction between one's partner and a romantic rival) and romantic relational aggression among college women (N = 315). Participants completed self-report measures of the variables of interest as part of a larger online survey on jealousy and relational aggression. A simple moderation model was tested using the PROCESS macro Hayes (2013) developed for SPSS. Cognitive jealousy and relationship satisfaction predicted romantic relational aggression, and relationship satisfaction moderated the relationship between cognitive jealousy and romantic relational aggression. Specifically, the relationship between cognitive jealousy and romantic relational aggression was stronger when participants were more satisfied with their relationships.

BSE-11
Name, Major: Martha Ann Ellard, Wildlife and Fisheries Science/Wildlife Science
Project Title: *Assessment of Grassland Bird Abundance within Agriculture Conservation Landscapes in the B*
Faculty Advisor, Department: Dr. Kristine Evans, Wildlife, Fisheries, and Aquaculture
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Conservation practices in agricultural landscapes not only benefit natural resources and the environment, but are known to improve density and species richness of many animals. Prairie Wildlife in Clay County, MS, is a long-standing example of integrating conservation practices in a working landscape, and has set aside over 2,000 acres of row-crop and pasture lands in native herbaceous vegetation to target restoration of Northern Bobwhite (*Colinus virginianus*) populations. We implemented point transect surveys for Northern Bobwhite and other grassland birds at 36 systematically located points within a >5,000 acre mixed agricultural landscape from June 12, 2017 to June 28, 2017. At each point 10-min visual and auditory bird surveys were conducted between 5:45am and 9:15am. We also conducted one round of late afternoon surveys (between 4:30pm and 7:30 pm) from June 12, 2017 to June 28, 2017 assess diurnal variability in calling. The average number of individuals of each target species including Northern Bobwhite (*Colinus virginianus*), Dickcissel (*Spiza americana*), Field Sparrow (*Spizella pusilla*), and Eastern Meadowlark (*Sturnella magna*), each indicators for natural prairie grasslands, either remained the same or decreased between morning and afternoon surveys. The target species averaged .92 (Northern Bobwhite), 1.64 (Dickcissel), .94 (Field Sparrow), .47 (Eastern Meadowlark) birds/point between the 36 points of morning surveys. Our data will be analyzed in Program Distance to assess target species densities (individuals/hectare) on the property. Baseline monitoring of grassland birds is being used to inform an updated conservation management plan for Prairie Wildlife, including targeted enrollment into Farm Bill conservation programs.

BSE-12
Name, Major: Jasmine Ferrell, Biochemistry
Project Title: *Torque Properties of Porcine Patella Tendon*
Faculty Advisor, Department: Lakiesha Williams, Agriculture and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: As a result of athletic injuries, the anterior cruciate ligament (ACL) is commonly replaced by the central third of the patella tendon (PT). The ACL failure mechanism is complex; however, research has shown that its failure is commonly associated with a torsional stress state. A tendon is a type of fibrous connective tissue, which attaches muscle to bone and makes joint movement possible. Like ligaments, tendons function to provide mechanical stability, elasticity and strength. Research studies suggest that the PT, when compared to the hamstring replacement of ACL and allografts, is a more effective replacement for the ACL. Understanding that the PT is more effective, the next step is to quantify the torque properties of the PT and determine if its properties are close to that of the ACL. For this study, porcine PTs were subjected to a torque stress state with a customized device developed in-house. The PT was attached to the patella bone at its proximal end and tibia and fibula at the distal end. Both the patellar bone and tibia/fibula were cemented into separate blocks and then loaded onto the torque device. One end of the device was connected to the gear, which turned the potted bone while the other potted bone remained stationary. This motion allowed for capturing tendon torque. Experimental data showed an increasing linear trend as is also shown in the typical stress-strain response of tendon in tension. This confirms that the recorded data was from the tendon only, but test are still being conducted to obtain an average data set. These current results suggest that the novel test setup works properly and the tendon can withstand torque. Future testing, including testing to failure, will allow for comparisons to the ACL torque failure rates that have already been observed through prior research studies.

BSE-13

Name, Major: Jennifer Fisher, Biological Engineering
Project Title: *Genomic Annotation of the Soybean Frogeye Disease-causing Fungus Cercospora sojina*
Faculty Advisor, Department: Kurt C. Showmaker, Institute for Genomics, Biocomputing, and Biotechnology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Frogeye disease in soybean plants is caused by the *Cercospora sojina* fungus. The main symptom of frogeye is distinct irregular circular lesions with gray centers with dark maroon margins that look like a frog's eye. Other symptoms include damp lesions on the stems and seedpods of the soybean plant. Frogeye is a common disease of soybean in southern United States and can cause thirty percent yield loss of crops. The Frogeye commonly spreads by contact of infected soybean tissue, growing infected soybean seeds, and transfer of spores of infected plants by the wind. There are several preventive measures in practice including using crop rotation, fungicide, and Frogeye resistant soybean varieties. In this study, the genome assembly of strain S9 of *C. sojina* and five Mid- South isolates were used to assess the genomic diversity of *C. sojina*. The initial annotation of *C. sojina* show that the genome is approximately 29.95 million base pairs long. In total, 14,059 Single-nucleotide Polymorphism(SNPs) were identified of which 6,407 were in exons, 3,649 were nonsynomous, 3,601 were missense mutations, 48 were nonsense mutations, and 690 were INDELS. Several bioinformatic programs and models were used to build a reference genome index for the S9 strain, map reads from the 5 samples, call SNPs, call INDELS, and identify alternative protein products. By analyzing the genomic and proteomic information from our study of *C. sojina*, we hope to gain a better understanding into the nature of the Frogeye disease.

BSE-14
Name, Major: Katy Franks, Biochemistry
Project Title: *Identification of Aspergillus flavus MicroRNA-like RNAs Differentially Expressed in Maize Lines with Different Levels of Resistance and Susceptibility to Aflatoxin Accumulation*
Faculty Advisor, Department: Din-Pow Ma, Biochemistry, Molecular Biology, Entomology, and Plant Pathology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: *Aspergillus flavus* is a common pathogen that infects corn (*Zea mays*) during pre-harvest and post-harvest stages. The infected corn produces aflatoxins B1 and B2, which can result in immunosuppression via aflatoxicosis in mammals if ingested. One of the strategies in reducing aflatoxin contamination is to breed maize lines with resistance to *A. flavus*. Several resistant maize inbred lines have been developed by Dr. Williams's group at USDA/ARS at Mississippi State. MicroRNAs (miRNAs) are a class of small non-protein coding RNA molecules found in many eukaryotic organisms and they are involved in many developmental processes and play key roles in gene regulatory networks and varied biological processes. One hundred and thirty-five miRNA-like RNAs (milRNAs) have been identified in *A. flavus* via Illumina deep sequencing and the expression of some of them were found to be correlated with aflatoxin production.

In this research, the differentially expressed *A. flavus* milRNAs between the resistant (Mp719) and susceptible (Va35) maize lines were identified by quantitative real-time PCR (qRT-PCR). Small RNAs were isolated from both maize lines inoculated with *A. flavus* NRRL 3357, which produces high levels of aflatoxin. The milRNAs in the small RNA samples were then subjected to qRT-PCR analysis using the delta-delta Ct (ddCt) method. This study will further our understanding of the molecular mechanisms governing maize resistance to *A. flavus* and aflatoxin accumulation. The identified differentially expressed milRNAs can be used as markers in the development of maize with enhanced resistance to aflatoxin accumulation.

BSE-15

Name, Major: Paul Gloth, Biological Engineering
Project Title: *Investigation of natural cross-linking agents for intraarticular injection*
Faculty Advisor, Department: Steve Elder, Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: This study aimed to determine the best natural crosslinking agent between Genipin, EGCG, and Punicalagin. The criteria for best crosslinkers were the highest change in mechanical strength while maintaining a low cytotoxicity. First, cells were exposed to the agents for 1 hour at varying concentrations to determine the level of cytotoxicity that each agent contained. Genipin and EGCG were dissolved in regular DMEM while Punicalagin was dissolved in PBS. Genipin was tested at concentrations of .25, .5, 1, 2, and 3 mM, EGCG was tested at concentrations of .25, .5, 1, and 2 mM, and finally Punicalagin was tested at concentrations of .25, .5, and 1 mM. In order to determine the level of crosslinking cartilage discs were exposed to equally cytotoxic concentrations of each agent and tested mechanically. Mechanical testing preformed was stress relaxation with a Mach-1 Mechanical Tester. The mechanical tests consisted of five stress intervals each of which were 5% of the total thickness of the piece of cartilage.

BSE-16
Name, Major: John Gwin, Chemistry
Project Title: *The Thermodynamic Characteristics of Ruthenium Polypyridyl Complex Interaction with G-quadruplex DNA*
Faculty Advisor, Department: Dr. Edwin Lewis, Chemistry
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Recently, Ruthenium based compounds have shown an increased interest in the drug development community due to overcoming common issues with platinum based drugs such as toxicity and cellular resistance. Ruthenium (II) polypyridyl complexes (RPCs) containing the large planar and redox-active tetraazatetrapyrido-pentacene (tatpp) ligand cleave DNA in the presence of reducing agents in cell-free assays and show significant tumor regression in mouse models of human non-small cell lung carcinoma xenografts.

Isothermal titration calorimetry was used to study the thermodynamics associated with the complexation of four different RPCs with G-quadruplex (G4) DNA. The specific RPCs were [Ru(phen)3]2+ (12+), [Ru(phen)2(dppz)]2+ (22+), [Ru(phen)2(tatpp)]2+ (32+), and [(phen)- 2Ru(tatpp)Ru(phen)2]4+ (44+). With exception to the diruthenium 44+, we examined the enantiomerically pure Δ-RPC and Λ-RPC isomers as well as the racemic mixture in terms of their binding to long and short looped mutants of the c-MYC NHE-III1 promoter sequence G4. We hypothesize that RPCs 22+, 32+, and 44+ bind to the exposed G-tetrad faces in a 2:1 mol ratio of RPC:G4-DNA. The phenanthroline ligands of 12+ appear too short to interact with the G-tetrad faces, and experimental data suggests that 12+ is likely a very weak or non-binder of G4-DNA. The enantiomeric identity of the 22+ and 32+ species exhibited similar affinity to their racemic mixtures with *K*a values of 6.7 x 104 M-1 and 1.1 x 107 M-1 for 22+ and 32+, respectively. The increase in binding affinity for 32+ was attributed to the larger π-interactive surface of the tetraazatetrapyrido-pentacene moiety relative to the dipyridophenazine moiety present in 22+. The racemic 44+ ligand exhibited two binding modes with *K*a values of 3.6 x 107 M-1 and 3.2 x 105 M-1. The high affinity binding mode is likely due to preferential binding of either the ΛΛ or ΔΔ isomers as suggested by the stoichiometry of the interaction.

BSE-17
Name, Major: Adrianne Harris, Animal and Dairy Sciences
Project Title: *L- Arginine: Effects on Follicular Development in Mares*
Faculty Advisor, Department: Brian Rude, Animal and Dairy Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Objectives of this study were to assess arginine supplementation at differing time points during gestation to mares and its effects on follicular development as well as breeding attempts. American Quarter Horse mares (n=20) began supplementation 21 days prior to their expected foal date (335 d). Mares were stratified by expected foaling date and randomly assigned to four treatments; 1) control 2) arginine supplemented during late gestation (21 d prior to expected foaling date until parturition) 3) arginine supplemented during early gestation (post foaling until 84 days into next gestation) 4) arginine supplemented early and late gestation (arginine throughout entire trial). Mares were supplemented arginine at 1% of their total diet. Day 1, 4, and 7 postpartum, size of dominant follicle was recorded. Progression to dominant follicle was measured on day 1, 4, 7 postpartum and at time of breeding. Mares were artificially inseminated when dominant follicle had reached maturity of 35 to 45 cm. If breeding attempt was not successful, mares were artificially inseminated again until conception. There were no treatment differences in days to dominant follicle (P= 0.2004) or breeding attempts (P=0.5847). More research is needed in this area to assess supplementing arginine at different time points and its potential effect on follicular development and conception.

BSE-18
Name, Major: Sarah Hartung, Animal and Dairy Sciences/Pre-Vet
Project Title: *Bactericidal Effects of Silver-Coated Carbon Nanoparticles on Pathogenic Escherichia coli, Salmonella typhimurium, and Salmonella anatum*
Faculty Advisor, Department: Jean M Feugang and Seongbin Park, Animal and Dairy Science
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Increasing rates of antibiotic resistance among food-borne pathogens is a rising global concern. Advances in nanotechnology allow for the design of potent antibacterial nanoparticles, such as the silver-coated single-walled carbon nanotube (SWCNTs-Ag). This compound exhibits bactericidal properties through energy deprivation, inhibition of DNA replication, and oxidant accumulation. In a previous work, the pegylated form of SWCNTs-Ag (pSWCNTs-Ag) was reported nontoxic to eukaryote cells [1]. The current study aimed to test the efficacy of pSWCNTs-Ag as an alternative treatment to antibiotics against food-borne pathogens.

Luciferase-transformed *Escherichia coli, Salmonella typhimurium,* and *Salmonella anatum* (10^7 colony forming unit/ml) were grown at 37°C in the presence of SWCNTs-Ag or pSWCNTs-Ag (0, 25, 31.25, 50, and 62.5 µg/ml). Growth kinetics were regularly assessed during 48 hours incubation through optical density measurements (OD) and bioluminescence imaging of luciferase activity. Bacteria were harvested at the stationary phase of the growth curve and proteins were extracted for proteomic analyses. Experiments were repeated twice with analyses performed in triplicates. Data were analyzed using ANOVA-1 and $P<0.05$ indicated significant differences.

Both nanotubes dose-dependently increased the lag-phase durations of bacteria growth curves, in comparison to controls (0 µg/ml; 2-3hours). Co-incubation of *Escherichia coli* with 31.25 µg/ml pSWCNTs-Ag or SWCNTs-Ag caused lag-phase durations of 40 or 21 hours, respectively. Regardless of the *Salmonella* strain, these durations lasted 24 and 21 hours, respectively. Optimal SWCNTs-Ag results were observed with 62.5 µg/ml (48 hours for *Escherichia coli* and 24 hours for *Salmonellas*). Bioluminescence imaging mirrored OD-based growth curves and proteomic studies are still ongoing.

Findings show that pSWCNTs-Ag has a dose-dependent action on lag-phase duration and stronger effect at lower dose, compared to SWCNTs-Ag. Reduction of luciferase activity during the lag phase may indicate a bactericide property of pSWCNTs-Ag that needs further investigations. Work supported by USDA-ARS Grant #58-6402-3-018.

[1] Chaudhari, Atul A., et al. "Novel pegylated silver coated carbon nanotubes kill Salmonella but they are non-toxic to eukaryotic cells." *Journal of nanobiotechnology* 13.1 (2015): 23.

PSE-06
Name, Major: Taylor Henry, Chemical Engineering
Project Title: *Mechanical Properties of 3D Printed Polymer Samples*
Faculty Advisor, Department: Dr. Santanu Kundu, Chemical Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: 3-D Printing is a rapid-prototyping method to produce components with complex geometries. This technique has attracted a lot of interest in various areas ranging from biomedical to electronics and aerospace engineering. Solid-3D objects can be created by this method using a layer-by-layer procedure or fused-deposition method with precise control. Here, acrylonitrile butadiene styrene (ABS) and T-glase are used in to 3-D print objects of different dimensions. These polymers are printed at different temperatures considering their melting points, and they are recycled for printing to maintain cost and environmental efficiency. In addition, the mechanical properties of these polymers are being investigated using tensile tests.

PSE-07
Name, Major: Hunter Hessler, Chemistry
Project Title: *Synthesis of unsymmetric CCC-NHC pincer ligands based on benzimidazole*
Faculty Advisor, Department: T. Keith Hollis, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: The chemistry of the Hollis group focuses on synthesis of organometallic pincer complexes for use in catalysis and organic light emitting diode (OLED) applications. CCC-NHC Pt complexes are of particular interest for OLED applications as they emit blue light, a much needed color for OLEDs. In order to expand the library of our CCC-NHC pincer complexes, symmetric and unsymmetric backbones are required. Synthesis of the unsymmetric ligands requires stepwise addition of NHC moieties to a phenyl ring core. My work has focused on preparing a reproducible synthetic procedure to obtain the monosubstituted phenyl ring (mono NHC) and further addition of the second NHC in high yields. These unsymmetric CCC-bis(NHC) pincer complexes should exhibit different properties and reactivity.

BSE-19
Name, Major: Anna Hinton, Biological Engineering
Project Title: *Intraarticular Drug Therapy in Osteoarthritis*
Faculty Advisor, Department: Steve Elder, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Intraarticular drug therapy will study the effects of genipin and punicalagin as a precursor to developing an injection that will modify osteoarthritis by strengthening and protecting the cartilage from degradation. Genipin will be used as a crosslinking agent and the punicalagin will provide anti-inflammatory and protective properties to the cartilage. The use of these drugs in combination will hopefully result in additive benefits to the articular cartilage extracellular matrix. Genipin and punicalagin will be tested individually with four different tests. Genipin and punicalagin will also be tested in combination to study how the two drugs interact. Mechanical testing will determine how these concentrations will affect the articular cartilage surface through friction and compression testing. Other tests will study how the treated cartilage will react to the enzymatic breakdown caused by osteoarthritis and also how many free amino groups are released from each sample. The enzyme collagenase will be used to mimic osteoarthritic breakdown of the articular cartilage extracellular matrix. Once treated with genipin and punicalagin, samples will be introduced to this enzyme to determine how effective the treatments are at reducing breakdown. The final test reads how many free amino groups there are being released by each sample. If the sample is sufficiently crosslinked by the use of the treatments, there should be fewer free amino groups. In combination, the drugs have shown significant results during collagenase testing. At this point in the study, treated cartilage has withstood the effects of the enzyme dramatically more than the untreated. Genipin has shown progressively positive results with each increased concentration, and punicalagin is expected to have similar results. The hope is to be able to use this information to develop an injection that can drastically impact osteoarthritis in the short time frame the drug interacts with the cartilage.

BSE-20
Name, Major: John Hunt, Biological Engineering
Project Title: *A Metabolomics Approach to Understanding Vancomycin Resistant Staphylococcus Aureus*
Faculty Advisor, Department: Nicolas Fitzkee, Chemistry
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Studying how microbes utilize nutrients in their extracellular environment is a facet of metabolomics research that has recently yielded interesting discoveries in antibiotic resistance studies. Vancomycin-resistant *S. aureus* (VRSA) is a serious medical problem when treating *S. aureus* infections due to a mutation resulting in synthesis of a thicker cell wall. We are interested in how vancomycin exposure may alter metabolic pathways in resistant strains of *S. aureus.* Using vancomycin as a stressor, bacteria are cultured and samples of their media are taken at key time points during their growth. Two strains of *S. aureus* are used in the experiments, namely LAC and TX11. TX11 is a resistant mutant of LAC that exhibits a tendency to form biofilms when vancomycin is introduced. Metabolite concentrations for 50 compounds are monitored as a function of time for LAC and TX11 in media with and without vancomycin. In the vancomycin-containing experiment, antibiotic concentrations are kept low so the bacteria will be able to survive. The rate of growth is measured and compounds in the media are quantified using NMR spectroscopy and a library of pur e compound NMR spectra. Variance in the samples can be visualized in three dimensions using principal component analysis (PCA). While both strains behave similarly early in the experiment, their behavior diverges at later time points. The most notable differences between the strains include altered metabolic utilization of isoamyl isovalerate, acetic acid, and L-arginine. Additional analysis can potentially reveal metabolic pathways that are upregulated or downregulated in response to vancomycin exposure. This information may provide insight into developing new treatments for VRSA.

BSE-21
Name, Major: Kenya Johnson, Biological Sciences
Project Title: *Investigating a role for the retrograde signaling protein, Rtg2p, in its own transcription*
Faculty Advisor, Department: Donna M. Gordan, Biological Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: In eukaryotic cells, retrograde signaling is used to communicate organellar dysfunction to the nucleus which leads to altered target gene expression to accommodate specific dysfunctions. In the yeast, *S. cerevisiae*, the retrograde signaling protein Rtg2p has been shown to be a key cytosolic sensor for detecting mitochondrial dysfunction. Recent work in the lab identified a single amino acid deletion in Rtg2p that results in defects in retrograde signaling (Jiang, J., unpublished data). Western blot analysis showed decreased Rtg2p steady-state levels possibly due to enhanced protein turnover. Interestingly, qPCR analysis found no detectable levels of *RTG2* mRNA for this mutant. As Rtg2p has been identified as a member of the SLIK (SAGA-like) transcriptional complex, this finding suggests that Rtg2p may have a role in influencing its own transcription. To investigate this, we used restriction-based cloning to replace the *RTG2* promoter with the constitutive GPD promoter in plasmids containing the wild type and mutant versions of *RTG2*. Once confirmed by restriction analysis, these plasmids were introduced into three yeast strains to test for Rtg2 protein levels by Western blot analysis, activation of retrograde signaling using a yeast colony color assay, and *RTG2* mRNA levels by qPCR analysis. If Rtg2p is involved in transcriptional self-activation, then promoter replacement should remove this regulatory step and return mRNA transcript levels for the mutant *RTG2* to that of wild type. Ultimately, results from these assays will be used to broaden our understanding of the many biological roles carried out by the mitochondrial retrograde sensor, Rtg2p.

This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences (NIGMS) of the National Institutes of Health (NIH) under grant number P20GM103476.

PSE-08
Name, Major: Shameria Jones, Chemical Engineering
Project Title: *Modeling non-covalent interactions in Dye Sensitized Solar Cells using Density Functional Theory*
Faculty Advisor, Department: Neeraj Rai, Dave C. Swalm School of Chemical Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: As nonrenewable resources dwindle, research into renewable energy increases with the demand of energy. Solar panels are at the forefront of this movement. Within a solar panel, sunlight is absorbed and then transformed into electricity. Among single junction cell devices, dye sensitized solar cells (DSSCs) are unparalleled in terms of voltage output. In this project, density functional theory is used to investigate the interaction between a dye molecule with a redox shuttle by analyzing the binding energy. In terms of binding energy, the smaller the binding energy the better the molecules interaction, which can lead to better photovoltaic system performances. So far binding energy calculations for single substituent neutrally charged dyes has shown to have negative values i.e. there interactions are attractive in nature. At MN15/6-31g* theory and basis set the hydroxy substituent dye has the largest value, where in comparison the halogen substituents appear to have binding energies that decrease with substituent size.

BSE-22
Name, Major: Chase Kayrouz, Chemical Engineering
Project Title: *Manufacturing an On-stage Incubator for Live Cell Imaging*
Faculty Advisor, Department: Renita Horton, Ph.D., Department of Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: The ability to perform live cell imaging can be critical to a number of research applications. For mammalian cell lines, this requires the maintenance of a humidified environment held at 37oC. Although a number of microscope incubation systems exist with these capabilities, the cost associated with such an instrument can range upwards of $20,000. We propose to design, build and test a low- cost (<$500) incubation system that can be easily integrated into most microscope platforms.

The proposed system will consist of a 3D-printable shell, transparent top and bottom plates, and ports through which material can flow for microfluidic experiments. The slide, petri dish, or microfluidic device will be housed within the bottom platform. Temperature and humidity will be controlled by flowing conditioned air through the device. A microcontroller will adjust the temperature of the perfused air according to feedback from a thermocouple inside the incubator. To achieve this, we will first use CAD software to model the device and perform a heat-transfer simulation. Then the device will be assembled and tested for its ability to fit properly on different microscopes, maintain temperature, and provide optical clarity. The final validation step will be to determine whether results from previous cell culture studies can be replicated within the new platform. If successful, this device will provide a low-cost, reliable system for real-time imaging during cell culture studies.

BSE-23
Name, Major: Steven Killough, Biological Sciences
Project Title: *Predictions of Arabidopsis Thaliana kinase functions using clusters of orthologs*
Faculty Advisor, Department: Dr. George Popescu, Institution for Genomics, Biocomputing, and Biotechnology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Biotic and abiotic stress- mediated protein kinase signaling pathways are crucial in understanding the mechanics of stimulus-response behavior in plants. The overarching goal of our research is identify the orthologs and conserved motifs and to reconstruct the phylogenies of several receptor like kinases (RLKs) and receptor-like cytoplasmic kinases (RLCKs), focusing on two recently studied *Arabidopsis thaliana* protein-kinases, FEI2 and PBL17. Our analysis pipeline, running on both CyVerse and IGBB/HPC2 computing clusters, uses a database of seven proteomes of crop species downloaded from Phytozome (currently being expanded to 14 species), and performs clustering of orthologs using the OrthoMCLv2.09 software. Phylogenetic relationships are assessed using MEGAv7 software, and alignments computed via MUSCLE. Sequence motif conservation is also evaluated. We focus particularly on the sequence characteristics of *Gossypium hirsutum* orthologs when attempting to predict the functional characteristics of FEI2 and PBL17 kinases. Upon determining the highest quality ortholog candidates in *Gossypium hirsutum*, ortholog clones' functions will be tested *in vivo*.

BSE-24
Name, Major: Mark Lewis, Biochemistry
Project Title: *Application of magnetic nanoparticles for post-collection semen manipulation*
Faculty Advisor, Department: Jean Feugang, Animal and Dairy Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Non-viable spermatozoa and the unpredictability of offspring gender upon fertilization pose limitations to breeding. Current techniques of sperm evaluation are non-specific, time-consuming, expensive, or less efficient for farmers. Recent advances in nanotechnology provide new tools that may allow for gender selection, through sperm sexing and semen dose enrichment with robust spermatozoa, through targeting and removal of moribund ones. Previous studies conducted in our laboratory have shown promising use of magnetic nanoparticle conjugates (MNPs) for sperm selection without affecting their function. Here we explored the efficacy of newly designed MNPs for semen dose enrichment and sperm sexing.

Pooled boar semen doses were incubated with MNPs designed to target non-viable spermatozoa for semen dose enrichment with robust spermatozoa (experiment 1) and X-chromosome bearing spermatozoa for sperm sexing (experiment 2). Targeted spermatozoa were trapped under an electromagnetic field and desired ones (robust and Y-chromosome bearing) were eluted for various analyses for experiment 1 (sperm motility, using a Computer-Assisted-Sperm-Analyzer and sperm viability, using fluorescent microscopy imaging and flow cytometry) and experiment 2 (DNA extraction and gene expression analysis to detect Y-chromosome). Polymerase chain reaction (PCR) amplicons were resolved via agarose gel electrophoresis for visualization. Motility data were statistically analyzed using the SAS package.

Designed MNPs showed beneficial effects on sperm motility characteristics, with dose-dependent increased proportions of motile and progressive spermatozoa. Flow cytometry indicated higher robustness of selected spermatozoa (high mitochondrial membrane potential, low reactive oxygen species, and low plasma membrane fluidity). A PCR protocol was established for further evaluation of semen dose enrichment with viable Y-chromosome bearing spermatozoa.

In conclusion, the designed MNPs indicated advantageous effect on sperm motility and potential to achieve high-throughput sperm sexing. Supported by USDA-ARS Grant# 58-6402-3-018.

BSE-25
Name, Major: Christina Loftin, Biological Sciences
Project Title: *Survey of Mississippi and Alabama Raccoons for Macroscopic Gastrointestinal Parasites*
Faculty Advisor, Department: Dr. Cooper Brookshire, Department of Clinical Sciences, College of Veterinary Medicine
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: *Baylisascaris procyonis,* a large intestinal roundworm of raccoons (*Procyon lotor),* occasionally results in serious human infection. Raccoons may also serve as a host for several other helminths including *Physaloptera rara, Gnathostoma procyonis,* and *Macracanthorhyncus ingens.* Our objective was to evaluate raccoon populations for evidence of *B. procyonis* due to its public health importance. Raccoon gastrointestinal tracts (n=130) were collected between February 2016 and March 2016 across 8 counties in Mississippi and Alabama. Blunt mucosal scrapings were obtained from the stomach through descending colon and combined with all tract contents. Helminth parasites were grossly collected from pooled contents using 600µm sieves and identified via macro and microscopic features. Among the helminths recovered, we identified two nematodes and one acanthocephalan to species level. Cestodes and other nematode species were recovered but not identified microscopically. We did not recover *B. procyonis* from any raccoons. Prevalence of recovered parasites was 40% (53/130) for *G. procyonis,* 35% (46/130) for *P. rara,* 41% (54/130) for *M. ingens.* Additionally, 22% (29/130) of raccoons had cestodes, and <1% had unknown helminth fragments.

Separate logistic regression models were used to test for factors of association with the presence of different helminth parasites or any helminth parasite. Sex was associated with parasite prevalence. Odds of female raccoons being infected was 2.4 times greater for *M. ingens* (P = 0.05) and 4.4 times greater for cestodes (P = 0.02) than males. The odds of females being infested by any parasite was 5.0 times greater than males (P = 0.002).

While none of the raccoons in the samples tested had *B. procyonis*, characterization of helminth populations in raccoons is important to investigate possible impacts on host health and the environment. Continued surveillance is important in raccoons as a reservoir for potential public health risk.

BSE-26
Name, Major: Justin Martin, Physical Education/Kinesiology
Project Title: *The Effects of Static Stretching and Eccentric Gastrocnemius Strengthening on Passive Dorsiflexion*
Faculty Advisor, Department: John Lamberth, Kinesiology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Evidence indicates that limited ankle range of motion is linked to overuse injuries and structural abnormality within the lower body (Johanson, Baer, Hovermale, & Phouthavong, 2008). Specifically, the subtalar joint is likely to compensate in attempt to correct for foot deformities (Tiberio, 1988). Physical therapists routinely assess foot functionality by placing the foot into subtalar neutral followed by measuring the degree of passive dorsiflexion. Current evidence demonstrates that a static stretching protocol (Johanson, Baer, Hovermale, & Phouthavong, 2008) and/or eccentric strengthening protocol (Nelson & Bandy, 2004) may increase the range of motion in many joints. Therefore the purpose of this study will be to examine the effectiveness of static stretching and/or eccentric strengthening alone as well as examine the effectiveness of combining the two regimens. The benefits of this study will provide a better understanding of rehabilitation for those affected by limited ankle range of motion.

BSE-27
Name, Major: Cary McCraine, Electrical Engineering
Project Title: *Remote Sensing of Wildfire using sUAS: Post-fire Mapping, Vegetation recovery and damage analysis in Grand Bay National Estuarine Research Reserve, Mississippi*
Faculty Advisor, Department: Sathishkumar Samiappan, GRI
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: The effects and damages associated with wildfires range from loss of vegetation and wildlife, extensive property damage, and the potential loss of human lives. It is vitally important for wildlife researchers and resource managers to have an estimation of effects of a wildfire on the local ecosystem as soon as possible for regeneration and future prediction purposes. While it is fairly easy to quantify the effects of wildfire damage on structures and urban areas, there is currently not a cost effective small scale method for resource managers to quantify the damage done on rural and heavily forested areas. To date, the only methods of mapping the damage is by actually taking GPS points around the perimeter of the burn or by using imagery from manned aircraft or from space- based sensors. While these methods have proven their worth extensively in the past they are costly and extremely time-consuming. This research attempts to validate another option by using small Unmanned Aerial Systems (UAS) equipped with high-resolution multispectral sensors to map and estimate wildfire damage at the Grand Bay National Estuarine Research Reserve (GBNERR) on the Alabama/Mississippi border gulf coast. By using an Altavian Nova fixed-wing UAS outfitted with a MicaSense RedEdge camera flying at 1000 ft. we were able to collect approximately 4.5 sq. mi. of 5-band multispectral imagery (red, green, blue, red edge and near-infrared) with a ground sample distance of approximately 3.2 in. This imagery was captured immediately after the wildfire in February 2016 and again in October 2016. By using this and other open source imagery, we were able to achieve an overall accuracy of 78.6% using Object Based Image Analysis (OBIA). We used the Normalized Difference Vegetation Index (NDVI) to classify between and produce maps of healthy and burned vegetation.

BSE-28
Name, Major: Erin McDevitt, Biochemistry
Project Title: *Exposure to organochlorine pesticide metabolites produces neutral lipid accumulation in immortalized and primary rat hepatocytes*
Faculty Advisor, Department: George Howell, III, Department of Basic Sciences, College of Veterinary Medicine
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: One common manifestation of type 2 diabetes is hepatic steatosis, or nonalcoholic fatty liver disease (NAFLD). Many recent studies have shown correlations between pesticide exposures and type 2 diabetes presence. However, the direct effect of organochlorine (OC) pesticide exposure on hepatic steatosis is unknown. Therefore, the present study was designed to determine if direct exposure three organochlorine metabolites p,p'-dichlorodiphenyldichloroethylene (DDE), trans-nonachlor, and oxychlordane promoted accumulation of intracellular neutral lipids in rat primary hepatocytes and in McArdle-RH7777 (McA) cells. Briefly, cells were exposed to OC compounds at various concentrations (0 μM, 0.02 μM, 0.2 μM, 2.0 μM, 20 μM, and 80 μM). Oil Red O staining was performed at both 24 hours and 48 hours to determine the time dependent effects on neutral lipid accumulation in the cells. In rat primary hepatocytes, Oil Red O levels showed a slight increase as the organochlorine concentrations increased at the 24-hour mark. However, at 48 hours trans-nonachlor showed significant concentration-dependent increases in Oil Red O levels resulting in concentration-dependent neutral lipid accumulation. In the McA cells, trans-nonachlor and oxychlordane showed the most significant rise in neutral lipid levels as the concentrations of each increased at both 24 and 48 hours. Thus, the effects of trans-nonachlor and oxychlordane appeared earlier in the McA cells. These data indicate that direct exposure to two organochlorine metabolites, trans-nonachlor and oxychlordane, does have a direct effect on neutral lipid accumulation in both primary and immortalized hepatocyte models with trans-nonachlor producing significant steatotic effects at 48 hours in both cell types. Our present data demonstrate that exposure to selected organochlorine pesticide metabolites may have a direct effect on the hepatocyte to alter hepatic lipid metabolism and promote hepatic steatosis or NAFLD.

PSE-09
Name, Major: Sam Mckinnon, Chemistry
Project Title: *Synthesis of π Conjugated Organoelectronic Materials via Direct Arylation of Electron Deficient Monomers.*
Faculty Advisor, Department: Dr. Colleen Scott, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Conjugated polymers have been of growing interest in material science due to their applications as semiconductors. They have the potential for implementation into organic light emitting devices (OLEDs), organic field effect transistors (OFETs), and polymer solar cells (PSCs). They are lightweight, inexpensive, and simple to fabricate owing to the advantage of solution based processing. Their synthesis, however, requires the ability to form aryl-aryl bonds, something typically carried out using traditional cross coupling strategies that employ stoichiometric amounts of transition metals to functionalize the aryl species. These methodologies are not only cumbersome, but require harsh reaction conditions which may not be suitable for sensitive substrates. An alternative approach to traditional cross coupling is the use of Direct Arylation; formation of carbon-carbon bonds without pre-functionalizing reactants via activation of C-H bonds. Direct Arylation, is a regio-selective catalytic reaction that can be carried out with minimal catalyst loading, and without the need for multiple reaction and purification steps, or the generation of toxic byproducts. While some direct arylation conditions require the presence of nucleophilic additives, we will attempt to use a modified electron poor silole monomer to generate conjugated co-polymers with aryl compounds under previously reported milder reaction conditions. Siloles are a family of low band gap compounds, with good charge carrying capabilities and optoelectronic properties. C-H activation on the silole monomer has been unsatisfactory due to ring opening, and non-linear branching polymers. By oxidizing the thiophenes at the 2 and 5 positions on the silole we hope to be able to carry out C-H activation without needing to brominate the silole, a yield sacrificing step.

PSE-10
Name: Madeline Milholland
Project Title: *Breakage of Paracetamol Crystals as a Function of Agitation Time*
Faculty Advisor, Department: Dr. Priscilla Hill, Chemical Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Chemical manufacturing plants often produce solid products by solution crystallization in vessels with a stirring apparatus. Controlling the stirrer speed in the vessel allows for production of many different shapes and sizes of crystals due to mass and heat transfer effects. Larger crystals can experience breakage if agitated at higher speeds, and crystals too small can result in clogging the filter following the crystallizer. This clogging lowers plant productivity because it requires the process to stop to clean the filter. This research studies the effect of agitation time on crystal size and aspect ratio distributions. The first step is producing paracetamol crystals. These initial or parent crystals are characterized using image analysis software to measure the aspect ratio, and major and minor axes for each crystal in the sample. Crystals are then agitated in hexane, a non-solvent, to prevent crystal nucleation and growth and isolate the effects of breakage. After agitation, the crystals are filtered out of the slurry and re-characterized to determine the effect of agitation. The concentration of solids in the slurry (g crystals/ g liquid) and the agitation rate (rpm) are held constant for all experiments. The crystals are repeatedly agitated for different lengths of time and characterized after every agitation experiment to quantitatively determine the effect of agitation residence time on the major axis length and aspect ratio distributions of a set of paracetamol crystals.

BSE-29
Name, Major: Jesse Mitchell, Landscape Contracting and Management
Project Title: *Vegetation monitoring in the upper reach of the main channel of Catalpa Creek*
Faculty Advisor, Department: Timothy Schauwecker, Landscape Architecture; Joby Czarnecki, GRI; John Ramirez, Civil and Environmental Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: The Red Bud-Catalpa Creek Watershed is an 11,707-ha watershed in northeast Mississippi. The watershed drains parts of the southeastern corner of the City of Starkville, Mississippi as well as the southern portions of the Mississippi State University campus, most of the H.H. Leveck Animal Research Center (South Farm), and the entirety of the Mississippi Agriculture and Forestry Experiment Station (MAFES) Dairy Unit.

Our research has focused on identifying existing plant species and their relative cover in 19 sample transects that correspond to stream cross-sections along the reach of the main channel of Catalpa Creek at South Farm. Plant species cover data was analyzed to provide a base profile of the plant communities to aid in plant selection during restoration. Preliminary results indicate that there are multiple levels of succession along Catalpa Creek with differing levels of plant diversity, coverage, and disturbance. In areas with a developing tree canopy, dominant species include *Acer negundo*, *Albizia julibissin*, *Maclura pomifera*, and *Juniperus virginiana*. Dominant species in the shrub layer include *Ligustrum sinense*, *Ambrosia trifida*, and *Lonicera japonica*. In the ground layer, dominant species include *Sorghum halapense*, *Toxicodendron radicans*, *Carex cherokeensis*, and *Verbena brasiliensis*.

Future work will focus on continued vegetation monitoring through the 2017 growing season, leading to the use of baseline data in planning for the future installation of Best Management Practices (BMPs) in the watershed. In 2018, we will collaborate with MAFES and the Natural Resources Conservation Service (NRCS) to install several BMPs at South Farm and the Dairy Unit.

BSE-30
Name, Major: Marc Moore, Computer Science
Project Title: *Identifying potential agents causing fish disease outbreaks in Mississippi Delta Using Metagenomics*
Faculty Advisor, Department: Dr. Henry Wan, College of Veterinary Medicine
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: In the past a few years, a number of disease outbreaks attributed to a virulent strain of *Aermonas hydrophila* (VAH) have caused significant economic losses in aquaculture industry in the southeastern United States, especially west Alabama and east Mississippi. Many hypotheses have been asserted but no experiment has been able to replicate the illness using VAH. In this study, we investigated the potential for an unidentified co-factor that aids in the expression of disease caused by VAH that is affecting Mississippi catfish farms using a metagenomic analysis of the pond water from infected and non-infected ponds. Water samples were gathered from two catfish farms and were subjected to ultrafiltration to concentrate the microbial particles and to extract nucleic acids for viruses (both RNA and DNA) and bacteria (16s rRNA). The nucleic acids were then subjected to next generation sequencing with pair-end reads. The sequences were processed with a metagenomic pipeline to compare between the paired samples from the same farm and to identify potential pathogens causing disease outbreaks. If a read is conserved across 16sRNA at a lower level (e.g. species), the pipeline will assign it to a higher taxonomy level (e.g. genus), and so on. Results for 16s rRNA data identified a total of 119 bacterial taxa (species, genus, or family) for pond 1A, 218 for pond 1B, 102 for pond 2A, and 119 for pond 2B. Within the pond pair 2A and 2B, 17 bacterial species were unique in the disease affected pond. In pond 1A and 1B, 15 species were unique to the disease affected pond. It is striking that *Aeromonas hydrophila*, a hypothetic fish pathogen, was identified only in the disease affected ponds but not in the unaffected ponds from either farm. In addition, *Microcystis aeruginosa* was another unique bacterium found exclusively within the infected ponds from both farms. *Microcystis aeruginosa* is a cyanobacteria responsible for the production of harmful algal blooms, neurotoxins, and peptide hepatotoxins that could contribute to the infection. Additional data analyses are required for viral sequence reads, and specific hypotheses will be further developed and validated through laboratory challenge studies.

BSE-31
Name, Major: Jenna Mosier, Biological Engineering
Project Title: *Effect of Fetuin-A as Protein Therapy for Calcification of Vascular Smooth Muscle Cells*
Faculty Advisor, Department: C LaShan Simpson, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Vascular calcification exists as an active process related to cardiovascular disease, and is typically seen as a result of the osteoblastic differentiation of smooth muscle cells. It is associated with an increase in free calcium and phosphate molecules in the serum that deposits in an atypical manner, leading to calcification and inflammation in the medial and intimal layers of the arterial wall. In order to inhibit and potentially reverse this process, current research has focused on a naturally occurring, circulating protein, Fetuin-A (AHSG), that reportedly acts as an inhibitor of calcification by binding to these free particles. In several studies, it is found that dialysis strips the body of fetuin, resulting in lower levels than found in healthy patients. Our goal is to not only understand the mechanisms behind this protein, but also to determine how it can be utilized as a therapeutic agent for patients with calcification. In this study, we will culture and treat human vascular smooth muscles cells in order to 1) induce calcification of the VSMCs, and 2) determine the level of fetuin required to most effectively reverse calcification. Cells will be cultured in calcifying media and treated with bovine fetuin, then analyzed with a calcification kit, PCR, western blots, and staining to determine calcification levels, protein levels, and gene expression, respectively. In future studies, we hope to potentially mimic uremic conditions *in vivo* to see if added fetuin has the desired effect in a living system.

BSE-32
Name, Major: Virginia Mullins, Biological Engineering
Project Title: *Alginate hydrogels as an injectable cell delivery system*
Faculty Advisor, Department: C LaShan Simpson, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Calcification of the arteries is an indicator of future heart disease and occurs primarily in patients with chronic kidney disease. A breakthrough in the study of vascular calcification was the realization that the process is similar to osteogenesis. This discovery led to the idea of using osteoclasts as a mechanism of reversing calcification just as osteoclasts reverse bone formation. My project studies alginate hydrogels as a means of directly delivering osteoclasts to sites of calcification. Alginate hydrogels are biocompatible and are highly useful in biological engineering. A calcium chloride (CaCl2) solution is used to ionically cross-link by using its divalent cations to bind to the guluronate blocks of the alginate that causes adjacent polymer chains to form junctions. The cross-linking process results in a gel structure. These hydrogels can also be formed in the shape of microbeads. These beads have a potential use in therapy for vascular calcification by encapsulating osteoclasts and then being injected directly into sites of calcification. Alginate microbeads can be formed quickly using a 1% sodium alginate solution and a 20% CaCl2 solution. The alginate solution is then dropped into the calcium solution using a syringe pump. The syringe pump allows a steady flow of alginate which causes consistent formation of beads. Production of microbeads capable of delivering osteoclasts to sites of calcification could prove to be an important step in therapy for vascular calcification.

Hydrogel microbeads were produced using a sodium alginate and a calcium chloride solution. These solutions resulted in a simple and fast gelation. Both solutions required a minimum stirring time of 12 minutes. Independent variables including stirring speed of the solutions, rate of the syringe pump, and needle sizes were examined for this project to determine optimal conditions for manufacturing microbeads.

BSE-33
Name, Major: Guarav Nag, Mechanical Engineering
Project Title: *Hydrodynamics of Turtle Shells*
Faculty Advisor, Department: Dr. Shanti Bhushane, Mechanical Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: The main objective of the project is to study the hydrodynamics of different turtle shells with different sizes and understanding the relationships between turtles optimum foraging and habitual selection. We approach the problem by generating a database of common species of turtles such as pond turtles, river cooters, and softshell turtles with the use of webdigitalizer to generate plot points and then generating 2D and 3D generated grids using PointWise to get geometry data. ANSYS Fluent is used to establish final simulation. It is observed that the generated grids have high Reynolds number which indicates turbulent flow. Therefore, the kω-SST turbulence model proved to be the most accurate model for the simulation and providing the final data points of lift and drag coefficients. It has been observed that there were two main outliers: Large softshell and large cooters, turtle due to physical characteristics and high pressure at the top and bottom of the shell. It has been reviewed that turtles with high drag and low lift coefficients such as cooters are more likely to stay under water and forge plants; on the other side, with high lift and low drag coefficient such as softshell turtles are likely to be found at the top or middle of the water body and hunt for food. For the ongoing work, simulation on multiple turtle shells should be carried out to validate the conclusion.

BSE-34
Name, Major: Brooke Nash, Chemistry
Project Title: *Removal of Aflatoxin M1 from contaminated Milk used Modified Biochar*
Faculty Advisor, Department: Dr. Ashli Brown, Mississippi State Chemical Lab
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: When dairy cows consume corn contaminated with *A. flavus,* their milk may become contaminated with Aflatoxin M1 (AFM1), a highly carcinogenic substance. If milk has an AFM1 concentration above 0.5 ppb, the FDA standard, the milk cannot be sold. In this study, douglas fir biochar was used to remove AFM1 from water and milk to produce a low cost and efficient method of extracting AFM1 from raw milk. Two biochars were synthesized for this project by impregnating with Mg/Al and magnetizing the chars using Fe2O3.Additionally, an unmodified douglas fir biochar was used as a baseline comparison. The characterization of the chars included surface area measurements, scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy dispersive x-ray spectroscopy (EDX), thermal gravitational analysis (TGA), and x-ray powder diffraction (XRD). Batch adsorption tests, pH studies, kinetic studies, and isotherm studies were conducted using high performance liquid chromatography (HPLC). This study will also be looking at the adsorption of aflatoxin in milk using HPLC/MS and ELISA analysis. The use of biochar may prove to be an easy and effective method for reducing AFM1 in raw milk that would benefit both farmers and consumers.

BSE-35
Name, Major: Nancy Nguyen, Biological Engineering
Project Title: *Examining the Use of AFM to Measure Stiffness in Calcified Vascular Smooth Muscle Cells*
Faculty Advisor, Department: C LaShan Simpson, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Vascular calcification is an active process which involves cell activity. Vascular calcification occurs when calcium builds up in areas that should not be. A precise mechanism for vascular calcification is not completely understood. It is believed that the process of calcification resembles of bone mineralization. It involves smooth muscle cells (SMC) forming osteoblast-like cells. Vascular smooth muscle cell are not differentiated; therefore, they can alter their phenotype in response to their environment which plays a key role to the process of calcification. There are different types of vascular calcification that can occur and various inducers and inhibitors that plays a role in calcification formation.

My project was to properly use and test for mechanical properties using the atomic force microscopy (AFM). This include looking at different articles how they prepare their sample to use AFM and observing their results. Depending on their research, different articles will culture and seed their cells differently. This is a general force-curve graph that I am shooting for when performing AFM. The stiffness of the cell can be evaluated using the slope of the force curve.

Testing our samples for mechanical properties guides us in the correct direction. We will need data to examine our results from experimentation. The cells would need to be tested before and after inhibitors are added to the calcified cells to look for increase or decrease of stiffness and calcification.

BSE-36
Name, Major: Hannah Nichols, Biological Engineering
Project Title: *Influence of Acid Etching on Pure Magnesium and its Alloys for Bone Fracture Fixation*
Faculty Advisor, Department: Lauren Priddy, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Because it is bioabsorbable and has mechanical properties similar to bone, pure magnesium has potential to be an effective metal used in orthopedic implants. The main obstacle to its implementation is its rapid degradation rate *in vivo* that can exceed the rate of healing of a fracture, induce inflammation, and provoke other adverse effects. One way to tailor the degradation rate of magnesium is to alloy it with other metals. The goal of our research is to compare the *in vitro* degradation rates of Mg alloys AE44, AM60, AZ31, and AZ91 to pure magnesium. Another way to modify degradation rate is by creating an equipotentialized surface through a process called acid etching, which is achieved by dipping a metal in an acidic solution to remove its residual oxide film. A pilot study comparing the degradation of an unchanged and acid etched sample of pure magnesium is currently being performed with the intent of performing a full-scale experiment based on the data collected. Samples of each alloy, unaltered and acid etched, will be submerged in a 37 C saline solution that mimics the properties of body fluid. The hydrogen gas (a byproduct of magnesium degradation) produced by each sample will be measured at specific time points to determine the degradation rate. Future experiments can improve upon this work by prolonging the duration of the experiment, using Hank's solution instead of a saline solution, and testing degradation rate using potentiodynamic polarization. As new Mg alloys and methodologies for testing degradation rate and biocompatibility are being developed, further investigation is necessary to determine which alloys would be best suited for various orthopedic applications.

PSE-11
Name, Major: Randall Niffenegger, Physics
Project Title: *Lost in Space: The Starchive*
Faculty Advisor, Department: Angelle Tanner, Physics and Astronomy
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: It is not hard to get lost in space, especially when looking for habitable life. When searching for extrasolar planets, or exoplanets, astronomers often put together information from varying sources such as large sky surveys, individual research documents, and cataloged tables. Doing this is like several people trying to put together a large puzzle with varying sets of pieces. You can see they are all forming a picture, but none of their pieces can connect to the other person's. The goal of the Starchive is to finish the puzzle. The Starchive is an open access stellar archive that will allow astronomers to share datasets to our expandable database and extract data collected from other astronomers. They may also utilize our existing data highlighting the parameters and spectra of young stars within 30 parsecs. The goal of this archive is to make an easy-to-use, central location for astronomers to compare stars parameters, which are not easily obtained, through combining all known datasets of these star and providing useful plotting tools. Currently focusing on young and nearby stars, important for searching for exoplanets, the open access nature of the database will allow the Starchive to grow to accommodate any valid datasets entered, and mold to the needs of the exoplanet community. A database of this size and versatility is a rather large leap into big data handling for the astronomical community. The Starchive hopes to pioneer these ideas in data handling and share our techniques with other fields to help navigate the space that is big data.

BSE-37
Name, Major: Amber Owen, Wildlife and Fisheries Science/Aquaculture and Fisheries
Project Title: *Assessing Species-Habitat Relationships in Priority Open Pine Ecological Systems in Mississippi*
Faculty Advisor, Department: Dr. Kristine Evans, Wildlife, Fisheries, and Aquaculture
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Landscape-level conservation planning efforts require assumptions regarding species-habitat relationships in priority ecological systems when identifying desired future conditions across large landscapes. In the Southeastern U.S. indicator species in imperiled open pine ecosystems are used to provide wildlife managers and biologists' insight into habitat conditions. In this study we surveyed for five open pine system indicator species including Bachman's sparrow (Peucaea aestivalis), Brown- headed nuthatch (Sitta pusilla), Northern bobwhite (Colinus virginiana), Red-cockaded woodpecker (Leuconotopicus borealis), Pine warbler (Setophaga pinus), and Prairie warbler (Setophaga discolor) in three management units containing upland pine forest in Sam D. Hamilton Noxubee Wildlife Refuge, Mississippi. These species all prefer open understory layers in a predominately pine system and the presence of some forbs and grasses. We sought to use empirical point transect bird survey and forest structure data across a random sample of 157 points during June 2016 to create species-habitat association models to further close knowledge gaps of how priority species interact with their habitat. We used Poisson regression models in an information theoretic approach to assess target species relationships with forest structure variables. Pine and Prairie warblers were the most detected target species across management units. Out of the five target species, habitat association models were made for Brown-headed nuthatch, Pine warbler, Prairie warbler. The models for Brown-headed nuthatch and Pine warbler showed a preference for pine bsal area. Additionally, the Pine warbler models showed that ground story also had a noticeable impact on relative abundance. Prairie Warbler models showed no noticeable preference for one habitat component with relative abundance influenced by components of pine basal area and overstory, hardwood midstory, and shrub and herbaceous ground cover.

BSE-38

Name, Major: Brianna Palmer, Animal and Dairy Sciences
Project Title: *Gopher Frog Health Study*
Faculty Advisor, Department: Dr. Carrie Vance, Department of Biochemistry, Molecular Biology, and Plant Pathology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: In 2010, an amphibian captive breeding program was established at Mississippi State University (MSU) in collaboration with various zoological organizations. This program is dedicated to understanding amphibian physiology and developing artificial reproductive techniques for declining species, such as the endangered Mississippi gopher frog (MGF). The MGF inhabits a single lake located in Harrison County Mississippi, has a total population of <100 individuals, and is one of only five amphibian species that is managed through a species survival plan (SSP). In 2012, a group of 3-4 year old MGFs (n=24.26) arrived at MSU.

This longitudinal study examined male MGFs (n=13) that were simulated with hormone treatments to produce sperm for assisted reproductive technologies from 2013 to 2017. The objective was to compare: 1) the number of injections, 2) weight, and 3) sperm quality (concentration and mobility) in each individual and across the population. Weights were taken weekly to monitor each individual's health, and sperm quality parameters were recorded in association with experimental hormone treatments. Data for each individual was entered into excel, transcribed into pivot tables, and graphed to display weight variation overtime.

The average number of hormone treatments per animal was 1.7, 1.9, 0.38, and 1.9 each year from 2014-2017, respectively. We found a negative correlation between sperm quality and the cumulative number of hormone treatments; specifically the average sperm mobility for the male population in 2015 was 48.5% and decreased to 0.0% in 2017. Moreover, a positive correlation between weight and the cumulative number of hormone treatments was observed, such that from 2013 to 2016 individuals gained on average 13 grams. In one case, male ID7450 had a decrease in sperm mobility by 49.7% and simultaneous weight gain of 21.9 grams. Examination of exogenous hormone treatments and the effect they have on amphibian reproductive physiology and health is ongoing.
Key words: amphibian; reproduction; health

BSE-39
Name, Major: Kendall Pargot, Biological Sciences
Project Title: *Genomic arrangement and function of genes associated with local adaptation and species cohesion in Helianthus annuus.*
Faculty Advisor, Department: Marl E. Welch, Biological Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: The objectives of this study were to investigate (a) the genomic structuring of intraspecific divergence and (b) the potential protein products of genomic regions under selection using population-level transcriptomic data. As part of a previous study, population genetic analyses were performed using RNAseq data collected from wild populations of Common Sunflower (*Helianthus annuus*) to identify transcriptomic regions under selection. A *de novo H. annuus* transcriptome assembled during this previous study was mapped to the newly published reference genome with the program GMAP. An additional alignment program, SPALN, was used to compare alignment accuracy for regions of the transcriptome that were multiply mapped. Of the 20,694 successfully mapped regions, 12,574 mapped to a single location in the genome. Using an approach based on joint assessment of ϕST and Tajima's D population genetic statistics, 999 outlier loci were found. Of these, 383 were singly mapped. Due to uncertainty associated with multiple mapping locations, only singly mapped regions were used in spatial analyses. To assess whether outlier regions were randomly distributed along chromosomes, a randomization approach was implemented, and spatial autocorrelations of population genetic statistics among loci were tested using Mantel tests. Gene ontology analyses were conducted using BLAST and Gene-Merge. We hypothesized that genes involved in local adaptation will have a clustered distribution across the genome, and that selectively consequent genes will be enriched for gene ontology terms associated with geographically variable traits in flowering plants. This work will elucidate the evolutionary processes giving rise to genomic divergence among populations while simultaneously maintaining species cohesion.

BSE-40
Name, Major: Kadie Parker, Biological Engineering
Project Title: *3D Bacterial Cellulose in Tubular Form to Mimic an In Vivo Vascular Environment*
Faculty Advisor, Department: C LaShan Simpson, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Vascular calcification is usually associated with chronic kidney disease (CKD). Vascular smooth muscle cells play an important role in vascular calcification in which the smooth muscle cells differentiate into osteoblasts. It is believed that vascular smooth muscle cells express bone matrix proteins that regulate and promote the process of calcification. Through this process of regulation and facilitation the vascular smooth muscle cells (VSMCs) are differentiated into phenotypically different cells that will generate the calcification. Specific treatments as well as certain cell and protein therapies are currently being researched to treat vascular calcification. However, once the therapies have been developed there is not an effective way to test them in a manner that mimics an *in vivo* environment. This is where bacterial cellulose can become an important resource in vascular calcification research. Bacterial nanocellulose (BNC) is formed from an aerobic bacteria, usually bacteria of the Gluconacetobacter genus. The bacteria can be cultivated in a nutrient media and it is then excreted as an exopolysaccharide. Once created, the BNC can very easily be purified and will contain no impurities or functional groups. Bacterial cellulose has been found to be an appealing biomaterial because it can withstand high temperatures and it has very good mechanical properties and biocompatibility. The BC also has a very stable nanofiber network and a high water content. It's also very versatile and can be produced in various shapes and sizes including tubular form. These characteristics of BC make it a very attractive product to mimic *in vivo* environments for research studies. Also cells, such as smooth muscle cells, can be seeded onto the potential bacterial cellulose tube which would mimic an even better and more accurate *in vivo* environment.

BSE-41
Name: Reid Pearlman
Project Title: *Effective Uses of modified biochar as an anion absorbent and soil amendment*
Faculty Advisor, Department: Richard Baird, Biochemistry, Molecular Biology, Entomology, and Plant Pathology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: As the production of biofuel has increased in recent years, a byproduct of the process, biochar, has drawn much interest from environmental chemists. Its potential uses span from removing harmful species from water to soil amending

Biochar has the ability to inexpensively purify drinking water from various contaminants. Extensive research has determined biochar as an inexpensive, effective, anion adsorbent that can replace current methods. The objective of this study is to study the magnetized biochar's adsorption ability. The environmental contaminates, fluoride and nitrate, were chosen for this experiment. The procedure involved placing 0.05 grams of magnetized biochar into vials with fluoride and nitrate solutions and to agitate for a period of five minutes. Optimal anion concentration, pH, temperature and time were determined throughout the study. The filtered solution was analyzed for fluoride using a UV-Vis spectrophotometer and nitrate using a LC-MS. Magnetized biochar was discovered to adsorb fluoride and nitrate better than non-magnetized biochar.

Recently, farmers have found much use for biochar as a soil amendment. Chitosan-modified biochars, which have been found to retain fertilizers, are currently being investigated as potential inhibitors to fungi that negatively affect the soybean plant. Currently being tested in a greenhouse study, soybeans are grown in a variety of soil inoculated with pathogenic fungi and the most pathogenic fungi is selected for further study. In the next study, the most pathogenic fungi were grown in media and chitosan-modified biochar was added to study its inhibitory effects. Further studies will be carried out using chitosan-modified biochar along with the most pathogenic fungi selected from the previous study using soybeans grown in a greenhouse.

PSE-12
Name, Major: Maggie Powell, Chemistry
Project Title: *Fluoride Removal Using Magnesium/Aluminum Modified Biochar*
Faculty Advisor, Department: Dr. Todd Mlsna, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Biochar is an inexpensive and efficient material that can be used to remove contaminants, such as fluoride, from water systems. Biochar can be made from various biomass and waste materials through pyrolysis. Black Owl Biochar was used for this experiment, previously modified with magnesium and aluminum. Batch adsorption tests were used to determine the best conditions for adsorption of fluoride onto washed and unwashed biochar. To determine the optimum dosage amount both biochars were added to 10 mL of 10mg/L NaF and allowed to shake for 24 hours. Afterwards the solutions were filtered and tested for the fluoride adsorption using UV-Vis spectroscopy.

PSE-13
Name, Major: Garrett Prater, Agricultural Engineering Technology and Business
Project Title: *Assessing in-stream processes along the upper reaches of Catalpa Creek in northeast Mississippi*
Faculty Advisor, Department: Timothy Schauwecker, Landscape Architecture; Joby Czarnecki, GRI; John Ramirez, Civil and Environmental Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Catalpa Creek is listed in the 303-d list of biologically impaired waterbodies due to sediments and a Total Maximum Daily Load (TMDL) has been developed that sets targets for sediment load reductions. In-stream processes can contribute up to 70% of sediment loads to streams in Mississippi. Hypothesizing that in-stream processes are the major contributors of sediment along the Catalpa Creek, a study is in progress performing physical soil testing and continuous GPS surveys on 19 benchmark cross sections focusing on the upper 2.6 mile reach of the Catalpa Creek main stream. The aim of the study is to quantify in-stream sediment loads by identifying temporal changes on the benchmark cross sectional area. Surveys are advanced following stormflow events, using a Trimble Geo7x GPS (1-cm accuracy) unit connected to the Global Navigational Satellite System (GNSS). Temporal changes in cross sections area are estimated using ArcGIS by comparing consecutive cross section surveys. Soil physical characteristics are determined for each cross section considering soil stratification. A volume of eroded material from each cross section is estimated by combining areal changes and physical characteristics of the material. Preliminary results have evidenced that streambank erosion contributes an important amount of sediment loads to the stream. The upper first mile of the main channel is the segment that contributes more sediment loads to the stream. However, the lower reach of the stream (lower 0.5 miles) evidenced progressive erosion processes caused by the presence of a temporary structure that belongs to the construction of the new south entrance to the MSU campus.

BSE-42
Name, Major: Nathaniel Prine, Chemical Engineering
Project Title: *Hydrogels Derived from Decellularized Porcine Aortic Tissue*
Faculty Advisor, Department: Lakeisha Williams, Agricultural and Biological Engineering
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Hydrogels derived from porcine tissue offer a novel treatment for myocardial infarction as a biological scaffold for complete tissue regeneration. The extracellular matrix (ECM) utilized to create these scaffolds is typically extracted from the dermis or urinary bladder, however the decellularization process required for these tissues is time restrictive. Offering a more time- efficient synthesis route, porcine aortic tissue promises unparalleled biocompatibility as well as a sustainable option for *in vivo* tissue engineering. This study demonstrates a unique decellularization process for porcine aortic tissue as well as the synthesis procedure for an injectable, temperature-responsive biological hydrogel. While rheological experiments confirmed temperature-induced cross- linking between 36-38o C, the storage and elastic moduli of the aortic hydrogel were considerably lower than the moduli of dermal or vesical hydrogels obtained in previous studies. Experiments suggest higher ECM concentration directly corresponds to increased hydrogel modulus and could be utilized to enhance the performance of the gel as an effective treatment for recovering victims of myocardial infarction.

PSE-14
Name, Major: Shanterell Redd, Biological Sciences
Project Title: *Aziridination Catalysis by a [Cu(Phen)2(OTf)]OTf Complex*
Faculty Advisor, Department: Joseph P. Emerson, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Aziridines are a strained, three member heterocyclic rings containing an amine nitrogen. Related to epoxides, aziridines have attracted recent interest because of their potential as building blocks for natural product analogues, medicinally active compounds, and polymers. There are two common catalytic routes to aziridines, the first involves a transition metal mediated nitrene transfer to alkenes, or alternatively a Lewis acid (or transition metal) promoted carbene addition to imines; both of these routes have been exploited in asymmetric applications. Copper-catalyzed alkene aziridinations are typically conducted using *N*-tosyliminophenyliodinane (PhINTs) as the nitrene source, with 0.5-20 mol % copper catalyst, although other nitrene transfer agents have been also utilized. Our interest in metal-mediated N-transfer reactions led us to examine catalytic aziridinations with the intent of preparing well-defined pre-catalysts possessing both high reactivity and the ability to use a broad range of nitrene transfer agents. Herein we report the synthesis and structural characterization of a new copper(II) complex that exhibits high reactivity in the aziridination of styrene and styrene analogues, where 0.5 mol % of the complex provides high yields of *N*-tosyl-2-phenylaziridine.

PSE-15
Name: Rebekah Ruiz
Project Title: *Synthesis and Characterization of Unsymmetric CCC-NHC Pincer Ligands Based on Imidazole*
Faculty Advisor, Department: T, Keith Hollis, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Synthetic chemistry has shown a particular interest in organometallic CCC N-Heterocyclic Carbene (NHC) pincer complexes. These species demonstrate a strong electron donating ability, selectivity and stability, making them widely applicable for their use as catalysts in the process of water splitting for hydrogen fuel production, as well as starting materials for organic-LEDs.The tunability of these complexes in regards to quantum efficiency, photostability, and emission wavelengths requires a variance of pyridine-based, heterocyclic ligands coordinated to the transition metal. Our group's three-step synthetic procedure includes an initial backbone cross-coupling reaction to place the heterocyclic compounds on the aromatic ring. Following the isolation of these aromatic backbones, a salt synthesis prepares the compound for deprotonation via a strong base, tetrakis(dimethylamido) zirconium. Once deprotonation occurs the zirconium metal is bound to the pincer ligand. This metal can then be replaced with the desired transition metal. In particular, the Platinum NHC complex has shown desirable photostability and wavelength emissions for the utilization in OLEDs. This summer, I've worked on synthesizing unsymmetrical backbones, alternating common heterocyclic compounds such as imidazole, triazole and benzimidazole, in an effort to identify the most efficient and sustainable route to synthetic platinum complexes. These unsymmetric backbones will allow the pincer complexes to be tuned for the desired properties.

BSE-43
Name, Major: Samantha Rushing, Wildlife and Fisheries Sciences/Wildlife Science
Project Title: *Long-term Viability of Cavity Trees Supporting Bats Roosting at Noxubee National Wildlife*
Faculty Advisor, Department: Dr. Scott Rush, Wildlife, Fisheries, and Aquaculture
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Cavity trees are home to many species of native bats around the world and can be found all across Sam D. Hamilton Noxubee NWR. This research seeks to identify the key characteristics of cavity trees that are most important to bats and what actions should be taken to increase cavity tree numbers and preserve the habitat for bat species. In order to do this, data on such characteristics as DBH and cavity measurements was collected and compared to data collected on the same cavity trees 10–13 years ago. It was determined that occupancy of cavity trees by bats is highly dependent on the size of the tree and the likelihood that trees will survive to a size large enough to be used is low. Therefore, preservation strategies should be put in place in order to allow for cavity trees to grow to a suitable DBH and increase the probability of use by bats.

PSE-16
Name, Major: Erik S. Antonio, Chemical Engineering
Project Title: *Synthesis of Carbon Nanodots from m-Phenylenediamine for the Measurement of Ca Ion Levels*
Faculty Advisor, Department: Santanu Kundu, Swalm School of Chemical Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Calcium is a crucial part to the human body, not only for its role in development of bones and teeth, but also for its effects in blood clotting, as an enzyme, muscle contraction, as well as various other roles. As too much calcium can be as hazardous as too little, there exists a need to accurately, and non-invasively, measure the level of calcium in a biological context. This work's focus is on the development of a simple biological sensor to determine the Ca level in body fluid. CNDs have been selected as the bio-sensor to determine the Ca level due to the higher fluorescence activity and the bio compatibility. Fluorescence intensity of carbon nanodots have been investigated with different Ca concentrations. Carbon nanodots (CNDs) were synthesized from m- phenylenediamine that emit blue (450 nm) fluorescence under ultraviolet light (365 nm) excitation. These CNDs were characterized using FT-IR as well as dynamic light scattering for size and structure information. Utilizing Ultraviolet-visible spectroscopy and Fluorescence spectroscopy a relationship was determined between the fluorescence and the concentration of calcium in solution. Fluorescence emission intensity alters with respect to the Ca ions concentration. In future work, similar studies will be conducted with modified CNDs, to increase the Ca detection sensitivity.

BSE-44
Name, Major: Emily Sanders, Chemical Engineering
Project Title: *Understanding Biochar's Effect on Bacterial Metabolites Using Quantitative NMR Techniques*
Faculty Advisor, Department: Nick Fitzkee, Chemistry
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Biochar is an attractive alternative to activated carbon that is used in soil amendment in agriculture due to its adsorptive properties, porous surface, and inexpensive cost. Biochar is used to treat waste in septic systems, to control algae in ponds, and remove pesticides from water runoff. However, the effect of biochar on the bacteria present in the soil remains poorly understood. Here, we investigate how exposure to biochar influences bacterial growth as reported by metabolic compounds in the growth media. In our experiments, *Escherichia coli* (*E. coli*) was grown in a complex, well-defined media (RPMI) as a model to gain an understanding of how the concentration of metabolites changes over time after treatment with biochar or activated carbon. The optical density (O.D.) at 600 nanometers was measured to assess the rate of bacterial growth after treatment, and quantitative NMR was used to monitor metabolite concentrations. The O.D. measurements showed that the bacteria treated with biochar grew faster than bacteria treated with activated carbon, but slower than untreated media. Quantitative NMR revealed that acetic acid and L-arginine exhibit the largest difference in the biochar-treated media. Together these data suggest that bacterial metabolism is significantly affected by the addition of biochar, and that bacteria in the rhizosphere may grow differently after soil amendment with biochar. Understanding the effects of biochar on bacterial growth could lead to a better understanding of how soil treatment affects the bacteria already thriving there. Future work is planned that will extend out experiments to the directly relevant bacterial species and growth conditions.

PSE-17
Name, Major: Avery Smith, Chemistry
Project Title: *Synthesis of π Conjugated Organoelectronic Materials via Direct Arylation of Electron Deficient Monomers.*
Faculty Advisor, Department: Colleen Scott, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Conjugated polymers have been of growing interest in material science due to their applications as semiconductors. They have the potential for implementation into organic light emitting devices (OLEDs), organic field effect transistors (OFETs), and polymer solar cells (PSCs). They are lightweight, inexpensive, and simple to fabricate owing to the advantage of solution based processing. Their synthesis, however, requires the ability to form aryl-aryl bonds, something typically carried out using traditional cross coupling strategies that employ stoichiometric amounts of transition metals to functionalize the aryl species. These methodologies are not only cumbersome, but require harsh reaction conditions which may not be suitable for sensitive substrates. An alternative approach to traditional cross coupling is the use of Direct Arylation; formation of carbon-carbon bonds without pre-functionalizing reactants via activation of C-H bonds. Direct Arylation, is a regio-selective catalytic reaction that can be carried out with minimal catalyst loading, and without the need for multiple reaction and purification steps, or the generation of toxic byproducts. While some direct arylation conditions require the presence of nucleophilic additives, we will attempt to use a modified electron poor silole monomer to generate conjugated co-polymers with aryl compounds under previously reported milder reaction conditions. Siloles are a family of low band gap compounds, with good charge carrying capabilities and optoelectronic properties. C-H activation on the silole monomer has been unsatisfactory due to ring opening, and non-linear branching polymers. By oxidizing the thiophenes at the 2 and 5 positions on the silole we hope to be able to carry out C-H activation without needing to brominate the silole, a yield sacrificing step.

SS-03
Name, Major: Katelyn Swiderski, Biological Sciences
Project Title: *The Focus4Teens Initiative: Developing Theory-Driven YR1 Needs Assessment Tools for Teen Pregnancy Prevention in the Mississippi Delta.*
Faculty Advisor, Department: Kathleen Ragsdale, Social Science Research Center
Project Type, Category: Poster, Social Sciences

Abstract: Focus4Teens is a multi-year project funded by the Centers for Disease Control and Prevention (CDC) and lead by Mississippi First to reduce teen pregnancy in the Mississippi Delta, which is disproportionately affected by births to adolescents. The Mississippi State University-based Focus4Teens Evaluation Team used the Ecological Model (EM) to explore teen pregnancy prevention (TPP) across individual, interpersonal, community, organizational, and policy factors through the development of theory- driven Focus4Teens YR1 needs assessments. We administered the Focus4Teens needs assessments to four distinct groups of Mississippi Delta TPP stakeholders including 1) youth ages 13-19; 2) parents of youth; 3) health clinic staff who serve youth; and 4) youth-serving organization (YSO) staff. We used focus groups, youth surveys, parent surveys, and in-depth interviews to explore various TPP domains such as 1) sexual and reproductive health (SRH) communication between teens and parents and teens and health providers; 2) teens, parents, and YSO staff members' knowledge of where teens can receive youth-friendly SRH care in their local communities: 3) teens' experiences seeking SRH care and preferred attributes of SRH providers: and 4) perspectives of parents, health clinic staff, and YSO staff on how to facilitate TPP efforts at individual, interpersonal, community, and organizational levels. The Focus4Teens needs assessments also explored community, organizational, and policy barriers to referring and providing SRH care to teens in the Mississippi Delta. Using EM to guide development of the Focus4Teen YR1 needs assessments ensured that multilevel factors were systematically considered for each of Focus4Teen's diverse groups of stakeholders. Grounding the Focus4Teen YR1 needs assessments in EM also increased the utility of the data for Mississippi First and the CDC and ensured the assessments' relevance for teens, parents, health clinic staff, and YSO staff in the Mississippi Delta. The results are being used to inform TPP efforts for Focus4Teens YR2.
External Funding: Centers for Disease Control and Prevention (CDC), Grant No. 1 NU58DP006142-01-00.

BSE-45
Name, Major: Allison Taylor, Biological Sciences
Project Title: *The origin and divergence of the GJB gene family of vertebrates.*
Faculty Advisor, Department: Federico Hoffman, Biochemistry and Molecular Biology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Vertebrate connexins are transmembrane proteins that assemble to form gap junctions that are essential to cell-to-cell communication. The connexin family includes five subfamilies: α, β, γ, δ, and ζ. Gap junctions are essential for many physiological processes, and for this reason mutations in connexin- encoding genes can lead to functional and developmental abnormalities such as partial or whole deafness and peripheral neuropathy. The present study focuses on resolving the evolutionary history of the β- connexin (aka Gap Junction β, or GJB) subfamily of vertebrates. Using computational tools we identified and retrieved the GJB repertoire of representative vertebrates, and non-vertebrate chordates, and used phylogenetic and synteny analyses to study their history. Our results indicate that the GJB and GJA subfamilies derive from a tandem duplication before the emergence of vertebrates. After the tandem duplication, the GJB subfamily expanded first in the common ancestor of jawed vertebrates, with additional duplications in the ancestor of amniotes. In the future, our goal is to assess variation among mammalian GJBs genes in order to compare with pathogenic mutations in humans.

PSE-18
Name, Major: Kevin Trinh, Mechanical Engineering
Project Title: *Shear-thickening behavior of fumed silica suspensions with anistropic nanoparticles*
Faculty Advisor, Department: Santanu Kundu, Dave C. Swalm School of Chemical Engineering
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: Shear thickening fluids (STFs) have generated a great deal of interest due to their shear-rate dependent properties. The importance of these materials arises from their dissipative effect at a large shear-rate, making them suitable for a wide variety of applications ranging from soft-body armors and sport equipment to micrometeoroid protection for spacecraft. Herein, the rheological properties of fumed silica suspensions in polyethylene glycol (PEG) is investigated upon the addition of multi-walled carbon nanotubes (MWNTs) and graphene oxide nanoplatelets (GONPs). Transmission electron microscope (TEM), atomic force microscopy (AFM), and shear- rheology were used to characterize the nanoparticles and the nanoparticle suspensions. Our results show the increase in viscosity at low shear rates and a more continuous shear thickening by adding MWNTs. Incorporation of GONPs improves the shear-thickening behavior as a decrease in critical shear rate for shear-thickening has been observed.

BSE-46
Name, Major: Carol Twilley, Animal and Dairy Sciences/Pre-Vet
Project Title: *Effects of dietary L-Arginine on placental efficiency in mares*
Faculty Advisor, Department: Brian Rude, Animal and Dairy Sciences
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Objectives of this study were to determine effects of L-Arginine supplementation on placental efficiency in mares. Pregnant mares (n=20) were randomly assigned to 2 diets beginning 21 days prior to expected foaling date. Diet 1 (C): basal diet (Nutrena: Safe Choice Mare and Foal) and Diet 2 (A): C plus arginine supplemented at 1% of diet. At foaling, placentas were weighed, and surface area and displacement volumes were determined. Placental efficiency was then calculated by dividing foal weight by placental weight. Data were analyzed using SAS to determine correlations between treatment and weight, volume, surface area, and efficiency of placenta. Placental volume has a strong positive correlation to foal weight (R=0.60353; P=0.0048), placental surface area has a strong positive correlation to foal weight (R=0.71238; P=0.0004), and placental weight has a strong positive correlation to foal weight (R=0.71238; P=0.0003). Treatment did not affect volume of placenta (R= -0.145267; P=0.5485), surface area placenta (R= -0.05771; P=0.809), placental weight (R= -0.23674; P=0.3149), placental efficiency (R= -0.32964; P=0.1558), or foal weight (R= - 0.01771; P=.9409). Further research is needed on arginine supplementation to gestating mares and its effects on placental characteristics.

PSE-19
Name, Major: Kimberly Waggoner, Aerospace Engineering
Project Title: *Correlation Between Grain Size and Hardness*
Faculty Advisor, Department: Dr. Mark Horstemeyer and Stephen Horstemeyer, CAVS
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: General Topic: The strength of structural materials is crucial to the safety of the public and further innovation in technology, and the strength of a material is dependent on its microstructure. Many processes such as annealing and mechanical cold working are used to manipulate the microstructure of materials, and therefore control its strength among other mechanical properties.

Specific Topic: The Hall-Petch relationship between grain size of a metallic microstructure and the strength of the material states that as the grain size decreases, the strength of the material will increase. We designed our experiment to observe if the effects of the Hall-Petch relationship were apparent after subjecting cubes of several common structural metals to compression testing.

Method: We machined 0.38" cubes of pure copper, pure magnesium, AE 44, aluminum 6061, aluminum 7075, and aluminum 1100F. We then subjected them to compressions on the Instron 5882. Next, we cut the cubes to reveal the grains along the X, Y, and Z planes of the material, and mounted the pieces to prepare for metallographic polishing and etching. We examined the microstructure on an optical microscope, and conducted grain size analysis on the pictures we took. We then performed Rockwell hardness testing on each of the specimens.

Results: This project is ongoing, however from the data obtained on pure copper there is a correlation in the grain size and hardness that shows what would be expected from the Hall-Petch relationship.

BSE-47
Name, Major: JaCynto Walker, Biological Sciences
Project Title: *Pyrolysis of Southern Yellow Pine with High Concentrations of co-Fed HDPE Plastic*
Faculty Advisor, Department: Dr. Jason Street, Sustainable Bioproducts
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: It has long been established that the components found in bio-oil need to be upgraded to be able mix with traditional hydrocarbon fuels. Bio-oil obtained from biomass is highly oxygenated and chemically unstable. There have been different attempts of solving this problem, but the experiments are very expensive and can quickly cause catalyst deactivation. This project involves a co-pyrolysis technique, which utilizes HDPE plastic and iron oxide during pyrolysis for the production of improved bio-oil that has a lower oxygen content, higher carbon content, and higher hydrogen content using an auger pyrolysis reactor. Multiple experiments using various percentages of pine, iron oxide, and plastic were performed using a high residence time and elevated temperature (> 575 ^{o}C). The oil from the experimental runs was obtained and the chemical and physical properties were analyzed to determine the most advantageous concentration of feed to produce oil with the best qualities. This new approach should reduce the concentration of oxygen contained in the bio-oil while making it more stable, so that the oil will be able to better mix with the traditional hydrocarbon fuels.

SS-04
Name, Major: Alexandra Wedderstrand, Psychology
Project Title: *Emotion regulation difficulties and placement instability: Exploring interventions*
Faculty Advisor, Department: Dr. Arazais Oliveros, Psychology
Project Type, Category: Poster, Social Sciences

Abstract: Research has shown a correlation between placement instability in foster care and emotion regulation difficulties. Due to this correlation, a two-part literature review was conducted to determine the effects of emotion regulation interventions in foster care populations. The first part of the review found four interventions studied in foster care populations. The second part of the review found an additional three interventions studied in foster care populations that also included permanency outcomes. The review found several common factors among the interventions that contributed to success. Among these common factors were a focus on emotion regulation and a caring, consistent adult. One implication of this review is that it may inform the development of interventions for foster care populations designed to decrease placement instability. The lack of interventions found, though, should also be noted, as more interventions should be put in place to increase child wellbeing and decrease placement instability. An additional implication of the current review is that research-supported interventions could be used to supplement or replace trainings for foster parents required in many states.

BSE-48
Name, Major: Kristina Wielgosz, Chemistry
Project Title: *Phosphate removal with modified magnetized Douglas Fir biochars*
Faculty Advisor, Department: Ashli Brown, Darrell Sparks, and Todd Mlsna, Department of Biochemistry, Molecular Biology, Entomology, and Plant Pathology
Project Type, Category: Poster, Biological Sciences and Engineering

Abstract: Phosphate is a major contributor to surface water eutrophication. In this study, two different magnetized magnesium-aluminum biochars were used to remove phosphates from water, serving as a low-cost water purification alternative to activated carbon. Douglas Fir biochar was impregnated with aluminum and magnesium cations then magnetized. A second Douglas Fir biochar was first magnetized then modified with magnesium and aluminum cations. The ability of the biochar adsorbents to remove phosphates from water was evaluated. The biochars were characterized using elemental analysis, scanning electron microscopy (SEM), transmission electron microscopy (TEM), surface area analysis (BET), energy-dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), and thermogravimetric analysis (TGA). Water batch adsorption tests were performed to measure and compare the characteristics of the biochars and determine optimum conditions for phosphate adsorption by the chars. The pH dependence, maximum adsorption, and equilibrium time were analyzed. Isotherms and kinetics were fitted to determine the maximum capacity of the chars and the order of the kinetics, respectively. The pH study was performed to determine the optimum pH for adsorption of phosphate. Batch adsorption competitive ion tests were also performed. The phosphate levels in the water from the batch adsorption tests were analyzed using ion chromatography. To test real world applications for the biochars, pond water samples were collected, spiked with phosphates, and tested for phosphate removal using the same batch procedures. This work proves that a combination of magnetized biochars with magnesium and aluminum, all low cost and available materials, can be used as an effective adsorbent to remove phosphate from aqueous solution.

PSE-20

Name, Major: Peyton Williamson, Physical Education/Kinesiology
Project Title: *Impact of Grip Diameter and Resistance Exercise on Muscular Performance*
Faculty Advisor, Department: JohnEric Smith, Department of Kinesiology
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: This study was designed to examine the effects of bar diameter on resistance training performance. Participants reported to the Applied Physiology Lab for three individual trials separated by 6 days of rest. Trial 1 was a familiarization while trials 2 and 3 were used to assess one-rep max, and were randomized between a standard Olympic bar and a standard Olympic bar + Fat Gripz attachment. The experimental trials were comprised of deadlift, bent-over row, upright row, barbell curl, and pull-ups, tested in that order. An approximately 10-minute dynamic warmup preceded each experimental trial. During the assessment, participants attempted to achieve a one rep max within 3 – 5 sets following three warmup sets. The warmup sets were 5 – 10 repetitions (1st warmup set) and 3 – 5 repetitions (2nd and 3rd set). Sets 1 and 2 were separated by 60 seconds of rest, while sets 2 and 3 were separated by 120 seconds of rest.

PSE-21
Name, Major: Tyler Woodby, Microbiology
Project Title: *Synthesis, Arylation and Metallation of Unsymetrical Proligands*
Faculty Advisor, Department: Keith Hollis, Chemistry
Project Type, Category: Poster, Physical Sciences and Engineering

Abstract: A general synthesis of bis N-heterocyclic carbene (NHCs) transition metal (Zr, Pt, Ni) pincer complexes has been reported previously. The reaction of 1,3-bis(imidazolyl)benzene with various alkyl halides - 1-iodobutane, 1-chlorobutane, and trimethylsilylmethyl iodide - has been extended to variations such as 1,3-bis(benzimidazolyl)benzene. A similar method was developed and optimized for the synthesis of 1-(1,2,4-triazole)- 3-bromobenzene for future use in unsymmetrical proligand synthesis. In a previously reported reaction, diphenyliodonium tetrafluoroborate or triflate salts were used to arylate the proligand. Arylation of the pro-ligand allows for further tuning of the steric and electronic properties of the pincer ligand. The proligands can then undergo metalation through a previously reported reaction using Zr(NMe2)4 and subsequent transmetalation with Pt(COD)Cl2 or Pd(COD)Cl2 for synthesis of new OLED materials.

Support provided by: