8th Annual

University Research Symposium (URS)

March 5, 2019

Hughes Gymnasium | Bell Conference Center

University of West Alabama

Livingston, AL

Venue: Hughes Gym

Poster Sessions | Graduate/Career Expo

8:00 am – 3:30 pm

- Registration and Poster setup 8: 00 am – 9: 00 am
- Poster viewing session I, Judging round 1 & Graduate/Career Expo 9:00 am – 12:30 pm
- Group Photo 12:30 pm
- Graduate/Career Expo 12:30 – 1:30 pm
- Poster viewing session II, Judging round 2 1:30 – 3:30 pm

- Break 3:30 – 4:30 pm

Venue: Bell Conference Center

Keynote | Awards

5:00 – 7:00 pm

- Keynote (Discussion with Jo: Learn about the journey of Jo Handelsman from Cornell to the White House to Wisconsin)
- Dinner
- Closing Remark and Awards Ceremony

ORGANIZING COMMITTEE

Dr. Mustafa Morsy, Chair

Dr. Jing Chen

Mrs. Hoda Hassan

Dr. John McCall

Dr. Hung King Tiong

Mr. Caleb Walters

MESSAGE FROM THE PRESDIENT

I am pleased to welcome all students, faculty, staff and visitors to our campus for the 8th annual University Research Symposium taking place on March 5th, 2019.

The URS is one of the most valuable experiences we can offer to our students, particularly undergraduates, to help them join graduate programs beyond UWA and to provide them with better career opportunities.

I was delighted to learn that almost 120 student authors are in attendance from UWA, the Alabama Water Institute, Auburn University, Birmingham Southern College, Stillman College, The University of Alabama, The University of Alabama at Birmingham, The University of Southern Mississippi, and the University of West Georgia. I would like to welcome each of you to UWA and wish you the best in your endeavor.

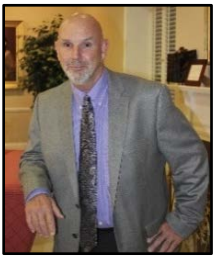
I am pleased that this year's symposium accepted student presentations from all programs offered by UWA, including graduate programs. Such expansion should support the significant growth in our program offerings such as the Ed. D. in Rural Education doctoral degree, and other new programs added in the last few years. We are proud of our growth and are happy to share the exciting accomplishments of our students, faculty and staff. I would like to praise all students and mentors for their efforts in developing such stimulating and diverse topics and studies.

I also would like to welcome to our campus the keynote speaker, Dr. Handelsman, who is the Director of the Wisconsin Institute for Discovery, at the University of Wisconsin-Madison. We are looking forward to an inspiring talk and discussion to motivate a new generation of successful graduates.

Finally, let me wish you well in your participation in this exciting conference and I hope that this will be the first of many more URS conferences on your research agenda.

President Ken Tucker

MESSAGE FROM THE DEAN



In the College of Natural Sciences and Mathematics, we strongly believe in treating "science" as a verb. It's not something you study – it's something you do. We want our students to understand that their chosen field is much more than a collection of facts. It's a process - a way of doing things. In light of this philosophy, we place great emphasis on involving our students in actual research. When students engage in independent research under the guidance of talented faculty mentors, they gain insight into the process that can be attained in no other way. Immersion in the techniques of academic research provides undergraduate students with a deeper understanding of their academic fields and prepares them for success in their academic pursuits and future careers. The faculty of the College of Natural Sciences and Mathematics takes great pride in the diverse backgrounds and individual interests of our students. The excellent mentors in the College take pride in assisting research participants concentrate in their field of focus and refine the skills of scientific research. Since 2012, the College has sponsored the University Research Symposium (URS) on Assessment Day each Spring Semester. It has grown from a small group of students displaying their research posters in a classroom in Bibb Graves Hall to a collection of some of the most outstanding student researchers from around the state and beyond. On this day, we celebrate the year's research efforts as students present the results of their research to a panel of judges and to the broader UWA community. Researchers from diverse disciplines highlight current and recent research projects, showcasing a wide range of topics, approaches, and interests. The URS also serves as a resource for other students not yet engaged in research pursuits. Such students can learn what sparked the intellectual interests of their fellow students, and how they can develop research projects of their own and nurture connections with faculty mentors. Finally, the URS has developed into an occasion for students, faculty, staff, prospective students, and alumni to celebrate the year's student achievements and to witness how student projects enhance learning, support faculty members' own work, and serve the greater community.

Dean John McCall

MESSAGE FROM THE CHAIR

On behalf of the organizing committee, it is my great pleasure to welcome you to the University of West Alabama's 8th Research Symposium (URS). I am happy to extend a warm welcome to students and visitors from nine regional institutions.

This year's symposium features more than 100 student authors from all scientific disciplines. The URS has played a vital role in advancing undergraduate research at the University of West Alabama (UWA) and we anticipate that the URS will greatly contribute to the experiences of our growing graduate student population as the University expands its graduate programs in various disciplines.

Educating students has always been the primary objective of UWA. We believe that the best way to achieve this is to expose our students to intellectually important questions through independent research and hands-on learning. The URS provides an accessible forum for students to display and promote their scholarly research. In addition, the URS provides students with opportunities to network with graduate and professional schools alongside industry representatives. I am thrilled that the URS exists to provide such opportunities not only for UWA students, but for students from colleges and universities all over the South.

Throughout the day, you will have the opportunity to meet colleagues and presenters, to discuss various ideas, and to expand your knowledge and network. We will conclude the day with wonderful words from the keynote speaker, Dr. Jo Handelsman.

I look forward to meeting and working with every one of you to build a community of successful professionals in the region.

Enjoy your day.

Mustafa Morsy

Chair and Co-founder

KEYNOTE SPEAKER

The keynote speaker is Dr. Jo Handelsman is well-known for her research on soil microbial communities. She is one of the pioneers of functional metagenomics, an approach to studying the functional diversity of unculturable bacteria in environmental samples. She is also known internationally for her efforts to improve science education and participation of women and minorities in science.

Dr. Handelsman assumed the role of Director of the Wisconsin Institute for Discovery, at the University of Wisconsin-Madison in February 2017, where she was honored recently as a Vilas Research Professor. In her previous role, she served as the Associate Director for Science at the White House Office of Science and Technology Policy (OSTP), appointed by President Obama and confirmed by the Senate in June of 2014. Prior to joining OSTP, she was a Howard Hughes Medical Institute Professor and Frederick Phineas Rose Professor in the Department of Molecular, Cellular and Developmental Biology at Yale University. She received her Ph.D. in Molecular Biology from the University of Wisconsin-Madison in 1984, and she served on the faculty at the University of Wisconsin-Madison from 1985 until moving to Yale in 2010.

Jo's leadership led to her appointment as the first President of the Rosalind Franklin Society; her appointment as President of the American Society for Microbiology in 2013; her service on the National Academies' panel that wrote the 2006 report, "Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering;" her role as co-chair of the PCAST working group that developed the 2012 report, "Engage to Excel," which contained recommendations to the President to strengthen STEM education to meet the workforce needs of the next decade in the United States; and her selection by President Obama to receive the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.

SPONSORS

The Tombigbee RC&D mission is to carry out activities that accelerate the development, conservation and wise use of human, financial and natural resources in order to improve the standard of living within the area.

RC&D is a local nonprofit organization led by local community leaders. To help you understand how RC&D works, the following information explains the RC&D program, the RC&D Area, the Council, and the relationships and responsibilities of each.

RC&D was initially started back in the 1960's to address rural poverty and help rural communities generate sustainable natural resource-based economies. Although today many RC&D Areas are not rural and are not poor, the need for the RC&D concept is just as strong as ever. RC&D is not the same-old, same-old – RC&D is collaborative, multi-leveled, action-oriented, and inclusive. And, sometimes, "RC&D" is difficult to explain and difficult to quantify. However, the effect of the RC&D approach to solving community problems involving local people in voluntary, empowering ways can be felt by almost every RC&D project that happens across the country.

SPONSORS

In the summer of 1930, Elton B. Stephens began selling magazines door-to-door in Birmingham, AL. Fourteen years later, after putting himself through undergraduate and law school, Elton and his wife, Alys, began what would become one of the largest privately held companies in the United States—EBSCO. Today, we operate businesses in a wide range of industries, from information services to manufacturing, and we employ 5800 people in 26 countries around the world. While we have grown in many ways, we continue to operate with the same entrepreneurial spirit and drive that originated with our founder.

SPONSORS

THE UNIVERSITY OF ALABAMA® | Alabama Water Institute

The University of Alabama established the Alabama Water Institute (AWI) in 2017 to build upon the strengths and excellence of campus programs in water-related research, education and innovation. The AWI focuses on basic and applied research efforts to sustain waterways, marshes, estuaries and coastal areas. It provides a forum for interdisciplinary research and education and brings together university researchers, students and staff to foster collaboration and a broad interdisciplinary focus on water issues that face our world today. AWI-affiliated researchers specialize in remote sensing, hydrological modeling, water quality, biodiversity, watershed management and human health through synergies with existing centers and the creation of new centers under the umbrella of AWI. To learn more about AWI, visit http://awi.ua.edu.

SPONSORS

Tiny Earth is a network of instructors and students focused on crowdsourcing antibiotic discovery from soil. The mission of the program is two-fold:

First, it seeks to inspire students to pursue careers in science through original laboratory and field research conducted in introductory courses with the potential for global impact.

Second, it aims to address a worldwide health threat—the diminishing supply of effective antibiotics—by tapping into the collective power of many student researchers concurrently tackling the same challenge, living up to its motto "studentsourcing antibiotic discovery."

Tiny Earth as we know it was launched in June of 2018, but it truly began six years earlier when Jo Handelsman founded a course—then called "Microbes to Molecules"—at Yale University with the goal of addressing both the antibiotic crisis and the shortage of science trainees. In short order, the course grew and became a part of a larger initiative until Handelsman returned to the University of Wisconsin-Madison and launched Tiny Earth in collaboration with its hundreds of partners worldwide.

Today nearly 10,000 students are enrolled in some version of the course annually in 45 U.S. states and 15 countries. The program, headquartered at UW-Madison's Wisconsin Institute for Discovery, is more than just a course: a network of talented students and instructors share research findings, best practices, and enthusiasm for discovery. The name Tiny Earth reflects the program's global reach, microscopic subjects, and tight-knit community.

SPONSORS

Waste Management is the largest environmental solutions provider in North America, serving more than 21 million municipal, commercial and industrial customers in the U.S. and Canada. We have invested in developing waste solutions for a changing world. Today, this includes not just disposal and recycling, but personal counseling to help customers achieve their green goals, including zero waste.

Waste Management is North America's largest residential recycler and a renewable energy provider. We recover the naturally occurring gas inside landfills to generate electricity, called landfill-gas-to-energy. Waste Management's fleet of natural gas trucks is the largest heavy-duty truck fleet of its kind in North America. With the largest network of recycling facilities, transfer stations and landfills in the industry, our entire business can adapt to meet the needs of every distinct customer segment.

As North America's leading provider of comprehensive waste management services, our mission is to maximize resource value while minimizing impact in order to further both economic and environmental sustainability for all of our stakeholders.

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- UWA College of Natural Science and Mathematics
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- Alabama Power
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TABLE OF CONTENTS

1. Effect of Curcumin and Piperine on *Toxoplasma gondii* (ME-49 Strain) Growth

Daniel A. Abugri[1*ǂ], Roishinique Johnson[2ǂ], Boniface J. Tiimob[1], Farooq Syed[3], Shaik Zainuddin[3], and Mahesh Hosur[3]

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Curcumin (1E,6E)-1,7-bis (4-hydroxy- 3-methoxyphenyl) - 1,6- heptadiene-3,5-dione) is a polyphenol bioactive compound known to have several biological and pharmacological activities such as antiplasmodium, antileishmania, antitrypanosomal, antischistosomal, anti-giardia, anticryptoporodium, antiviral, anticancer, antidiabetics, anti-inflammatory, and antioxidant properties. Piperine, a natural alkaloid present in *Piper nigrum* and *Piper longum* and known to potentiate antibiotics activity, curcumin neuroprotective activity and enhances curcumin bioavailability *in vivo*. However, little is known about curcumin and piperine anti-*Toxoplasma gondii* activity, especially in the type-2 ME 49 clone 7 strain that is known to affect HIV-AIDS patients. Additionally, type-2 ME 49 is known to easily transform to the bradyzoites form during culture in host cells. In this study, we reported for the first time the anti-*Toxoplasma gondii* (ME-49 strain) activity of curcumin and piperine at 72 h *in vitro.* The IC_{50}s for curcumin (CU), piperine (PP), sulfadiazine (SZ) and pyrimethamine (PR) were calculated to be 2.55mM (p <0.001), 4.77mM (p = 0.58), 5.03mM (p = 0.05), and 0.10mM (p = 0.09) respectively at 72 h. In conclusion, these natural bioactive compounds were found to be good potential inhibitors of *T. gondii.* Thus, further studies using derivatives of curcumin and piperine as well as their combination with the current anti-*Toxoplasma* drugs will lead to the discovery of new effective and safe antitoxoplasmosis drugs.

2. Phytoaccumulation of Arsenic from Biosolids Obtained from the Prudes Creek Wastewater Treatment Facility in Jefferson County, Alabama

Abrar Alfantokh, Kevin Morse, and Ketia Shumaker

Department of Biological and Environmental Sciences, University of West Alabama, Livingston, AL 35470

Heavy metals (HMs) are one of the most hazardous contaminants in the environment due to the adverse effects it can have on biological systems. Various methods are used to clean up HMs from the environment, but most of them are expensive and cause negative impacts on the ecosystem. Phytoremediation, however, is one cleaning method that is cost effective and environmentally friendly. This green technology uses plants to remove contaminants from soil and water. This thesis focused on the sources and impacts of HMs, especially Arsenic (*As*), on the environment and how effective six plant species were in removing HMs grown in commercial potting soil and biosolids collected from the Prudes Creeks Wastewater Treatment facility in Jefferson County, Alabama. Indian mustard *(Brassica juncea),* sunflower *(Helianthus annuus L*), cowpea *(Vigna unguiculate)*, T-Raptor (a *Brassica* hybrid), dill mammoth *(Anethum graveolens)* and ryegrass *(Lolium multiflorum*) were tested for four-weeks in laboratory conditions and analyzed to determine their ability to tolerate and hyperaccumulate *As* from the two different substrates. Results from this study showed that plants grown in potting soil had a significantly higher biomass than plants grown in the higher HMs contaminated biosolids. Based on the plants' bioconcentration factor and translocation factor values, dill mammoth and Indian mustard were found to be suitable for phytoextraction; while sunflower grown in the lower HMs potting soil substrate was found to be suitable for phytostabilization.

3. Electrospinning of Cellulose Acetate Nanofibers: Process Optimization

Nikki Angel[a], Liping Guo[b], Feng Yan[b], and Lingyan Kong[c]

[a] Department of Mechanical Engineering, the University of Alabama
[b] Department of Metallurgical and Materials Engineering, the University of Alabama
[c] Department of Human Nutrition and Hospitality Management, the University of Alabama

Cellulose acetate (CA) is the acetate ester of cellulose and produced from cellulose via the process of acetylation. Currently, electrospinning has become a widely used technique to produce CA nanofibers for potential applications such as filtration, medical dressing and food packaging. Being biodegradable and biocompatible, CA nanofibers bring additional advantages for these applications, e.g., high surface area, high porosity, and light weight. The quality of the CA nanofibers, which can be characterized by the prevalence of defects on the fibers, pore size, and fiber diameter, directly affects its performance. Fiber quality is, in turn, directly determined by the electrospinning process parameters. Therefore, in this project, we aimed to investigate the effect of electrospinning parameters, including CA concentration, voltage, and spinning distance, on the electrospinnability of CA nanofibers and fiber diameter, using process optimization principles and response surface methodology. Certain process parameters, including solvent (acetone), needle diameter (gauge 22, inner diameter 0.413 mm), temperature (20 °C), and feed rate (2 mL/h), were kept constant throughout the experiment. Preliminary experiments were conducted to determine the extreme conditions of each parameter and define a working boundary. Then, trials of electrospinning CA nanofibers were conducted following a 3-factor, 3-level Box-Behnken design within the predetermined range. CA nanofibers were characterized by scanning electron microscope (SEM) for their morphology and SEM images were analyzed using the ImageJ software for their mean diameter. Data are being analyzed for empirical modeling and constructing response surface contour plots.

4. Lead in Tap Water – Results from Preliminary Tests

Caren Bartuin, Macy Philips, and Heather McDonald

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Lead is a powerful neurotoxin with no beneficial biological function. Exposure to lead can cause permanent kidney damage and cognitive impairment, especially in children. Although, the negative effects of lead exposure were known in the 1800's, the use of lead pipes was popular until the 1950's. In 1986, the use of lead in pipes was finally outlawed, but many homes built before this time still have lead pipes. The lead poisoning crisis in Flint, Michigan began in 2014 and is a stark reminder that drinking tap water from lead pipes, in certain circumstances, can be dangerous. The Environmental Protection Agency (EPA) mandates that all community water systems must prepare and distribute an annual water quality report. However, this report only applies to the water being put into the water system, not to the water coming out of a particular faucet. This research project therefore explores the possibility of lead in local tap water. Specifically, samples of tap water from local residences were collected and tested using Baldwin Meadows 9 in 1 test strips. In addition, the performance of the test strips was evaluated using solutions of lead acetate at concentrations of 10, 15, 20, and 25 parts per billion (ppb). Results from this study will help determine whether or not lead is present in local area tap water samples at a level above the EPA's action level of 15 parts per billion.

5. Dendroclimatic Relationships Across the Geographical Range of Sugar Maple

Kaylen E. Bendolph[1], Ketia L. Shumaker[1], and Carolyn A. Copenheaver[2]

[1]Department of Biological and Environmental Sciences, The University of West Alabama, Livingston, AL

[2]Department of Forest Resources and Environmental Conservation, Virginia Tech, Blacksburg, VA

Climate change poses one of the largest threats to forest ecosystems in North America, but we do not fully understand how current climate influences tree growth. The objective of this study was to connect sugar maple radial growth to temperature across a portion of the geographic range. Monthly temperature data were correlated with sugar maple tree-ring width data from 12 sites in the United States and Canada. Current and prior year's summer temperatures were the main drivers of sugar maple radial growth. Sites from the central portion of sugar maple's range were less responsive to temperature than sites at the northern and southern range limits. These results suggest that climate change is likely to affect sites at the northern and southern limits more than in the central portion of sugar maple's range.

6. Electrospinning of Thymol and Curcumin-Loaded Pullulan Nanofibers

Isabelle Berry [a], Liping Guo [b], Feng Yan [b], and Lingyan Kong [c]

[a] Department of Chemical and Biological Engineering, the University of Alabama

[b] Department of Metallurgical and Materials Engineering, the University of Alabama

[c] Department of Human Nutrition and Hospitality Management, the University of Alabama

Electrospinning is an effective method for producing very fine and uniform micro- and nanofibers with high surface area to volume ratio and superior mechanical properties. Electrospun nanofibers can be used as a delivery platform for active ingredients and compounds. In the present study, pullulan nanofibers loaded with thymol and curcumin were fabricated using electrospinning and characterized for their morphology, size, and crystalline structure. Pullulan is a linear polysaccharide produced extracellularly from starch by a fungus *Aureobasidium pullulans*. Pullulan is safe for use in food and cosmetic applications, and has excellent fiber forming property. Both thymol, a chemical found in thyme, and curcumin, the most active compound in turmeric, possess potent antioxidant and antimicrobial properties. Preliminary tests were conducted to determine the optimal ranges of pullulan concentration, applied voltage, feed rate, and spinning distance. Then, throughout the experiment, 20% (w/v) pullulan dissolved in water was used, and electrospinning parameters were fixed at feed rate of 2 mL/h, applied voltage of 18 kV, and spinning distance of 10 cm. Fibers were collected for 1 h before further analyses. Scanning electron micrographs showed that all samples contained smooth and continuous nanofibers. The mean fiber diameters of pullulan fibers, thymol-loaded pullulan fibers, and curcumin-loaded pulllulan fibers were 194 ± 97 nm, 330 ± 123 nm, and 203 ± 102 nm, respectively.

7. Phytoremediation of Lead Nitrate using *Helianthus giganteus*

Meaghan Claire Boone, Sutherlyn Cowling, Kevin Williams, and Ketia Shumaker

Department of Biological and Environmental Sciences, The University of West Alabama, Livingston, AL 35470

Phytoremediation uses living plants to remove hazardous contaminants, including heavy metals, from the soil, air, and water. The contamination of soil and water is largely caused by heavy metals that accumulate in our environment. Phytoremediation is a cheaper and simpler technique to remove heavy metals from the environment. Plants that can perform phytoremediation are called hyperaccumulating plants. Some examples of these plants are Indian Mustard (*Brassica juncea*), Willow (*Salix alba*), Indian Grass (*Sorghastrum nutans*), and the Common Sunflower (*Helianthus annuus*). Phytoremediation uses the ability of all parts of a plant to perform bioaccumulation, translocation, and contaminant degradation to remove hazardous substances. In this experiment, the Mammoth sunflower, *Helianthus giganteus*, is being used to determine how well they can perform phytoremediation in various concentrations of Lead. There were four groups of plants: the control, 10ppm, 30ppm, and 50ppm. There were 4 large planter trays, each containing three seed boxes with fifteen seeds per seedling box. The plants were watered two to three times a week and measured once a week to monitor their growth. This experiment lasted four weeks and then the plants were harvested for analysis. The soil used already contained 3.79 ppm of lead. The results found that the Sunflower roots accumulated more lead than the shoots. Within both shoots and roots, the 10 ppm concentration group accumulated more lead than the 30 ppm, or 50 ppm concentration groups. An anomaly in our data was our root control group, which contained 870 mg/kg of lead, compared to the root 10 ppm concentration group, which contained 505 mg/kg of lead. Helianthus giganteus can effectively phytoremediate lead in the roots at moderate concentrations.

8. Isolating Microbes from Soil in Search of Novel Antibiotics

Lauren Brown, Moureen Jepchumba, and Mustafa Morsy

The University of West Alabama, Livingston, AL 35470

Microbial communities in soil are generally high in abundance and diversity, making it an excellent source of antibiotic-producing bacteria. Because antibiotics are misused and overprescribed, harmful pathogens are rapidly evolving drug resistance, creating a pressing demand for new antibiotics. We aimed to determine which soil conditions are rich with antibiotic-producing bacteria and to isolate novel antibiotic-producing bacteria. Soil samples were collected from Lake LU nature trails and Looksookold Road. Serial dilutions were made to culture individual bacterial colonies. The soil samples contained an abundance of bacteria with the highest values of 450 CFU/g on LBA from samples collected from Lake Lu nature trails. Colonies with various morphological features were selected and tested for antibiotic activity against safe relatives of clinically relevant human pathogens (*Escherichia coli, Staphylococcus epidermidis* and *Salmonella newport*). Four isolates showing antimicrobial activity only against *Salmonella newport*. Antibiotic-producers were selected for further identification through 16S rDNA sequencing. We plan to rescreen our soil bacterial for more antibiotic producers, as we believe we have technical issues with our screening methods. In addition, we plan to identify all antibiotic producers using various physiological and chemical methods. We hope to identify the chemical nature of the antibiotic produced by our bacteria. We hope our discovery of antibiotic producing bacteria can help solve the growing problem of antimicrobial resistant.

9. Isolation and Identification of Antibiotic-Producing Bacteria from Soil

Manquell Burroughs, Chad Boddie, and Mustafa Morsy

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Most antibiotics currently prescribed to treat infections are derivatives of natural compounds produced by bacteria and fungi. Unfortunately, most antibiotics will not remain clinically effective long-term due to the increasing frequency of antibiotic resistance. Increasing instances of multidrug resistance coupled with a decrease in the discovery and development of novel antibiotics is setting the stage for a global healthcare crisis. To combat this increasing public health threat, the idea of "crowdsourcing" to isolate and identify new antibiotic producers and new drugs is growing in prominence. This work represents the results of implementation, in our undergraduate Microbes to Molecules Course, of the Tiny Earth: Student sourcing antibiotic discovery. Suspensions of soil samples from two locations (university construction site and shore of the university lake) were plated onto LB media to yield individual colonies. A 485 diverse bacteria colonies were arrayed into two 96-well plate and grown overnight at 37 °C in LB media. Isolates were tested for antimicrobial activity against a panel gram positive and Gram-negative bacteria. We identified 15 of unknown bacteria as antibiotic producers. Isolates exhibiting antimicrobial greatest antimicrobial activity will be identified using 16S rRNA sequencing followed by nucleotide BLAST sequence alignment.

10. Edible Oleogels: Bioaccessability of Retinyl Palmitate

Isaiah Byrd and Nuria Acevedo

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Oleogels have the potential to entrap and protect labile molecules while providing a suitable matrix for the delivery of lipid bioactive components. Previously, it was demonstrated that 10% Policosanol oleogels (PCOs) can entrap and protect retinyl palmitate (RP) from photodegradation. The goal of this study was to determine the ability of PCOs to gradually release RP during *in-vitro* digestion. PCOs were prepared at 10% w/w concentration containing 1% w/w RP. RP in liquid oil (RP-LO) was used as a control to account for the effects of structural difference on the release of RP. A three part (saliva, gastric, duodenal) *in-vitro* digestive system was developed to evaluate bioaccesibility of RP in the different matrices. Samples were collected at various times (0, 30, 60, 120, 180 min) upon the duodenal stage to analyze the rate and amount of RP released. Normal phase high-performance liquid chromatography (HPLC) was used to quantify RP in the digested fractions. Compared to RP-LO, the RP-PCO had a slower and gradual RP release over three hours of digestion. The maximum release of RP from the liquid oil was observed after 30 minutes digestion whereas the maximum RP bioaccesibility in PCOs was upon 60min digestion. Our results demonstrated that PCOs are a suitable strategy to allow controlled and enhanced bioaccesibility of RP in food systems.

11. Viral Infection and Dopamine Regulated Stress Response in Fruit Fly *Drosophila melanogaster*

Bianca Caton, Stanislava Chtarbanova, and Andy Chaudhuri

Department of Biological Sciences, University of Alabama, Tuscaloosa, AL 35401

Dopamine is a key neurotransmitter playing a critical role in stress response initiating the release of adrenaline. Increasing evidence suggests that dopamine also plays a significant role in immune cell function. Overcoming stress in the body is the first step to resistance and immunity, and inadequate dopamine levels or an inefficient dopamine response can lead to immune suppression and susceptibility to infections. The experiments presented here explore the regulatory effects of dopamine on the anti-viral immune response using the fruit fly, *Drosophila melanogaster,* as a model system. We use four different fly lines that carry mutations in genes encoding for different components of the dopamine synthesis pathways (*Castup1, PuZ22, pale 2* and *VMAT*). *W1118* flies are used as wild type control. We infect adult *Drosophila* with the RNA-containing Flock House Virus (FHV), which is pathogenic to flies and kills them within days. We hypothesize that *Catsup* mutant flies, which express higher dopamine levels will have enhanced immune response and a greater survival to FHV, whereas *pale2, PuZ22*, and *VMAT* mutants that have lower dopamine levels will succumb faster than *Catsup1* and wild type controls. We injected mutant flies with PBS to monitor the mortality rates due to microinjection. On day 7, we recorded about a 10% mortality due to microinjection irrespective of mutations. One-week-old female flies from each different dopamine mutant group (10 x 3 replications) will be injected with FHV, and we will analyze the mortality to determine the role of dopamine on viral resistance. These experiments are currently under progress.

12. The Effects of Local Fungal Endophytes on Bamboo

Zavier Chaney, Laban Kitur, Blake Cleckler, and Mustafa Morsy

The University of West Alabama, Livingston, AL 35470

For thousands of years now, humans have been domesticating many crop plants that serve as a major food source and for utilization for many other industrial uses. Humans struggle to improve their crops and protect them from pests, diseases and environmental elements such as drought, excessive water, or lack of nutrients. Many improvements in crop production have been achieved, however, more sustainable methods are needed to meet the global climatic changes. Bamboos are perennial flowering plants of the grass family *Poaceae* that have many uses ranging from building materials to medicinal uses. The bamboo industry is worth more than $60 billion, and the U.S. is one of the largest importers of bamboo products. Resource Fiber (Boligee, Al) has planted hundreds of acres of bamboo in the efforts of trying to improve their bamboo outcomes to maximize production under a local environment. We tested the effect of several fungal endophytes on the growth of bamboo with our hypothesis being that some endophytic fungi isolated from wild plants growing in Alabama will help bamboo strive under local environment, soil, and weather. We used 4 endophytes (W1, W5, W11, and W14) and measured the number of emerging shoots, shoot length, and shoot width, which are all fiber related parameters. These measurements were then compared to a non-symbiotic control (NS), in which no endophyte was added. We collected our data over a 5-month period. Out of the 4 groups that were compared to NS, W11 had the most positive results. Throughout the comparison time, W11 showed 24% more growth in length, and 4.2% more emerging shoots when compared to the NS control group. Our preliminary data shows a positive influence of the fungal endophytes on the plants. Therefore, we hope to continue our research and find new endophytes that have an even larger influence on plant growth.

13. Clear-Brew Coffee

Sarah Coffey and Yun Ho Kim

Department of Physical Sciences, The University of West Alabama, Livingston, AL 35470

The concern with long-term coffee consumption is teeth staining. Different methods remove the aromatic compounds that contribute to flavor, color, and scent; however these methods also remove the caffeine from the coffee as well, which makes it less appealing to some consumers. Different methods were tested to determine the best way to remove the coloring compounds in coffee, while leaving the flavor and scent aromatics and caffeine intact. Simple and vacuum distillation were the first methods tested. Filtration was the second method and included activated charcoal in the filter paper – 2 filters, 3 filters, and 4 filters were tested. The final method tested was extraction using a 20 percent acetic acid solution. Coffee grounds were soaked in the solution overnight, the liquid filtered out, and the grounds used to brew coffee. All of the resulting solutions were taken and processed via liquid chromatography. Both methods of distillation removed the color and left the scent aromatics intact, but did not carry over the caffeine. The multiple filtration methods also removed the color, but also removed more caffeine and scent aromatics as additional filters were used. Future research will test how different roasting times and temperatures will affect the caffeine content in coffee beans.

14. Recent Archaeology of Barracks Life at Fort Tombigbee

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Two seasons of excavations at the soldiers' barracks at eighteenth-century Fort Tombigbee have revealed numerous artifacts and architectural features to help interpret life at the remote fort. Artifacts from different areas show how varied life can be even in a single structure. In the North-West area of the barracks, artifacts of higher quality have been excavated, whereas artifacts of lower quality were found in the South-East area of the barracks. The North-West area of the barracks was closer to the Sergeants' quarters, which most likely accounts for why artifacts of higher quality are in this area and not others. Further analysis of artifacts in the lab have revealed this hypothesis to be correct.

15. Herbaceous Vascular Plant Biodiversity in an Open Black Belt Prairie of Greene County, Alabama

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Black Belt Prairies are one of the most diverse and important ecosystems within the Black Belt region of Alabama. These vast and open prairies are known for the highly diverse flora found within them. Although they once extended across the Black Belt, these prairies have been dramatically reduced over the last 100 years. With agriculture and cattle grazing mostly at fault, less than 1% of prairie habitat remains. As a result, Black Belt prairie is a threatened ecosystem, the second most important in Alabama. Despite its imperiled status and the extensive floral diversity of the Black Belt Prairie ecosystems, no comprehensive inventories of prairie flora exist. Over the course of two consecutive years, we made monthly collections of all vascular flowering plant species found in an intact Black Belt Prairie located near Mt. Hebron, in Greene County, Alabama. All collected specimens were pressed, dried and identified. Field collections resulted in the identification of 252 specimens representing 113 different species from 79 distinct genera, and 28 different families. This complete plant survey now serves as the baseline for prairie management and restoration, and has been published as a Black Belt Prairie manager resource guide.

16. Fluorescent Turn-On Sensors for Transition Metals

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Rhodamine derivatives were studied as fluorescent turn-on sensors for transition metals using UV-Vis and fluorescence spectroscopy. In solution, the rhodamine derivative **Rh-pyr**, which contains a pyridine metal binding moiety, has a ring-closed form which is nonfluorescent and colorless. Upon the addition of a transition metal ion, namely copper(II) triflate, formation of a complex with the Cu^{II} cation induced a ring opening process; the open form was strongly fluorescent and pink in color. Detection of Cu^{II}, Fe^{III}, and Zn^{II} cations were performed in acetonitrile using **Rh-pyr** dye (2.5 μM) and the similar **Rh-phen** dye (2.5 μM), which contains a phenol binding site instead of the pyridine center**. Rh-pyr** dye was most sensitive and selective for the detection of the Cu^{II} cation and Zn^{II} cation, with a turn-on signal at λ_{max} 520 nm in absorbance and at λ_{max} 554 nm in chelation-enhanced fluorescence for Cu^{II} and for Zn^{II}. **Rh-phen** dye was most sensitive and selective for the detection of Fe^{III}, with a turn-on signal at λ_{max} 540 nm in absorbance. Further investigation of the formation of the rhodamine dye complexes with Cu^{II}, Fe^{III}, and Zn^{II} are being conducted using electrospray ionization mass spectrometry.

17. Antibiotic-Producing bacteria from UWA campus: Tiny Earth at UWA

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Antibiotic resistance is a growing medical problem worldwide, prompting scientists to face the prospects of a post-antibiotic world. To help prevent this, the Tiny Earth was formed in 2014 to crowd-source antibiotic discovery. As part of the Tiny Earth to crowd-source novel antibiotics, we isolated antibiotic-producing soil bacteria from two sites one near the Sucarnoochee River near one's house and the second on the side of the road both in Livingston, AL. We isolated a total number of 940 bacteria and screened two 96-well plates of unknown bacteria against ESKAPE (multi-drug resistant) pathogen relatives, specifically we used *Escherichia* coli, *Staphylococcus epidermidis* and *Salmonella Newport*. We identified about 32 unknown bacteria (16% of screened bacteria) with ability to produce inhibition zones around one or more of the tested pathogen-relatives. Several of these unknown bacteria were able to inhibit the growth of both gram positive and gram negative bacteria, indicating an interesting wide –spectrum antimicrobial activity produced by these bacteria. We are in the process of identifying the antibiotic producer using by the amplification of the 16S rRNA gene via Polymerase Chain Reaction (PCR), followed by DNA sequencing and BLAST search.

18. The Adventures of Discovering a Bacteriophage: *Sumter*

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A bacteriophage is a virus that hijacks a bacteria in order to replicate. The discovery of the bacteriophage *Sumter* was a complex process. It began by taking a soil sample from the University of West Alabama Rodeo Complex. *Sumter* was then filtered and purified. Then the phage DNA was extracted and then the whole genome was sequenced. The phage was stained with uranyl acetate, and images were captured using a transmission electron microscope.

19. Inhibitory Effect of Tea on the *in vitro* Enzymatic Digestion of Starch

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Previous studies of phenolic compounds have demonstrated their ability to decrease the rate of starch hydrolysis by inhibiting digestive enzymes for starch. A major implication of such inhibition is a slowed rate of starch digestion into glucose, which thereby reduces a sudden rise in blood glucose level after a starchy meal. Tea, rich in phenolic compounds, has been widely reported for its beneficial health effects. Accordingly, this study explored the inhibitory abilities of four types of tea, i.e., green tea, oolong tea, black tea, and white tea, on the *in vitro* enzymatic digestion of potato starch (PS) and high-amylose maize starch (HAMS). The *in vitro* digestion was carried out in simulated intestinal fluids and the reducing sugar content released from digestion was measured at 1 h and 2 h using the 3,5-dinitrosalicylic acid assay. Total phenolic content (TPC) in the teas was determined using the phenolic-binding Fast Blue BB assay. Results showed that the TPCs in green tea and oolong tea were significantly ($P < 0.05$) higher than those in black tea and white tea. Yet, all teas demonstrated significant inhibitory effect on the digestion of both starches. No significant difference in the inhibition was found among these teas, except that green tea showed higher inhibition on HAMS digestion at 2 h. It was also noticed that both starches were digested to the same extent after 2 h of digestion, but at different rates. At 1 h, the extent of HAMS digestion was significantly higher than that of the PS, possibly due to its higher content of amylose that is more soluble than amplopectin and thus more accessible by the digestive enzymes. In conclusion, our results suggested that tea, regardless of its type, can slow down enzymatic digestion of starch and therefore imply a potential benefit for controlling postprandial hyperglycemia.

20. Investigation of Bacterial Contamination on Acetate Agar Media Plates of *Chlamydomonas reinhardtii*.

Seth Hamby, Taylor Box, Taylor Berry, and Mautusi Mitra
University of West Georgia

Three different species of bacteria strains were observed to be growing on the TAP (**T**ris **A**cetate **P**hosphate) media plates of the green micro-alga *Chlamydomonas reinhardtii* in our research lab. We named these three bacterial strains according to the algal strain plates they grew on, namely: Clip 185, CC4533, and LJMSG0182. Several biochemical experiments were conducted to characterize the bacteria biochemically. These tests include Gram staining, oxidase test, growth/hemolysis on blood agar media, sugar fermentation tests using Phenol red agar, Mannitol salt agar and MacConkey agar media. LJMSG0182 fails to grow on LB agar media, unless it is supplemented with an exogenous acetate. Hence we tested different carbon sources to find alternative carbon source other than acetate, for LJMSG0182. We tested two different amounts of four different antibiotics to determine the antibiotic and dose that will inhibit bacterial growth but allow *Chlamydomonas* to survive on the TAP media. 16S rRNA gene sequences are used for studying bacterial phylogeny and taxonomy. Currently, we are sequencing the 16S rRNA gene sequences of these three bacteria to identify the bacterial species. We will be presenting the results of our physiological, biochemical and molecular tests performed on the three bacterial strains.

21. Investigation in Rapeseed/Turnip Hybrid for Phytoremediation

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This research was to investigate the possible phytoremediation capabilities of a Rapeseed/Turnip Hybrid species. In order to determine the phytoremediation potential of this species, individual species were grown in various concentrations of soils contaminated with lead nitrate and monitored on their overall productivity. The specimens were analyzed to determine hyperaccmulation capabilities and storage of contaminants within the roots and shoots of the plant body. It was determined that the hybrid species was successful in hyperaccumulation of the contaminant lead nitrate. Through analysis it was determined that although some amounts of lead nitrate are found within the shoots, there is a substantial amount of lead nitrate stored within the roots of the species at various concentrations. Our results discovered that within the shoots, 3.18mg/kg of lead was found as a result of absorption from fertilized potting soil. Shoots from the contaminated soils containing lead nitrate discovered 13.3mg/kg in 20 ppm, 23.3mg/kg in 50 ppm, and 46.1mg/kg in 100ppm. Within the roots of plants grown within contaminated lead nitrate soils it was discovered 451mg/kg of lead was found in 20ppm, 511mg/kg were found in 50 ppm, and 685 mg/kg were found in 100 ppm. This research has concluded that the Rapeseed/Turnip Hybrid species does have the potential go undergo phytoremediation. This knowledge of phytoremediative properties for the Rapeseed/Turnip Hybrid provides understanding of the possible influences to deer populations that are a result of the uptake of lead nitrate and it can be used to further investigate the potential for large scale cleanup practices of lead nitrate using this species.

22. Temporal Changes in the Relationship Between Climate and Radial Growth of Sugar Maple

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Sugar maple radial growth is determined by environmental conditions. The objective of this study was to analyze the changes over time in the relationship between sugar maple annual radial growth and precipitation in 12 study sites across the U.S. and Canada. Results show a declining influence of precipitation on sugar maple radial growth post-1970. This implies that environmental factors other than precipitation are increasing in their influence on sugar maple growth.

23. Neuro-protective Effect of Ayurveda Preparation, Saraswatharishtam, on Spectracide Induced Movement Disorder in Fly Model

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Parkinson's disease is a progressive neurodegenerative disorder associated with severe loss of motor functions due to degeneration of dopamine neurons in the brain. The etiology of most cases of the disease is unknown. However, several studies have discovered many possible environmental triggers, Spectracide, a commonly used herbicide, being a major chemical of interest. Some Spectracide related health symptoms include skin diseases, kidney failure, reproductive dysfunctions, cancer and neurodegenerative diseases. This study entirely focuses on the possible neurodegenerative effects of Spectracide exposure using fruit fly a model system to study the human diseases. We are interested to know whether Saraswatharishtam (SWRT), a traditional brain tonic could be an effective treatment for Spectracide induced neurological defects. SWRT is an Ayurveda medicine, mixture of 18 different types of Indigenous plant extracts reported to be very effective for memory loss and several other neurological dysfunctions. Flies were fed Spectracide (25 and 10%) mixed with 5% sucrose solutions to score the mortality and record negative geotaxis. Only 5% sucrose was used as control. Spectracide fed flies showed parkinsonian symptoms like tremor, rotational movement and frequent fall against the gravity. Kaplan-Meier survival curve revealed that both the doses of Spectracide killed the flies within 36-96 hours in a dose dependent manner. The negative geotaxis also being adversely affected recorded by its slow movement. The flies were pre fed with SWRT for 72 hours and transferred to the 10 % Spectracide solution mixed with 5% sucrose to see the rescue effect. We did not find any toxic effects of SWRT, rather flies become more active when treated alone. We conclude that SWRT could have neuroprotective effect and may be useful for the treatment of neurological disorders. The experiment is in progress.

24. Finding Antibiotic-Producing Bacteria in the Soil

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The discovery of new antibiotics within the past few decades have been slim to none and with new antibiotic-resistant bacteria surfacing there is a dire need to find novel antibiotics. The University of West Alabama has conducted a series of experiments on soil samples collected around the area to try to find novel antibiotic-producing bacteria. About 75% of antibiotics were discovered in soil. Therefore, we are focused on the isolation of bacteria from soil in order to discover novel antibiotics. We collected soil samples from the UWA lake trail and a UWA greenhouse and then isolated bacterial colonies from 1 gram of this soil by suspending the soil in 10 ml 0.9% saline solution. Single and diverse colonies were collected into two 96-well plates and grown at 37oC for 24 hours with shaking in preparation for antibiotic production screening. We screened our 190 bacterial colonies against three different pathogens (*Escherichia coli*, *Staphylococcus epidermidis* and *Salmonella newport*) to determine the ones producing inhibition zones. We identified sixteen, nineteen, and five unknown bacterial colonies are capable of inhibiting *E. coli, S. epidermidis, and S. newport*, respectively. In addition, two of our unknown bacteria were able to kill all three pathogens. We are only one month into this research course; we plan to identify the unknown bacteria through molecular and physiological tests and attempts to identify the chemical nature of the antimicrobial compounds produced by these bacteria. This project has allowed us to attempt to make a contribution to the community around us and learn about biological processes that will benefit us in the future.

25. Using Functional Marker Genes to Characterize Denitrifying Microbial Populations in Oil-Impacted Barrier Islands

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Disturbances to estuarine, coastal, and barrier islands can drastically alter their ecosystem services. Erosion and loss of sediment accretion, excess nutrient loading, invasive species, and oil spills are examples, which can affect the physical and biological structure and function of these vital systems. In addition to providing protection by reducing storm surges and dissipating wave energy, barrier islands support coastal economies while contributing to improved water quality which also supporting fisheries and tourism. In this century, these ecosystems are further threatened with chronic stresses (i.e. rising sea levels, climate change, invasive species, new and re-emerging pathogens) and pulse disturbances (i.e. oil spills, flooding, super storms). The Chandeleur Islands, a chain of low-elevation barrier islands in Louisiana waters located forty miles south of Gulfport, MS, is an important coastal defense and ecological habitat. Subjected to gradients of oiling during the 2010 Deepwater Horizon oil spill and to the ongoing northern expansion of black mangrove (*Avicennia germinans*), this study assessed the denitrifying microbial populations using nitrogen (N) cycle biomarker genes. We hypothesized that oiling events could further increase the vulnerability of this barrier island chain thereby reducing its resiliency to future stresses. The primary objective of this study was to assess denitrification capacity in saltmarsh cordgrass and black mangrove marsh study sites on the Chandeleur Islands. We applied quantitative polymerase chain reaction (qPCR) to key functional genes in the microbial denitrification pathway. We measured gene products that catalyze the first, second, and third enzymatic steps in the denitrification pathway from (nitrite to dinitrogen; NO^{2-} to N_2). Three eco-functional marker genes were investigated; (1) *nirS*, encoding the nitrite reductase gene; (2) *norB*, encoding the nitric oxide reductase gene; and (3) *nosZ*, encoding the nitrous oxide reductase. Quantification of denitrification biomarker gene abundances indicated lower values for *nosZ* and *norB* but varied for *nirS* in environmental DNA (eDNA) extracted from samples collected from *A. germinans* mangrove-associated sediments than for eDNA from samples collected from *S. alterniflora* cordgrass-associated sediments. Our findings suggest influences of marsh plant types on denitrifying microbial population abundances. As denitrification in coastal and estuarine habitats are responsible for as much as 50% removal of nitrogen released to the ocean, such changes in microbial N-cycling populations could reduce the microbial transformation of N furthering contributing to decreased water quality through eutrophication by added nitrogen loading from coastal systems.

26. Isolation and Biochemical Characterization of Probiotics for Potential Improvement of Lactose Intolerance

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Improving food shelf life, safety and quality (i.e., human and animal health-related) by using probiotics are trending applications in the food industry today, but the fact that these generally-recognized-as-safe (GRAS) lactic acid bacteria (LAB) that utilize lactose can improve lactose intolerance in patients is under explored to date. Our purpose was to identify potential antimicrobial peptide- and lactase-producing LAB in farm animals and produce. Samples were enriched and screened for antimicrobial LAB against indicator microorganisms, *Listeria monocytogenes* and *Escherichia coli*, on de Man, Rogosa, and Sharpe (MRS) agar plates using a "sandwich overlay" technique supplemented with "deferred antagonism" indicator overlay method. Lactase-producing and sheep blood hemolytic isolates were determined using a modified disk-diffusion technique on agar plates containing 5-bromo-4-chloro-3-indolyl-β-D-galactopyranoside substrate (X-gal) (20 μg/ml) and sheep blood (5%), respectively. Subsequent 16S rDNA identification of LAB isolates was carried out with an ABI 3730XL sequencer. Deferred antagonism antimicrobial analyses for 12 samples of farm animals (3) or fresh produce (9) exhibited a total number of 161 LAB with confirmed activities against *E. coli* (34), *L. monocytogenes* (46), both *E. coli* and *L. monocytogenes* (75), or with no activities (6), suggesting that this group of probiotics be utilized for subsequent investigations. Lactase activity analyses for these LAB determined 22 isolates with differential lactase reactivity (i.e., dark blue or blue colonies). Subsequent blood agar hemolysis analyses revealed beta- (10) and gamma-hemolytic (12) groups of lactase-producing LAB. 16S rDNA analyses for 10 select LAB isolates identified human pathogen (1), human probiotics (1), starter cultures (4), bacteriocin-producing (3) and unknown bacteria (1). Searching new GRAS materials for improvement of food safety and quality (i.e., shelf life and health-related) by the food safety agencies and industries are an ongoing effort. Our findings suggest a group of probiotics that may serve a greater benefit for both needs.

27. Isolation of Antibiotic-Producing Bacteria from Our Living Complexes: Tiny Earth at UWA

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Due to the widespread use of antibiotics, bacterial pathogens are rapidly developing resistance to currently available antibiotics. As these antibiotic-resistant pathogens manifest in humans and cause infections, these infections cannot be treated with most, if any, available antibiotics. Few new antibiotics are being discovered to combat this problem because they are not as profitable for pharmaceutical companies as drugs that treat chronic illnesses. This project was conducted to discover novel antibiotic-producing bacteria from soil because soil has a history of yielding antibiotic-producing bacteria. Soil was collected from Hoover apartment complex 4 and the front yard of Deauris'. One gram of soil samples was diluted in 0.9% saline solution and 200 µl were plated on LB agar plates. Single bacterial colonies were isolated into 96-well plate and grown overnight in LB media (100 µl) with shaking at 37oC and 250rpm. We screened total of two 96-well plates of unknown bacteria against three different pathogens (*Escherichia coli*, *Staphylococcus epidermidis* and *Salmonella newport*) to find antibiotic producers. We identified a total of 25 unknown bacteria capable of inhibiting the growth of at least one of these pathogens, but none that were able to inhibit all three pathogens. The 16S rRNA genes of isolates are being amplified by single colony PCR; amplicons will be purified and sent for DNA sequencing. The sequences will be then searched on the NIH BLAST 16S database to determine the closest known species to those isolated.

28. Metabarcoding for Freshwater Fish of the Mobile Basin Watersheds

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Alabama has a higher number of freshwater fish species than any other state in the United States. Many of these species are currently imperiled. The process of effectively catching specimens from freshwater ecosystems in Alabama can be expensive and time-consuming, so the use of environmental DNA (eDNA) to determine which species are present within a particular area is invaluable for research. However, having a database of mitochondrial DNA sequences is required to interpret the results obtained from the eDNA samples. We are making a reference database of mitochondrial DNA sequences for the species of freshwater fish that are native to the Mobile Basin watersheds of Alabama, through the use of sequences obtained from fin clips and from GenBank. For the amplification of the sequences using polymerase chain reaction (PCR), we will be focusing on the cytochrome oxidase I (COI) gene or the 12S region of the mitochondrial DNA. There are benefits and detriments to either: while there is more data on COI, we hypothesize that PCR using COI would be biased towards certain species and could provide inaccurate results. The mitochondrial DNA sequences obtained were aligned using the BioEdit software, and the alignments were used to create a phylogenetic tree with the Mega7 software. The implications of metabarcoding would not only be to efficiently determine the presence/absence of a particular species but would also determine the relative composition of a particular region.

29. Respiration Rates of the Dwarf Seahorse, *Hippocampus zosterae*

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Dwarf seahorses (*Hippocampus zosterae*) inhabit subtidal seagrass beds along coastlines of the Bahamas, Central America, and parts of the southern United States. Various factors, including habitat degradation and overutilization, have led the Center for Biological Diversity to petition for listing of *H. zosterae* as threatened or endangered. Considering this, it is crucial to further our understanding of how *H. zosterae* responds to changes in environmental conditions. Given their small size and relatively low mobility, *H. zosterae* are likely highly sensitive to small-scale changes in water quality. Understanding respiration in the fish may be critical in predicting how they may respond to environmental stressors. In this study, dwarf seahorses were collected from two locations in Santa Rosa Sound on the northern Florida Gulf Coast on 19 October 2018 and retained in saltwater aquaria at the University of West Alabama. A second attempt to collect *H. zosterae* at Indian River Lagoon on Florida's Atlantic coast was unsuccessful. Respiration data was collected for eight *H. zosterae* on 27 November and 29 November 2018. Fish were placed in a respiration chamber, each chamber containing 300 mL of salt water. Oxygen decline was measured using a Hach HQ40D portable DO meter. Measurements were recorded every ten seconds for a total of one hour. Respiration for two seahorses was collected at one time, as there were two probes on the meter. Wet weight of seahorses was determined at the end of the experiment, and average oxygen consumption was assessed. Mean oxygen consumption for *H. zosterae* in the laboratory was estimated to be 0.0093 mg O_2 kg^{-1} min^{-1}. This value is quite low in comparison to other estuarine fishes. Further work will be conducted to determine how respiration varies between isolated populations of H. zosterae, and the effect of environmental stressors on respiration.

30. Discovery of Novel Bacteriophage OKaNui

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Bacteriophage are a highly important element in the discovery of new treatments for bacterial diseases. As viruses and bacteria evolve, they are becoming immune to antibiotics which was my motive for discovering my bacteriophage. *OKaNui,* my discovered bacteriophage, was found in Meridian, MS from a soil sample that was collected in August 2018. The full process of the bacteriophage discovery encompassed many elements that required supreme focus and hard work. The host for my bacteriophage was *Mycobacterium smegmatis* mc^2155. Using processes such as spot and full-plate lysate tests, serial dilutions, and gel electrophoresis, *OKaNui* was fully concentrated and isolated to the extent that its DNA could be extracted and preserved. *OKaNui* is now a newly registered bacteriophage in the official bacteriophage database.

31. Do Human Eyes Create Tear Splatter and Does it Matter?

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No research currently has been done involving human eye splatter, with potential importance is left undiscovered. It is still undetermined if the splatter displays a pattern, plays key roles in the innate immune system, or even strengthens the risk against eye infections. In this study, an individual has a moistened Bio Glo 1 mg strip stroked across the eye until desired staining occurs. After a yellow film forms the patient is asked to blink several times, pictures are taken and enhanced with Photoshop to evaluate each eye to see if there is tear splatter and if so if it has a specific pattern. The significance of determining tear splatter patterns and the presence or absence of eye infections may reveal another layer of innate defense.

32. The Use of *Vigna unguiculata* as a Candidate for Lead Uptake in Soils

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This project is focused on the phytoremediation capabilities of cowpea (*Vigna unguiculata*) in lead nitrate ($PbNO_3$) contaminated soil. The goal is to determine the level of contamination that the cowpea can withstand and effectively remove lead from the soil. There are 3 treatments and 1 control for this experiment. Each treatment is triplicated. There are 5 seeds planted in each pot and 3 pots per treatment. Due to the weights of the roots and shoots being low, the samples were combined. Instead of having 3 replicates per treatment, all of the roots for each treatment type were weighed together, and all shoots were weighed similarly. We anticipated uptake inhibition after 200 ppm. Our results showed that all treatments took up lead nitrate throughout the duration of the trial, with 500 ppm at a reduced rate. To further support this, the soil samples have shown lower amounts of lead in the soil except in 500 ppm, where the soil lead concentrations exceeded root and shoot uptake. As expected, most of the lead uptake was concentrated in the roots instead of the shoots, leading us to believe that cowpea would be an ideal candidate for phytostabilization.

33. Culture-based Isolation and Identification of Soil Microorganisms for Potential Soil Regenerating and Agricultural Benefits

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In previous research, we observed forty-five different microorganisms from black (12), light black (10), white (9), or red soils (14) by colony morphology, following enrichment or no enrichment, suggesting the involvement of microorganisms are likely to contribute to soil fertility for agricultural benefits. While most identification work of microorganisms regenerating soil fertility has focused on metagenomics, the culture-based technique, namely, the application of pre-cultured microorganisms isolated for soil fertility regeneration, has been under explored. Collected soil samples from Sumter County, Alabama were homogenized in an automated lab blender followed by plating (i.e. both enriched and non-enriched samples) sample dilutions on nutrient agar media containing the fungicide Amphotericin B for investigative comparison of the indigenous bacterial colonies. DNA was extracted using bead-extraction method, a cost-efficient and inclusive method, and outsourced to Molecular Cloning Laboratories in San Francisco, CA. Experimental findings on 16S rDNA bacterial identification of a subset (i.e., 9 isolates) of forty-five isolates generated 11 functionally characterized microbial identities, including human pathogens (*Bacillus cereus*, *Saprophyticus* sp, *Lelliottia* sp), pesticides (*Bacillus thuringiensis*), food curation (*Staphylococcus xylosus*, *S. succinus*), human probiotic (*Lactobacillus plantarum*), plant growth and soil fertility promoting bacteria (*Aeromonas caviae*, *Pseudomonas* sp., *Bacillus megaterium*, *Stenotrophomonas* sp.), determined with a reducing number of functional variety from black (3), white soil (2), or red (1). Further analysis using La Motte Soil Testing Kit revealed pH and the composition of Nitrogen, Phosphorus, Potassium, and pH (i.e., N/P/K/pH) variations in black (low/low/low/8), light black (trace/medium/medium low/8), red (high/medium/medium low/7), and white (trace/trace/medium/8) soils. Soil fertility is vital to agricultural yield and application of cultured soil microorganisms may efficiently improve the productivity of soil for agricultural benefits. Our findings suggest a group of bacteria with plant growth promoting related or unrelated function that may be utilized and/or further analyzed for culture-based regeneration of soil fertility.

34. Patient Surveys and Prescription Medication Compliance

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To better evaluate patient prescription compliance and its contribution to antibiotic resistance, we surveyed 200 subjects from across the United States, as well as three additional countries (Australia, Germany, and England). We have a growing population of individuals with multiple medical conditions taking several medications at once. Problems can arise whena patient does not inform their doctor of all the medications they are on, when they see several different doctors, do not tell the other doctors of the medicines they are already taking, and not taking medications as prescribed.In rural areas patients often do not have convenient access to a primary care physician or a pharmacy so they must travel to get the medical care they need. To compound the problem, transportation is a problem for many rural residents.There are Medicine Use Review (MUR) services available at many pharmacies, but studies found that they are underutilized. These MUR services are put into place to help patients, who come into pharmacies, keep track of all of their medications and to help avoid harmful drug interactions.

35. Discovery and Purification of the Bacteriophage Chip

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Bacteriophages are a type of virus that infect bacteria. The bacteriophage, Chip, was discovered on West Main Street, Livingston, Alabama on 9/4/18. Chip was collected by digging into the damp soil with a plastic spoon and putting the soil in a plastic bag. A series of methods was used to purify chip, which included: filtration, enriched isolation, plaque assays, serial dilutions, and webbed plates. From the lysate, DNA was extracted and the phage was imaged by transmission electron microscopy.

36. Antibiotic Production Against Relatives of Human Pathogens Seen in Bacteria from Campus Soil

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While the increasing use of antibiotic drugs in medicine has been beneficial in combating bacterial infections, it has also resulted in the evolution of deadly superbugs that are increasingly resistant to all antibiotics on the market. The ESKAPE pathogens are a particular group of bacteria that are aggressively pathogenic, actively evolving drug-resistance. The purpose of our project is to search for bacteria in soil around the University of West Alabama campus that produce new antibiotics that can inhibit the growth of these pathogens. Many antibiotics have previously been discovered in soil bacteria. Using serial dilutions, we isolated and grew soil bacteria at 30°C and tested them for antibiotic production against safe relatives of the ESKAPE pathogens. We screened 337 unknown single bacterial colonies against gram positive and gram negative bacteria and identified 50 of them as antibiotic producers. These results indicate that our soil samples are rich in antibiotic producers (about 15% of the screened bacteria showed antibiotic production). Chemical extraction of the unknown bacterial extracts are to follow to identify the chemical nature of the antimicrobial compounds produced by these bacteria. In addition, we are in the process of identify the bacterial species using 16S rRNA amplification and sequencing.

37. The Effect of Endophytes On Plant Production in Harsh Environments

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Crop production is one of the factors that play a vital role in society's success, as food is of the most important element needed for human survival. Although the recent increase in productivity of many crops due to breeding programs, development of genetically modified crops, and the use of chemical fertilizers, pesticides, and insecticides, there is a dire need to much more increase in crop productivity to meet the food demand increased by growing human population. In addition, climate changes and increased harsh environmental conditions, i.e. drought waves, make meeting the goals of feeding the world in a real challenge that needs creative and sustainable ideas and farming practices. One of the most promising methods is applying a wild plants beneficial microbiome into crop plants to help them surviving harsh environments, as they do in their native host. We hypothesize that corn plants that have been colonized with endophytic fungi will have increased productivity compared to a non-symbiotic (NS) control plants under field conditions. Field trials were conducted during the summer of 2018 growing season. The field trials were conducted in uncontrolled environment as in regular farming conditions. Plants were watered for a week after planting and were dependent on rainfall the rest of growing season. Data shows that most treatments compared to NS showed great results. Endophyte coded W11, W14, J, 8A, and 1D had dramatic increase in corn ears production, up to 34% increase. On the other hand, endophytes coded 3B and W1 had lower production compared to NS. Overall the field trials were successful for showing that corn production can be maintained and in some cases be better in harsh conditions. Without a doubt, the plant microbiome will play a crucial role in improving crop production in more sustainable way than the current methods.

38. Fungi: Bio-Fertilizer to Improve Crop Productivity

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There are thousands of people around the world that go hungry every day, but this number will grow exponentially by the year 2050. Scientists are predicting a food shortage and one of the ways to combat this shortage is through the use of biofertilizer to boost the crop yields. One method to apply such biofertilizers is to restore the beneficial microbes that was lost from crop plants due to the overuse of chemical fertilizers, pesticides and insecticides over the years. Our lab focuses on the discovery of beneficial endophytic fungi present within wild plants growing under harsh environments. We apply these endophytes to crop plants in order to improve productivity and the ability to withstand harsh conditions such as drought and soil salinity. While traditional fertilizers can have harmful effects on the environment by running off into rivers and other bodies of water, fungi live within the crop plants and do not wash away easily and supply nutrients to the plants. We tested 12 endophytic fungi on tomato plants under greenhouse conditions and our results concluded a dramatic increase in tomato yields. They not only increased the number of tomatoes produced but also their weight. Two treatments had a significant increase in the amount of tomatoes produced over the non-endophytic control treatment, with W8 having a 98% increase and W12 having an 89.1% increase. Our controlled condition testing has proved these endophytes to be beneficial, next is to test these endophytes under field conditions. The ultimate goal of the project is to develop our fungal technology into a product that serves the farmers for various crops. In addition, we plan to understand the mechanisms by which endophytes contribute to plant production and survival.

39. The Autonomous Toy Picking Robot

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Two of the major objectives that need to be achieved while building the Toy Picking Robot is autonomy and obstacle avoidance. For a device to achieve full autonomy, it cannot be subjected to outside control. Autonomy requires thorough programming from start to finish. With the implementation of programming techniques and electro-mechanical controls, autonomy and avoidance can accurately be achieved. Implementing electro-mechanical controls would involve constructing the robot and manipulating the electrical wiring and switches of the different components of the bot to achieve the most accurate results. Programming via microcontrollers using C and python programming, would consist of manipulating electrical ports of the microcontroller board to meet the desired task. As part of the current study, we will discuss about our discoveries by applying the above techniques to achieve an accuracy of at least 90% for autonomy and obstacle avoidance. We have designed an autonomous robot according to the IEEE's 2019 hardware competition guidelines. With regards to being fully autonomous, the robot must also achieve as many orbits as possible. To achieve this, ultrasonic sensors and the GY-521 or similar module are needed to measure the distance or placement of the vehicle on the course. Ultrasonic sensors use high frequency sound waves to measure distance; this component could be used as a source to provide autonomy as well as avoidance. Likewise, the GY-521 module includes 3-axis microelectromechanical (MEM) accelerometer and a 3-axis MEMs gyro. The accelerometer measures the acceleration along one direction, while the gyroscope measures the angular acceleration on another axis; with this module we will be able to achieve orbital autonomy.

40. Discovery, Isolation, and Characterization of Mycobacteriophage *Candle*

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The mycobacteriophage *Candle* was discovered in a soil sample found in Northport, Alabama at the base of garden okra plants. Using the host, *Mycobacterium smegmatis* mc^2155, the sample was filtered, purified, and diluted until the bacteriophage was ready for DNA extraction. Techniques including polymerase chain reaction, gel electrophoresis, and grid staining were used in the final steps. Photos of the phage were taken before finally being archived.

41. Using Novel Methods to Estimate Feral Swine Population Abundance and Behavior in Sumter County, AL

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Invasive species are a global problem, with many causing widespread damage to both native communities and ecosystems. Due to crop damage and management efforts, invasive species have an annual impact of over $120 billion dollars in the United States alone. Although there are many non-native species in the Southeastern US, feral swine are arguably causing the most damage to native ecosystems. Given their destructive activities, secretive behavior, and ability to quickly reproduce, they are exceedingly difficult to manage using conventional methods. To help counter this growing problem, the University of West Alabama and the Sumter County Soil and Water Conservation District were awarded a grant to assist and educate local landowners in the control and management of invasive species (Partners Against Invasive Species or PAIS). To help landowners, we deployed motion operated game cameras to identify and monitor feral pig activity on various properties and remotely operated traps to capture feral swine throughout the county. Since May 2018, we have collected over 5,000 photographs of feral swine in the area, complete with date and time stamp for each. Our goal is to analyze the photographic documentation to estimate the relative abundance of feral swine populations, to correlate this with trap success, and to identify how swine behavior patterns change with season and the habitats they frequent.

42. Assessing the Impact of "Osmotion": an Active Learning Module Focused on Improving Comprehension of Osmosis and Diffusion for Underrepresented Minority Students

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In the United States, underrepresented minorities (URMs) face barriers to success in secondary education that result in higher attrition rates and limited representation within the science, technology, engineering, and mathematics (STEM) workforce. Much research has recognized that active learning, as opposed to passive learning, can alleviate this disparity and disproportionately benefit URMs. However, these results were accomplished by revamping entire courses to become highly structured which thereby limits the applicability for other educational programs which may lack the support or funding for a pedagogical shift. We therefore explored if introducing an active learning module for a core yet rarely mastered concept in introductory biology - Osmosis and Diffusion (O&D) - would render a similarly disproportionate effect while being more implementable among educational programs. To test this, students attended one active learning module which included a lecture, graphic organizer, and the "osmotion" kinetic activity where students physically re-enacted the processes of O&D as water and solute molecules. To assess student confidence and comprehension, the Osmosis and Diffusion Confidence Inventory and Osmosis and Diffusion Conceptual Assessment were utilized, respectively. Our findings indicate that, despite significant improvements in both groups, the pre-existing achievement gap between URMs and non-URMs persisted. Additionally, although both groups significantly improved confidence in O&D, the active learning module did not disproportionately benefit URMs as expected. We suggest that additional studies are warranted to determine the appropriate amount of active learning practice needed to close the achievement gap between URMs and non-URMs in introductory biology.

43. Can *Capsicum annuum* be used as a Natural Method to Fight Bacterial Growth?

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Bacterial contamination on food products, especially preserved and canned food, can be a problem. Food industry tends to use many chemicals to prevent bacterial growth and prolong their product shelf life. *Escherichia coli* and *Salmonella Newport* have become major causes for food recalls in recent years. In 2018, nearly 50 tons of beef was recalled by the USDA for being contaminated with *E. coli* and *S. newport.* Spices found to contain antimicrobial components are that of cayenne pepper and paprika. The chemical compound found in cayenne pepper, (*Capsicum annuum*) is believed to have properties to enable it to kill bacteria. There have been many thoughts on whether or not adding the spice *Capsicum* from peppers to the food if that would help to fight off the bacteria. Our research is focused on discovery of a natural ways to preserve food product against common bacterial contamination (mainly *E. coli* and *Salmonella newport*) instead of the use of chemical preservatives. We are testing the effects five different concentration of the active compound found in *Capsicum annuum* (capsaicin) at four different pH levels on the viability of the two gram negative bacteria (*E. coli* and *S. newport)* growing in liquid cultures. In addition, we are also testing two gram positive bacteria *Staphylococcus epidermidis* and *Staphylococcus cohnii* to see if the class of bacteria will have an influence on the effectiveness of the capsaicin on the cell viability. We expect that the capsaicin will be more effective in inhibiting the growth of gram positive bacteria compared to negative ones due to the fundamental structural differences in their cell walls. This project is class based research, we are still working on the experiment and we expect to present our available data at the time of the symposium.

44. The Fight Against Burnout: A Systematic Analysis of the Relationship Between Empathy, Self-Efficacy, and Burnout in Patient Care

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This systematic review examines burnout in long-term caregivers and how empathy and self-efficacy are related to it. It is known that burnout is an increasing problem in health care, and that self-efficacy seems to affect burnout, while empathy's relationship to burnout is unknown. Most previous studies seem to examine only how self-efficacy or empathy is related to burnout, but very few examine all three of them together. Therefore, this review attempts to answer the following questions: how does empathy and self-efficacy affect burnout in formal, long-term caregivers, and what kind of intervention programs are effective in decreasing burnout? This review answers these questions by including relevant studies regarding burnout, empathy, and self-efficacy and combining their overall results to understand how all three variables are related to each other. Using the online database PubMed, 277 articles were obtained with the original search. After applying filters and screening abstracts and full texts, 47 studies were included in the systematic review. Based on results from the included studies, it was found that self-efficacy affected burnout the most, while empathy did not. Contrary to what is normally assumed, burnout is actually what affects empathy rather than the assumption that empathy affects burnout. Therefore, when a caregiver has low self-efficacy, they have higher burnout. When they have high burnout, they express less empathy to their patients, which decreases quality of long-term care. It is suggested to employ intervention programs in long term care facilities for caregivers who are experiencing burnout with the goal of: increasing self-efficacy, providing effective education on coping mechanisms, and identifying and addressing other specific causes of burnout. Decreasing burnout will not only be beneficial to the caregivers themselves, but it will positively impact the health of the patients that they care for on a day-to-day basis.

45. Herbicide Induced Reproductive Dysfunction in *Drosophila melanogaster*

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Spectracide is a very commonly used herbicide that contains four harmful components viz., atrazine, diquat dibromide, fluazifop-p-butyle and dicamba that are banned in various European countries but still permitted in the United States. The active ingredients in Spectracide are reported to cause neurological disorders and may have an adverse effect on reproductive function. Our previous experiments report that Spectracide disrupts the biological clock in the fly models and creates oxidative stress. This experiment is designed to explore the effects of Spectracide on reproductive behavior and performances using the fruit fly, *Drosophila melanogaster*. Young adult male and female flies (5-7 days old) were fed a 10% Spectracide solution mixed with 5% sucrose for six hours and the grooming behavior observed at 6, 12 and 24 hours. The control flies were fed a 5% sucrose solution. We observed that male grooming behavior in the presence of females is severely affected by Spectracide (1 time/ minute) when compared to controls (4 times / minute). Also, Spectracide fed flies (six hours exposure) produce fewer progeny that show a significant delay in larval development compared to control. Since grooming activity is a major event by males prior to mating, we hypothesize that the low numbers of progeny could be due to either disruption in fertility or defects in reproductive development caused by the active ingredients of the Spectracide when exposed for six hours. Histopathology of adult reproductive systems and the sperm motility assessments are being conducted to better understand the actual deleterious effect of Spectracide. Taken together, these results suggest that elements in Spectracide have a negative effect on reproductive behavior and outcome in *Drosophila melanogaster*, thus, these compounds could also be harmful to humans.

46. Isolation and Biochemical Characterization of *Vibrio parahaemolyticus* Protected from Laboratory Validation from Natural Seafood Sources

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Viable but non-culturable (VBNC) state of foodborne bacteria is a prerequisite for false-negative validation by the standard examination/evaluation protocol and causes high risk to seafood safety. Some strains of *Vibrio parahaemolyticus* behave as such and more likely contribute to contamination found in seafood products. Our research was to explore a novel reviving method that can vitally improve the detection method devised today in evaluating seafood samples for foodborne *Vibrio* varieties. An improved pre-enrichment method was devised for investigative isolation of VBNC *V. parahaemolyticus* from various sources. Buffered indicator plates containing thiosulfate-citrate-bile salts-sucrose media (TCBS) were subsequently utilized for selective culturing and isolation of *V. parahaemolyticus*. Gene-specific PCR, Urease and Kanagawa hemolytic tests were followed for virulence characterization of the isolates. Significant differential revivability was determined for 15 biological and 3 technical tests using Student's t-test ($P<0.05$). Extracted DNA using bead collision method was analyzed using 16S rDNA sequencing with an ABI 3730XL sequencer. TCBS screening for enriched or enriched + heated (80 °C) shellfish samples exhibited 15 green or dark green colonies, a representative color of *V. parahaemolyticus*; however, a small subset of the isolates (i.e., 5/15) were acquired following a prolonged heat treatment of enriched samples, suggesting the availability of a novel group of *V. parahaemolyticus*, in which their revival from VBNC state depends on pre-enrichment followed by heat treatment. Positive urease production and negative hemolysis formation were noted. DNA analysis of two dark green isolates by virulence genes PCR and 16S rDNA sequencing confirmed that these isolates were TLH-positive *V. parahaemolyticus*. Food outbreaks driven by false validation may involve novel bacterial properties that may be attributed to the lower detection rate of *V. parahaemolyticus* than the hospitalization rate of the contracted patients. Our findings suggest a conditions combined method for detection of this group of *V. parahaemolyticus*.

47. Microbial Community Structure and Diversity of *Avicennia germinans* & *Spartina alterniflora* Associated Sediments in Northern Gulf of Mexico Salt Marsh Habitats

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Salt marshes are coastal wetlands that support critical services (e.g., water quality protection, mitigation of shoreline erosion, sediment trapping, fisheries nursery, recreation/tourism). As these coastal wetlands undergo more frequent and intense threats in this century arising from chronic (e.g., rising sea levels, climate change, invasive species) and pulse (i.e. oil spills, flooding, superstorms) disturbances, communities are faced with daunting economic losses. Events such as the 2010 Gulf of Mexico oil spill disaster coupled with significant population changes in human land use and an expanding invasive population of *Avicennia germinans* (black mangrove) act as add-on catalysts to further accelerate deterioration and loss of barrier islands, particularly those at low-elevation such as the Chandeleur Island chain. The Chandeleur island chain's native vegetation is primarly *Spartina alterniflora* (saltmarsh cordgrass). However, black mangrove (*Avicennia germinans*), an invasive species is also present. Oil impacted the barrier island chain to varying degrees; therefore, it was important to investigate the microbally-driven ecosystem service, denitrification, a nitrogen (N) cycle pathway. While oil can inhibit microbially mediated denitrification, nitrification and denitrification processes have been found to be relatively low in *A. germinans* sediment. The objective of this study was to i) characterize microbial community composition along an *S. alterniflora* vs *A. germinans* sampling gradient, ii) compare and contrast the impact of expanding black mangrove on microbial diversity over time, and iii) characterize denitrifying microbes and diversity indices along sampling gradients. Sites containing *A. germinans* exhibited a higher diversity of microbial taxa associated with Deltaproteobacteria (known sulfur oxidizing/hydrocarbon degraders) when assessed in Y3. Interestingly, alpha diversity was consistent for *S. alterniflora* marsh across sampled months (i.e. May, July, August 2017) and varied within Site 2 samples associated with *A. germinans.* As weathered oil continues to be detected at our study sites 8-years post spill, it will be important to continue to evaluate the impact of oil and invasive species such as *A. germinans* on vital microbial geochemical processes which act to remove nitrate so as to reduce available N in the system that contributes to eutrophication and further poor water quality.

48. A Comparison of Resident Arthropod Communities Utilizing Native and Non-Native Grass Species in Eastern Mississippi.

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An estimated 50,000 thousand non-native species have been released into the U.S. over the last 100 years, and many have caused serious harm, both ecologically and economically. These non-native species outcompete native species for resources, can reduce local biodiversity, and have been reported to cost the U.S. approximately $120 billion dollars annually. Cogongrass (*Cylindrica imperata*) is among the most aggressively growing invasive plant in the Southeastern US, which spreads rapidly with wind-dispersed seeds and, once established, forms dense monospecific stands. Given that the growth morphology of this plant differs markedly from naturally occurring vegetation, we compare the diversity and abundance of resident insect communities between non-native Cogongrass dominated areas and adjacent stands of native vegetation (*Polygonum*). To measure insect communities, five pitfall traps were placed in each vegetation type for a 24-hour period. A subsequent set of samples was collected two weeks later. All captured insects were placed in sample jars, returned to the lab, and identified to Order. Over the course of the two sample cycles, we found that native vegetation supported higher insect abundance and diversity (49 individuals captured, representing 6 different orders) than did areas dominated by the invasive Cogongrass (29 individuals captured, with 4 distinct orders, of the 29 individuals, 25 were represented by Hymenoptera). As documented in other studies, out results support the growing body of literature demonstrating that non-native species have the ability to reduce biodiversity.

49. The Diversity of Coastal Aquatic Insects at Varying Levels of Salinity

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The goal of this experiment was to evaluate coastal aquatic ecosystems of varying salinity in order to determine at which concentrations certain families of insects no longer occur. A secondary goal was to explore the salinity concentration at which aquatic insects completely disappeared. Salinity was measured and aquatic insects were collected from small, wadeable ponds located on barrier islands along the U.S. Gulf Coast. Aquatic insects were collected with a D-frame dip net by making five, evenly distributed 1-meter-long sweeps in vegetation along the perimeter of the ponds. A total of five ponds with differing salinity levels were collected and samples were preserved with 70% isopropyl alcohol before transport back to the lab for identification. The salinity of the ponds were 5, 10, 15, 16, and 25 ‰. Insects were collected at every salinity concentration except for 25 ‰. The greatest insect diversity was at found at 5 ‰ while the highest abundance was at 10 ‰. Further research is planned to replicate sampling at ponds matching previous salinity concentrations and to sample ponds between 16 and 25 ‰.

50. Phenomenal Increase in Crop Production using Fungal endophytes

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The human population is growing fast and the current production of crops is not sufficient enough to meet the increasing demand, in fact it is expected that the current production of crops will need to double to secure food supplies to feed an expected 10 billion people by the year 2050. This challenge is coupled with the changing climate threats that agricultural industries face, which brings heat waves and droughts. Various methods such as classical breeding and biotechnology approaches have aided in producing more crops in a significant manner, but other new innovative technologies are required to meet the goals of doubling crop production. Microbes, specifically beneficial fungal endophytes, play an internally important role in aiding host organisms survival in nature, including harsh environments, and are a part of what is referred to as the microbiome. Past agricultural practices have led to a loss of this microbiome in crop plants. By reintroducing these beneficial endophytes to crop plants, agricultural industries could see an additional increase in crop yields, even during a changing climate. We hypothesize that colonized tomato and corn plants with novel fungal endophytes isolated from wild plants, will produce more crops than a non-symbiotic control. Greenhouse and field trials were conducted during 2018 for tomato and corn, respectively. Based on these trials, our data revealed that fungal endophytes increase crop production by 18-98% and 5-28%, respectively, when compared to the non-symbiotic control. The overall mechanism behind this phenomenal increase is unknown and warrants further studies for better understanding.

51. Formation of Amylose-Aroma Inclusion Complexes: Menthol, Limonene, and Thymol

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As the linear component of starch, amylose can form V-type inclusion complex with a variety of small molecules. The V-type amylose single helix has a hydrophobic cavity which allows for the residence of hydrophobic ligands, such as aroma compounds. Inclusion complexes formed between starch and flavor compounds are of great interest due to their influence on flavor perception in food and on molecular encapsulation in flavor technology. In this study, the feasibility of amylose to form inclusion complexes with a series of aroma compounds, including menthol, limonene, and thymol, were explored. The inclusion complexes were prepared by heating V_{6h}-type amylose with aroma compounds at various weight ratios and temperatures. Crystalline transitions of amylose were characterized by wide-angle X-ray Diffractometry (XRD), and thermal properties were analyzed by differential scanning calorimetry (DSC). Results showed that all the three aroma compounds (menthol, limonene, and thymol) were successfully complexed with V_{6h}-type amylose at the temperature of 70 °C, evidenced by a peak shift in 2θ angles from 20° (V_{6h}-type) to 18° (V_7-type) on XRD patterns. Reaction temperature of 50 °C resulted in partial crystalline transition to a mixture of V_{6h} and V_7-types, indicating partial inclusion complexation of the aroma compounds. A weight ratio as low as 1:02 (amylose:aroma) was sufficient for complete crystalline transition and complexation. Dissociation endotherms with peak temperature at 118, 107, and 96 °C were observed on DSC thermograms of the amylose-menthol, amylose-limonene, and amylose-thymol inclusion complexes. Due to the volatile nature of flavor compounds, the study of amylose complexation with flavor compounds is of great significant for the protective effect, as well as for further applications of flavor retention and release in food products.

52. Sb_2Se_3 Thin-Film Solar Cells Grown by Close-Space Sublimation

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Solar cells are electronic devices that directly convert energy from sunlight into electricity and provide affordable and sustainable energy. Recently, thin-film solar cells attract great attention due to its light-weight and flexible as well as high power conversion efficiency. Cadmium sulfide (CdTe) and copper-indium-gallium-selenide (CIGS) are two most successful commercialized thin-film technologies with efficiency of over 22%. However, the toxicity of cadmium, the limited earth storage of telluride, and the high cost of indium and gallium post great barriers to achieve the needed PV module capacity beyond terawatt. Sb_2Se_3 is a promising absorber material to fabricate thin-film solar cells because it is low-cost, non-toxic and earth-abundant. Particularly, the orthorhombic crystal structure of Sb_2Se_3 indicates an anisotropic photoexcited carrier transport behavior. Thus, we can tune the grain orientation to change charge carriers transportation and then further improve the device performance. Close-space sublimation (CSS) is an ultra-fast physical vapor deposition technique ($\sim$1 um min^{-1}). Here, we employ the CSS growth technique to tune the growth behavior of Sb_2Se_3 and to realize a high quality Sb_2Se_3 thin-film solar cell with a high efficiency. In this work, we theoretically investigate the anisotropic electronic and optical properties of Sb_2Se_3, and experimentally demonstrate the grains can be tuned by changing CSS growth conditions. This study paves the way to scale up the manufacturing of non-cubic absorber materials with ribbon-like structures and confirms the great potential of Sb_2Se_3 for thin-film solar technologies.

53. Evaluation of Nutritional Quality and Microbial Safety of Microgreens from Commercial and Local Organic Farms

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Microgreens are specialty vegetables, attributed to their densely-packed nutrition, intense flavor, and vivid color. Although hydroponic growing can increase the productivity, commercial microgreens may be less nutritious and more susceptible to microbial contamination. The study aimed to evaluate the total chlorophyll content (TCC), total phenolic content (TPC), antioxidant capacity (AC), and total microbial content (TMC) of two microgreen species, i.e., alfalfa sprouts and broccoli sprouts, from two sources, a local grocery store and a local organic farm, respectively. Microgreen samples were cut and homogenized and the homogenized mixture was centrifuged and filtered. TCC was determined using a spectrophotometric method following 80% (v/v) acetone extraction. Following 80% (v/v) methanol extraction, the solution was measured for TPC using the direct, phenolic-binding Fast Blue BB assay, and for antioxidant capacity using the relative 2,2-diphenyl-1-picrylhydrazyl radical scavenging capacity assay. The indigenous microorganisms of stomached/homogenized samples in buffered peptone water (0.1%) were diluted, plated, incubated (30 °C), and enumerated using bacterial Plate Count Agar and acidified fungal Potato Dextrose Agar. The TCC of both alfalfa and broccoli sprouts from the local farm was significantly ($P<0.05$) higher than those from the commercial farm. The commercial and local microgreens showed no significant difference in their TPC and AC. Broccoli sprouts showed significantly ($P<0.05$) higher TPC, yet lower AC than alfalfa sprouts, regardless of their sources. TMC analyses revealed that the groups and numbers of bacteria in microgreens are much more diverse than those of fungi (>1000-fold cfu/ml), while no significant difference was detected between commercial and local microgreens. Given the culinary trend and market demand, microgreens have gained popularity as a specialty crop. However, their easy perishability, i.e., nutrient loss and short shelf life, is a challenge for farmers. An evaluation of the nutritional quality and microbial safety can provide valuable information for farmers, suppliers, and consumers.

54. Adipose Tissue Development of Neonatal and Weanling Sprague-Dawley Rats in Response to a Maternal High Fat Diet Supplemented with Lycopene

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Excess adipose tissue (AT) may undergo adipocyte differentiation in response to nutritional stimuli. It is unknown if lycopene may metabolically activate adaptive thermogenesis and disrupt the ensuing dysfunction of excess energy. The purpose of this study was to assess AT development of Sprague-Dawley offspring from mothers fed high fat diets (HFD = 50% fat) supplemented with 1% lycopene during the suckling and post-weaning period. Three Sprague-Dawley rats were randomized to a 25% normal-fat diet (NFD) or HFD on their 5th day of gestation. Upon delivery, one HFD mother was transitioned to a HFD supplemented with 1% lycopene. Four pups/litter were euthanized at postnatal day 14 and 25 (P14 and P25, respectively) with visceral white AT (WAT), brown AT (BAT), and body weight (BW) recorded. At P25, the remaining weanling pups (3 pups/litter) were fed the diets of their respective mothers until euthanizing at P35. The HFD was effective in inducing weight gain as evidenced by increases in BW and WAT in the HFD group not receiving lycopene supplementation compared to pups from the NFD litter across at all time points. At P14, WAT was 42.5% lower ($p=0.003$) in rats reared by mothers consuming lycopene-supplemented HFD compared to the non-supplemented HFD group. At P25, significant decreases in WAT ($p=0.004$, 25.6% lower) were also observed concomitantly with significant increases in BAT ($p=0.025$, 40% increase) in rats reared by mothers consuming lycopene-supplemented HFD compared to the HFD group not receiving lycopene. Albeit non-significant, BW and WAT in the lycopene-supplemented HFD group remained lower while BAT remained higher through P35. Results suggest that lycopene may influence cardiometabolic outcomes such as accrual of AT mass and subsequent obesity. Additional research is warranted to determine diet-induced signaling pathways by which lycopene may influence adipocyte differentiation.

55. Systemic and Adipose Tissue Redox Balance in Sprague-Dawley Rats fed Standard Fat and High Fat Diets Supplemented with Lycopene

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Dietary fat promotes oxidative stress and adipose tissue (AT) accrual, further exacerbating redox imbalance. The purpose of this study was to compare the effects of lycopene, a lipophilic antioxidant, on systemic and AT redox balance in Sprague-Dawley rats fed diets meeting and exceeding recommendations for fat intake in humans. Male Sprague-Dawley rats (n=18) were fed 30% fat (control) or 60% fat purified diet (HFD) supplemented with 100mg lycopene/d. Three rats per group were euthanized at weeks 3, 7, and 10, with visceral AT and body weight recorded. Redox markers assessed included serum and AT lipid peroxides assayed by thiobarbituric acid-reactive substances (TBARS) and antioxidant capacity (AC) using oxygen radical absorbance capacity assay. Statistical models were adjusted for dietary intake. At weeks 3 and 7, there were no significant differences in serum or AT redox markers or AT mass between groups; however, body weight was significantly lower in the HFD group at both times ($p=0.016$ and $p=0.008$, respectively). At week 10, AT was significantly higher ($p=0.028$) in the HFD group, yet there were no significant differences in TBARS between groups. Of interest, the HFD group exhibited significantly greater AT lipophilic AC ($p=0.031$). Significant correlations between serum and AT TBARS ($p=0.036$, $r=0.841$) and serum and AT lycopene ($p=0.021$, $r=0.879$) were observed at week 10. Overall, no significant differences in systemic and AT oxidative stress were observed between groups; however, the HFD group exhibited increased lipophilic AC. Results suggest that lycopene may modulate systemic redox balance through the attenuation of AT oxidative stress.

56. Agronomic and Nutritive Value of Cool-season Annual Mixtures for Baleage Production

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Baleage is a high moisture feed that is gaining popularity in the Southeast due to its consistent nutritive quality and timely harvest. The objective of this study was to compare the agronomic and nutritive value of two different cool-season annual mixtures, wheat (*Triticum aestivum*) and T-Raptor (*Brassica rapa* × *napus*; T) or wheat and crimson clover (*Trifolium incarnatum*; C) with (I) or without (N) inoculant. The baleage was tested at 8 time periods. The samples were analyzed for CP, ADF, NDF, ADL, pH, and VFA's by Dairy One Laboratories (Ithaca, NY). There was no difference in ADF concentration among treatments, but day 120 after ensiling was greater ($P \leq 0.0024$*)* than all other sampling dates. There was no difference in NDF between forages and silage inoculant treatments. Crude protein of C was greater ($P \leq 0.0001$) than T by 3.6 units. The pH of C was greater ($P \leq 0.001$) than T, but not different between I and N treatments. The pH increased at day 120 due to the lack of long-term anaerobic stability but was within normal range at day 28. Lactic acid concentration interactions for forage and silage, and silage by day were not different ($P = 0.0372$, $P \leq 0.0001$ respectively). There was no difference ($P = 0.2633$) between forage treatments for acetic acid. Forage treatments differed ($P \leq 0.0001$) with I being greater than N (5.49 vs. 1.94 %, respectively). Acetic acid increased ($P \leq 0.0001$) across all days. Butyric acid concentrations were greater ($P \leq 0.056$) for C as a result of the buffering capacity and pH differences. These results are interpreted to mean that use of silage inoculants in these mixtures is not economically viable, but that these mixtures are suitable for baleage production and provide adequate forage quality to maintain animal performance.

57. Enhanced Storage Stability and Photo-stability of β-Carotene by Nanoencapsulation using Amylose Inclusion Complex

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β-Carotene (BC), which provides the red and orange color of many plants, is one of the most common dietary carotenoids. In the body, BC can be converted to vitamin A, an essential nutrient involved in cell differentiation, immunity and vision. Moreover, BC itself functions as an antioxidant that can reduce oxidative stress which contributes to many chronic diseases, such as metabolic syndrome, obesity, and cardiovascular disease. However, the benefits of BC are often compromised by its instability under light exposure or high temperature. Nanoencapsulation by amylose inclusion complex is a novel technique which has the potential to increase the stability of BC, by protecting BC in the nanocrystals of the V-type amylose. The formation of amylose-ascorbyl palmitate (AP)-BC ternary inclusion complex was described in our previous study. This study aimed to evaluate whether the storage stability and photo-stability of BC will be improved by this nanoencapsulation technique. To evaluate the storage stability, amylose-AP-BC inclusion complex was stored at 45 °C for up to 16 days, using amylose-AP-BC physical mixture as the control. Results showed that BC in the control was degraded much faster than that in the inclusion complex, with 3% and 75% retention of BC at day 16, respectively. To evaluate the photo-stability of BC, amylose-AP-BC inclusion complex was placed in dark with and without UV exposure at 20 °C for up to 6 h, using AP-BC solution as the control. Without UV exposure, the retention of BC was 63% and 94% in the control and inclusion complex, respectively. When exposed to UV, BC in solution was completely degraded within 2 h, while the retention of BC was 84% in the inclusion complex. In conclusion, nanoencapsulation by amylose inclusion complex significantly increased the stability of BC during storage at an elevated temperature and under UV exposure.

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