PROCEEDINGS OF THE

FALL 2024 MISSISSIPPI COLLEGE

"RESEARCH & REASONING"

STEM SYMPOSIUM

Departments of Biology, Chemistry & Biochemistry,

Engineering, Computer Science & Physics,

Mathematics, and Physician Assistant Studies

MCC LOBBY, DECEMBER 4, 2024

Sponsored by the

Mississippi College Office of Research &

School of Science and Mathematics

About the Fall 2024 Mississippi College "Research & Reasoning" STEM Symposium

Student Poster Presentations

- Undergraduate and graduate students from the Mississippi College School of Science and Mathematics are invited to submit an abstract and present a poster.
- Each student presenter should be a current student of the Department of Biology, Chemistry & Biochemistry, Engineering, Computer Science & Physics, Mathematics, or Physician Assistant Studies.
- Oral presentations may be scheduled during the week of the symposium.
- New researchers with one semester of data and seasoned researchers with a complete project are all welcome to present.

Symposium Sponsors & Acknowledgments

The Fall 2024 Mississippi College STEM Research Symposium is sponsored by the Mississippi College Office of Research, directed by Dr. David Magers, and the School of Science and Mathematics, under the direction of Dr. Stan Baldwin, Dean. The Mississippi College Office of Research, provides easels for posters and gift cards for recipients of People's Choice Awards.

The Mississippi College Medical Dental Alumni Association(MDAA) provides two overall awards for the best research projects as judged by qualified faculty.

Assistance with voting and coordination of the event is provided by members of the Mississippi College Chapter of Tri-Beta under the direction of Dr. Jana Thoma. This symposium was coordinated by Dr. Joseph A. Kazery and Dr. Angela Reiken.

Symposium Schedule

Date ..... **December 4, 2024**
Location ..... **College Math, Chemistry, Computer Science (MCC) Lobby**
Mathematics Seminar Oral Presentations..... **10:00 AM - 11:30 AM**
Poster Set-up ..... **1:00 PM - 1:30 PM**
Poster Presentations ..... **1:30 PM - 3:30 PM**
People's Choice Voting & Judging ..... **1:30 PM - 3:30 PM**
People's Choice & MDAA Awards ..... **3:30 PM - 4:00 PM**

Abstracts
Fall 2024 Mississippi College "Research & Reasoning" STEM Symposium

Biological Sciences

Poster #1

- **Title:** Triple Combination CFTR Modulator Therapy for CF Patients
- **Presenter:** Amanda Matthews, PA-S II
- **Co-Authors:** Amanda Matthews, PA-S II
- **Department:** Physician Assistant Studies
- **Research Mentor(s):** Katryna Horton, MPAS, PA-C
- **Research Sponsor(s):** Department of Physician Assistant Studies
- **Abstract:**
  Cystic fibrosis is a life-threatening, autosomal recessive disease that affects more than eighty-thousand people worldwide. Until recently, the treatment regimen for CF patients included symptom-target therapies to prevent and treat bacterial infections as they arose. More Recently, CFTR modulators, which target the mutated CFTR protein were introduced. The purpose of this literature review is to answer the question: "In cystic fibrosis patients, does adding a triple combination CFTR modulator to their treatment regimen improve pulmonary disease and quality of life compared to traditional symptom-targeted therapies?" A PubMed, MEDLINE, and UpToDate search was conducted for this literature review. Results were filtered to include peer-reviewed journals from the last ten years limiting the results to English and free texts. Phrases such as "triple therapy CFTR modulators," "cystic fibrosis," "trikafta," "kaftrio," "lung function," and "quality of life" were used to narrow the search. Seven articles were chosen for this review and divided into quantitative and qualitative research. The quantitative research examined the impact of triple CFTR therapy on the pulmonary health of adult and pediatric patients, patients with mild to severe lung disease, and patients colonized with resistant bacteria. The qualitative research examined patients' perceptions of their respiratory health as well as their overall quality of life while on triple CFTR therapy. The results of this literature review demonstrated that adding a triple CFTR modulator to the treatment regimen of CF patients improves patient lung function, decreases pulmonary bacterial colonization, and improves patients' overall quality of life.

Poster #2

- **Title:** Ketamine vs ECT for Treatment-Resistant Depression
- **Presenter:** W. Ethan Burch, PA-S II
- **Co-Authors:** W. Ethan Burch, PA-S II

- **Department:** Physician Assistant Studies
- **Research Mentor(s):** Megan Colvin, MPAS, PA-C
- **Research Sponsor(s):** Department of Physician Assistant Studies
- **Abstract:**
  Treatment-resistant depression (TRD) is major depressive disorder (MDD) that has failed to respond after two trials of medical treatment. Electroconvulsive therapy (ECT) has long been the treatment of choice for severe TRD, but more recently ketamine has also been shown to be an effective treatment for severe TRD. The purpose of this literature review is to determine if ketamine or ECT has better outcomes in treating severe TRD. A search was performed using PubMed, UpToDate, Academic Search Complete, and Science Direct, with randomized controlled trials in the past 10 years providing most of the information. Different phrasings of "treatment-resistant depression and ECT or ketamine" were used to narrow the search. The underlying theme of the articles reviewed is that ketamine and ECT are both effective in treating TRD. Still, there is inconsistency in the data present as to whether ECT or ketamine is the better treatment option.

Poster #3

- **Title:** Depression and Cardiovascular Disease
- **Presenter:** Natalia Corales, PA-S II
- **Co-Authors:** Natalia Corales, PA-S II
- **Department:** Physician Assistant Studies
- **Research Mentor(s):** Megan Colvin, MPAS, PA-C
- **Research Sponsor(s):** Department of Physician Assistant Studies
- **Abstract:**
  Depression is the leading mental disorder worldwide and is defined by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) as at least 2 weeks of a depressive mood or anhedonia paired with significant functional impairment. Cardiovascular disease (CVD) is the leading cause of death in the United States. Cardiovascular disease includes coronary heart disease, which often leads to myocardial infarction. The links between depression and cardiovascular disease are multifactorial and often not fully recognized. The purpose of this literature review is to determine if adults with depression are at a greater risk of CVD compared to those without depression. A literature review was conducted using Elsevier, PubMed, and CINAHL. Other resources accessed included DSM-5, the Center for Disease Control and Prevention (CDC), and the World Health Organization (WHO). Peer-reviewed journals from the years 2015-2022 were used. Phrases such as "depression", "cardiovascular disease", "inflammatory biomarkers", "IL-6", "CRP", "cardiovascular risks", and "inflammation" were used to search the literature. Inclusion criteria included publication date between 2014-2024, all adult population, and full-text access. The common consensus of the articles researched showed that individuals with depression were at a greater risk for CVD. Furthermore, individuals who already had a diagnosis of CVD demonstrated

increased cardiovascular mortality if depression was also present. Therefore, it is crucial that screening for CVD take place in patients with depression and, conversely, screening for depression in those with CVD. Recognizing and screening the appropriate patients may lead to improved patient outcomes and reduced long-term healthcare costs.

Poster #4

- **Title:** Synthesis and Comparability of Conventional Chitin Beads for Bioremediation Analysis
- **Presenter:** Andrew Doubert, Guy Gordon
- **Co-Authors:** Andrew Doubert, Guy Gordon, Nathan Prine, Aaliyah Newsome, Trent Selby, Joseph Kazery
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Joseph Kazery
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Metal and metalloid pollution, known as potentially toxic elements (PTEs), in an aquatic system affects the environment while also affecting public health. Pollution of PTEs comes from a variety of sources from construction to fossil fuels to domestic wastes. Despite the extremely limited removal of tiny inorganic particles and dissolved PTEs from wastewater, remedial techniques do exist. While PTEs cannot be broken down, the principal method of removal is by absorption or adsorption. Bioremediation is the use of naturally occurring substances to break down or remove pollution, as can be used for the removal of PTEs. This study's goal is to use the chitinous waste of crayfish exoskeletons as an adsorption media for PTEs. In this study, we have modified chitin by demineralizing and deproteinating (DMDP) the material to observe its properties. We compared our harvested exoskeletons to lab-grade chitin to observe the quality of our chitin. From there, our harvested DMDP chitin was solubilized at an initial 0.5% with and a 1% concentration of chitin in our bead-making process. The beads of our DMDP beads concentrations were then compared by Brunauer-Emmett-Teller (BET) analysis to observe differences in total surface area, pore size, and pore volume. All of these properties allow for adsorption capability. Once the optimal properties are determined, the chitin beads will be used in an uptake study to determine the rate of uptake and capacity of cadmium.

Poster #5

- **Title:** Measuring Test Anxious Students' Pupil Response to Positive and Negative Feedback
- **Presenter:** Amy N. Snyder
- **Co-Authors:** Amy N. Snyder, Erick A. Bourassa
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Erick A. Bourassa
- **Research Sponsor(s):** Department of Biological Sciences

- **Abstract:**
  The blue-box stress test (BBST) was developed and validated in the Bourassa lab for identifying students with and without test anxiety. The underlying assumption of the BBST is that test anxious students (but not non-test anxious students) will deploy more attentional resources to the performance indicator when being given negative feedback than the actual task, causing a decrease in actual performance. However, there is only indirect (EEG) data supporting this assumption. The present study used pupil tracking to confirm this underlying assumption of the BBST as well as determine if the attentional bias towards the performance indicator (the region of interest, ROI) is due to hypervigilance towards, or failure to disengage attention from, the ROI. The results show that overall, BBST score did not correlate with the duration participants gazed at the ROI (with either good or bad feedback), nor did the BBST correlate with the latency to look at the ROI. However, the ratio of duration and (1/latency), when being given bad feedback relative to good feedback, significantly correlated with BBST score ($r = -0.277$, $p = 0.0025$). Because the ratio of duration to (1/latency) significantly correlated with BBST, but neither the duration or latency alone did, this suggests that students with test anxiety either have hypervigilance towards the ROI or actively avoid the ROI. This is consistent with the hypervigilance-avoidance model of attentional bias in anxiety, further supporting the BBST as a valid tool to measure test anxiety.

Poster #6

- **Title:** Grapheme-Color Synesthesia is Associated with Enhanced Working Memory to Graphemes, but not Colors, that is Supported by Enhanced Activity in the Supramarginal Gyrus and Decreased Activity in the Primary Visual Cortex
- **Presenter:** Anna Grace Brister
- **Co-Authors:** Anna Grace Brister, Erick A. Bourassa
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Erick A. Bourassa
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Grapheme-Color Synesthesia (GC-S) is a condition where individuals perceive color when viewing non-colored graphemes. Previous work has shown that synesthetes have enhanced working memory for abstract concepts (such as words); however, it is unclear if this advantage arises from synesthetic association itself. This study investigated whether synesthetes have improved working memory efficiency to graphemes compared to nonsynesthetes, but not to simple visual stimuli such as color. Ten synesthetes and sixteen nonsynesthetes performed a working memory task consisting of 4, 6, 8, and 10 items per trial, with items consisting of either color swatches or non-colored graphemes, while brain activity was recorded using functional near-infrared spectroscopy (fNIRS). As expected, performance decreased for both groups as the number of items increased, but significant differences emerged on the most

demanding trials (8 or 10 items per trial). On those trials, synesthetes and nonsynesthetes performed similarly on color trials, but synesthetes maintained accuracy on grapheme trials while nonsynesthetes' accuracy significantly decreased. Neuroimaging showed that synesthetes, relative to nonsynesthetes, had increased brain activity in the associative visual cortex during color trials. On grapheme trials, synesthetes, relative to nonsynesthetes, had increased brain activity in Brodmann area 40 (supramarginal gyrus) as well as decreased activity in the visual cortex. These findings show that synesthetes have differential processing of color and grapheme stimuli, and that the synesthetic experience may enhance the efficiency of working memory for the synesthetic stimuli.

Poster #7

- **Title:** First Report of Neuroinvasive Zoonotic Parasite *Baylisascaris procyonis* in Mississippi Raccoons
- **Presenter:** Joshua Berry
- **Co-Authors:** Joshua Berry[1], William Janous[1], Steven Mills[1], Aamani Kalluru[1], Fritz Valerio[1], Javian Ervin[1], Chinaza Nwaiwu[1], Bryan Beltran[2], Nicole Phillips[2], Steven Everman[3], Trent Selby[1], and Scoty Hearst[1]*
- **Department:** [1]The Department of Chemistry and Biochemistry, [2]The Department of Biology, Mississippi College, Clinton, MS; [3]Biological, Environmental, and Earth Sciences, the University of Southern Mississippi, Hattiesburg, MS; [4]Department of Medicine, The University of Mississippi Medical Center, Jackson, MS
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
Raccoons have increasingly become semi-domesticated animals living in close proximity to humans in both urban and rural settings. Raccoons can be infected with a wide range of parasites including some very dangerous zoonotic parasites. Infected animals can shed parasites and parasitic eggs in their feces. These eggs can survive in the environment for extended periods of time, potentially infecting humans and their pets as well. The current status of zoonotic parasites in Mississippi raccoons that pose a risk for human exposure and infection is currently unknown. In this study, we surveilled a small number of Mississippi raccoons (49) for intestinal parasites by necropsy. Sanger sequencing was used to identify parasitic species which are a threat to public health. *Baylisascaris procyonis* is an extremely dangerous neuroinvasive zoonotic parasite with pediatric health concerns. Infections of this parasite are fatal due to neuroinvasive larval migrans. *Baylisascaris procyonis* has never been found in Mississippi, but has been reported in neighboring states. Here, we report the first cases of *Baylisascaris procyonis* in Mississippi raccoons. Overall, our data suggests that Mississippi raccoons harbor this dangerous parasite warranting

future surveillance studies to determine raccoon infection rates throughout Mississippi and to fully assess the threat of this parasite to public health.

Poster #8

- **Title:** Take Me Down to the Parasite City Where the Fish are Infected in the Mississippi
- **Presenter:** Aamani Kalluru
- **Co-Authors:** Aamani Kalluru[1], Ella Bailey[1], Fritz Valerio[1], Christian Leach[1], Javian Ervin[1], Stephen Mills[1], William Janous[1], Chinaza Nwaiwu[1], Wilson Hooker[1], Jose Alfonso Xavier Fernandez[1], Caroline Armstrong[1], Alison Cevallos[1], Joseph Kazery[2], Nicole Phillips[3], Steven Everman[4], Trent Selby[1], and Scoty Hearst[1]*
- **Department:** [1]The Department of Chemistry and Biochemistry, [2]The Department of Biology, Mississippi College, Clinton, MS; [3]Biological, Environmental, and Earth Sciences, the University of Southern Mississippi, Hattiesburg, MS; [4]Department of Medicine, The University of Mississippi Medical Center, Jackson, MS
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
  Emerging infectious diseases pose an ongoing threat to human and animal health. Zoonotic parasites in aquatic environments are a growing global human health concern requiring vigilant surveillance. The Mississippi River is home to hundreds of species of wildlife including fish species harvested for human consumption potentially exposing humans to pathogenic parasites. The current status of zoonotic parasites in Mississippi fish that pose a risk for human exposure and infection are currently unknown. In this study, we surveilled the Mississippi River and channel catfish for trematode parasites using eDNA followed by next generation sequencing of the ITS gene. DNA was extracted from multiple locations alongside the Mississippi River and from channel catfish fecal matter. We found zoonotic trematodes in both the Mississippi River and channel catfish samples. These species pose a threat to public health and warrant caution, when consuming fish from the MS River or when enjoying recreational activities on the MS River. Future analysis will be perform using other primer sets for confirmation and we will also monitor variations in trematode parasitic communities with seasonal changes.

Poster #9

- **Title:** Treatment Options for Patent Ductus Arteriosus
- **Presenter:** Elizabeth Braswell, PA-S II
- **Co-Authors:** Elizabeth Braswell, PA-S II
- **Department:** Physician Assistant Studies
- **Research Mentor(s):** David Braden, MD; Justin Goebel, MSPAS, PA-C

- **Research Sponsor(s):** Department of Physician Assistant Studies
- **Abstract:**
  A patent ductus arteriosus (PDA) is one of the most common complications associated with preterm birth. There are many approaches to the treatment of PDA, including non-steroidal anti-inflammatory drug (NSAID) use, transcatheter closure, surgical ligation, or expectant management. This review aimed to investigate how expectant management versus early intervention with NSAIDs affected morbidity and mortality in preterm infants with PDA. UpToDate, PubMed, MEDLINE, and CINAHL were searched to obtain sources for this review. The phrases “expectant management for patent ductus arteriosus,” “patent ductus arteriosus management in preterm infants,” and “NSAIDs for closure of patent ductus arteriosus” were used. Studies published greater than ten years ago, meta-analyses and systematic reviews were excluded, and NSAID use and expectant management had to be among the treatment options used in each study. Five studies were selected and reviewed thoroughly. While the results of each study varied slightly from each other, almost all of the studies showed a marginally increased death rate in the groups of infants treated with NSAIDs. The studies that included incidence rates of necrotizing enterocolitis (NEC) revealed that the groups treated with NSAIDs had mildly lower rates of NEC than the expectant management groups. The studies had conflicting results in terms of the incidence of bronchopulmonary dysplasia (BPD). Still, when the numbers from all the studies were combined, the preterm infants treated with NSAIDs had a few more cases of BPD and death than the expectant management infants. Overall, the infants receiving expectant management had slightly better outcomes.

Poster #10

- **Title:** Pregnancy-Related Mortality Impacting Mississippi Women
- **Presenter:** Katie Rose Barbour, PA-S II
- **Co-Authors:** Katie Rose Barbour, PA-S II
- **Department:** Physician Assistant Studies
- **Research Mentor(s):** Jacob Carpenter, MPAS, PA-C
- **Research Sponsor(s):** Department of Physician Assistant Studies
- **Abstract:**
  The United States (US) maternal mortality rate is one of the highest among developed nations and continues to rise in health-care provider shortage areas. The southern US has the highest rates, with Mississippi having the highest. Mississippi has a large rural population and subsequently a large number of maternity care deserts contributing to the higher rates. The purpose of this literature review is to investigate if women who reside in maternity care deserts are at an increased risk for severe maternal morbidity and mortality (SMMM) during pregnancy. Articles selected were reviewed for sociodemographic characteristics that may contribute to SMMM. Most studies compared these characteristics to the woman’s geographic location chronic comorbid health

disparities, and her availability of healthcare providers. One study compared the differences between rural and urban societies and their effects on SMMM. Analysis of results showed that in the US, more White females ages 10-24 live in rural communities. Similarities for these women included low-income level, being uninsured or having Medicaid insurance, and living in a Southern state, which increased their risk for SMMM. These findings were consistent with findings in the other studies used for this review; however, when comparing their data to the state of Mississippi, the results demonstrate that more Black women reside in rural areas. Comorbid health conditions like diabetes and hypertension exacerbated the risk of developing SMMM due to the pathophysiology of how these underlying conditions affect pregnancy.

Poster #11

- **Title:** Lumbar Spinal Stenosis Treatment
- **Presenter:** Riley DiMaggio, PA-S II
- **Co-Authors:** Riley DiMaggio, PA-S II
- **Department:** Physician Assistant Studies
- **Research Mentor(s):** Katryna Horton, MPAS, PA-C
- **Research Sponsor(s):** NA
- **Abstract:**

  Lumbar spinal stenosis is one of the most common sources of leg and back pain. It is a significant cause of disability in the elderly and is the most common cause of spinal surgery in patients sixty-five years of age and older. There are two commonly used treatment options for spinal stenosis: physical therapy and surgery. The purpose of this literature review is to analyze the outcomes of patients with lumbar spinal stenosis who undergo physical therapy compared to those who undergo a surgical approach; secondary outcomes included assessment of the risks and benefits of each treatment method. A PubMed, National Library of Medicine, and UpToDate search was performed for this literature review with peer-reviewed journals from the year 2014-2024, except for one study, which was performed in 2005. The phrases “lumbar spinal stenosis,” “physical therapy,” and “surgery” were used. Non-human studies were excluded. This review demonstrated that there may not be a preferred treatment of choice when comparing the effects on pain and function for those treated with physical therapy versus surgery. For a majority of the studies reviewed, the patients’ outcomes were compared, and there was no significant improvement reported in one group versus the other. Therefore, initial treatment should include a conservative approach consisting of patient education, medications for pain control, and physical therapy to regain or maintain activities of daily living. A surgical approach should only be considered for patients who are not showing any signs of improvement.

Poster #12

- **Title:** Characterization of Chitosan for Bioremediation through Bead Structure Analysis
- **Presenter:** Nathan Prine, Aaliyah Newsome
- **Co-Authors:** Aaliyah Newsome, Nathan Prine, Andrew Doubert, Guy Gordon, Trent Selby, and Joseph Kazery
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Joseph Kazery
- **Abstract:**
  Metal and metalloid pollution negatively impacts ecosystems, the environment, and public health. Also known as potentially toxic elements (PTEs), PTE pollution comes from many sources including fossil fuels, construction, and domestic wastes. These PTEs in water treatment plants are not effective at removing dissolved or small inorganic substances in wastewater. However, there are other methods of remediation. Due to PTEs not being degradable the principal method of removal is by sorption processes. Bioremediation is the use of naturally occurring substances to break down or remove pollutants, in this case, PTEs. This study uses the chitinous cuticle (exoskeleton) of crayfish as an adsorption media for PTEs. In this study, modifications were made to chitin by deproteinating and demineralizing the material to observe its properties. A common derivative of chitin is chitosan. Chitosan is a linear polysaccharide obtained by the process of deacetylation of chitin. In this study, we compared our harvested exoskeletons to lab-grade chitosan to observe the quality of our pure chitosan. Our chitosan was then solubilized at two different concentrations to form 5% and 8% chitosan beads. The beads were then compared to observe differences in total surface area, pore size and pore volume; which are properties of overall porosity quantifying their adsorption capability. Once the optimal properties are determined, the chitosan beads will be used in an application study to determine the rate of uptake of cadmium and overall capacity of cadmium concentration adsorbed.

Poster #13

- **Title:** Impact of Kratom Extracts on Mouse Behavior Reveals Safety Concerns
- **Presenter:** Jaylen Vance
- **Co-Authors:** Jaylen Vance, Christina Raley, Todd Cox, Aamani Kalluru, Hannah West, Makayla Stage, Chinaza Nwaiwu, Carlie Masa, Ashton Griffin, Avery Foret, Hanna Bynum, Joshua Berry, Hamzeh Alzoughool, Jessica Carro-Pedreira, Katee Herman, Zarina Lala, Alya Shanklin, Mallory Wilbanks, Swizel Fernandes, Nilay Kantibhai Zalavadiya, Anuradha Ragila, Ashley Carter, Hinaben Patanvadia, Harsh Bharatbhai Patel, Landon Maloney, Trent Selby, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of

General Medical Sciences of the National Institutes of Health under grant number P20GM103476.

- **Abstract:**
  Kratom (*Mitragyna speciosa*) is a tropical evergreen tree used in herbal medicine. Kratom has opioid-like properties and some stimulant-like effects. The efficacy and safety of kratom are unclear leading many countries to regulate Kratom as a controlled substance. Recently the City of Clinton, Mississippi, banned Kratom sales in gas stations and vape shops. To explore the safety of Kratom at low and high dosages, we performed behavioral studies in mice after IP injection. We found that at high doses the compounds in Kratom supplements impairs motor function, impairs balance and coordination, have a sedative effect, and caused 10% fatality in mice. Our research supports Clinton's move to ban sales of this potentially dangerous supplement. Our research suggests that humans taking high doses of kratom could have impaired motor and balance functions that could inhibit their abilities to drive a vehicle safely. Also, the sedative effect and the 10% fatality in mice suggest that high doses of Kratom could also be fatal to humans who overdose.

Poster #14

- **Title:** Fish Quality Analysis of Three Lakes in Central Mississippi and a New Non-lethal Biopsy Method
- **Presenter:** Ella Bailey
- **Co-Authors:** Ella Bailey, Aamani Kalluru, Younsu Bae, Hanna Bynum, Todd Cox, Amelia Hurt, Lori Madison, Evan Powell, Christina Raley, Makayla Stage, Jaylen Vance, Hannah West, Chinaza Nwaiwu, Carlie Masa, Ashton Griffin, Avery Foret, Joshua Berry, Hamzeh Alzoughool, Jessica Carro-Pedreira, Katee Herman, Zarina Lala, Alya Shanklin, Mallory Wilbanks, Swizel Fernandes, Nilay Kantibhai Zalavadiya, Anuradha Ragila, Ashley Carter, Hinaben Patanvadia, Harsh Bharatbhai Patel, Landon Maloney, Dawson Stegall, Karleigh Butler, Trent Selby, and Scoty Hearst
- **Department:** Chemistry and Biochemistry Department
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
  Emerging contaminants, such as toxic metals are a threat to human and animal health. Heavy metal pollution in aquatic environments is a growing global human health concern requiring vigilant surveillance. Lakes are home to many species of wildlife including fish species harvested for human consumption potentially exposing human to toxic metals. Lakes and reservoirs are also used as a source for drinking water and crop irrigation, where pollution from landfills, agriculture, and industrial sources leach into these bodies of water potentially causing

human exposure to heavy metals. We performed consumption safety testing based on toxic metal analysis of fish species from three lakes in central Mississippi: Wolf Lake, Eagle Lake, and the Ross Barnett Reservoir. Our results will reveal the consumption safety of fish species from these three bodies of water. Surveying toxic metal accumulation in fish requires euthanizing the fish. We also developed a nonlethal method to measure toxic metals in catfish. Similar methods have been used to measure Hg in fish without causing mortality or reducing fish survival. Our results will reveal the accuracy of the nonlethal method compared to the traditional whole-fish methods and the fish survivability of this method. Once fully developed, this nonlethal biopsy method can be used to surveil metal accumulation in catfish species without causing fish mortality.

Poster #15

- **Title:** Bioaccumulation of Toxic Metals in Shed Skins of Gray Ratsnakes Across a Contaminated Landscape
- **Presenter:** Madeline Walling
- **Co-Authors:** Madeline Walling, Noa Parks, Marinee Humphries, Emily Gant, Drew Doubert, Micaela Jolly, Madilyn Thomas, Parth Patel, Christian Leach, James Lock, Joseph Kazery, Scoty Hearst, and Frank R. Hensley
- **Department:** Department of Biological Science and Department of Chemistry and Biochemistry
- **Research Mentor(s):** Joseph Kazery, Scoty Hearst, and Frank R. Hensley
- **Research Sponsor(s):** Mississippi College Department of Chemistry and Biochemistry; Mississippi College Department of Biology, Mississippi INBRE, funded by an Institutional Development Award (IDeA) under grant number P20GM103476.
- **Abstract:**
  During the operation of Camp Clinton, a World War II prison camp, various activities could have contaminated soils with heavy metals. Potential contamination sources include the operation of diesel-powered pumps, maintenance and repair of vehicles, disposal of waste oil and batteries, and storage and use of lead-based paints. Frequent use of an abandoned building on the site by Gray Ratsnakes (*Pantherophis obsoletus alleghaniensis*) allowed for the collection of 53 shed skins over 6 active seasons. Six additional snake skins were collected from sites up to 1 km from the building. We tested shed snake skins and soil samples for heavy metal contaminants and mapped the locations of snakeskin collection sites in the context of soil contamination. We concluded that snakes accumulate heavy metals, particularly As, Cu, Pb, and Zn and that some shed skins exceeded the average toxin levels found in nearby soils. Snake skin contamination levels do not necessarily closely match local soil contamination levels. The weak relationship between skin toxins and soil hotspot location is consistent with the fact that ratsnakes range 1km or more across their activity ranges and that a significant fraction of their diet includes wide-ranging songbirds whose toxin levels would be independent of local soils.

Shedding skin might be a mechanism by which snakes reduce their contamination load.

Poster #16

- **Title:** Bridging the Knowledge Gap: A Comprehensive Approach to Octocoral Identification
- **Presenter:** Kiersten A. Mengel
- **Co-Authors:** Kiersten A. Mengel and Jana N. Thoma
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Dr. Jana Thoma
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Scientific research often has a way of not reaching the general public in a comprehensive or cohesive manner. To bridge that gap of knowledge between scientists and non-scientists, identification guides must be made in such a manner so as to be accessible to the public, while still retaining the depth and accuracy of original scientific research. The purpose of this work is to provide non-scientific, Open Water divers with an identification guide to octocoral taxonomy in Florida in order to give them a better understanding of the underwater world around them. This sea fan identification guide will be accessible to non-scientists by interspersing scientific jargon, using reduced vocabulary, and by utilizing engaging images for in and out of the water. Using this guide as a gateway into the language of science, hopefully non-scientific divers will better appreciate the diversity of aquatic life and thus be more likely to participate in conservation efforts.

Poster #17

- **Title:** The Physiological Targets of Terpinen-4-ol Extracted from Tea Tree Leaves
- **Presenter:** Causey L. Simmons
- **Co-Authors:** Simmons, C. L., Alzoughool, H. S., Grice, S. K., Pitcock, G. M., Redhead, A. C., and Whittom Reiken, A. A.
- **Department:** Mississippi College Department of Biological Sciences
- **Research Mentor(s):** Angela Whittom Reiken, Ph.D.
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Tea tree oil, derived from the leaves of *Melaleuca alternifolia*, has been thought for centuries to have medicinal purposes and today, is commonly found in many over-the-counter products and remedies. Literary review helped determine that terpinen-4-ol is the primary compound in tea tree oil that provides beneficial effects in the human body. This study aims to determine the extraction methods to maximize the yield for tea tree extract and to identify the physiological targets of terpinen-4-ol. Using ethanol as a solvent, a -20 ℃ cold soaking technique, a 37 ℃ incubation, and a hybrid procedure were implemented as the experimental methods to determine efficient recovery of compounds, with highest yields

based on mass being attributed to -20 ℃ cold soaking. Bioinformatics research hypothesizes that the protein targets involved in the application of tea tree extract, specifically terpinen-4-ol, are predominantly nuclear receptors, cytochrome p450s, and voltage ion gated channels. Future research is needed to explore the *in vitro* effects of tea tree extract on cellular models that contain the indicated targets like cytochrome p450s and voltage gated ion channels or to see the downstream results of nuclear receptor targets.

Poster #18

- **Title:** An Analysis of the Physiological Targets of Salidroside Compound Extracted from *Rhodiola rosea* Root
- **Presenter:** Anna C. Redhead
- **Co-Authors:** Redhead, A. C., Alzoughool, H. S., Grice, S. K., Pitcock, G. M., Simmons, C. L., and Whittom Reiken, A. A.
- **Department:** Mississippi College Department of Biological Sciences
- **Research Mentor(s):** Angela Whittom Reiken, Ph.D.
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Rhodiola rosea Root, also known as Golden Root or Rose Root, has been medicinally used for years to help reduce anxiety and depression while also boosting athletic performance. Systemic review determined salidroside as the predominant compound contributing to the range of positive health benefits for the human body. The purpose of this study is to determine the most effective extraction method for the *Rhodiola rosea* Root compounds and to identify the targets within biological systems for these compounds. Experimental testing of the various extraction methods was conducted to optimally isolate salidroside from the *Rhodiola rosea* Root. The methodologies of -20 ℃ cold soaking, 37 ℃ incubation, and hybrid procedures were employed, with the hybrid procedure yielding the most extract. Further research proposes that the application of the *Rhodiola rosea* Root, especially the compound salidroside, contains specific protein targets. Additional research is needed to analyze the *in vitro* effects of the *Rhodiola rosea* Root extract on cellular models that contain receptor targets like lyase and other carbonic anhydrase family enzymes in addition to other enzymes including adenosine kinases.

Poster #19

- **Title:** Growth of *Drosophila melanogaster* Gut Microbes on Selective Media
- **Presenter:** Shelby Beshears
- **Co-Authors:** Shelby Beshears, Isaac Encinas and Caroline Hendon
- **Department:** Biological Sciences
- **Research Mentor(s):** Jerry W. Reagan, Jr.
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Development of *Drosophila melanogaster* larvae requires an intact gut

microbiome. Published evidence (Conseguera, et al, 2020, PLOS Biology, 18(3): e3000681) and Schornborn et al, 2021, iScience, 24: 103216) suggests a potential interaction between the gut microbiome, dietary constituents and development. Therefore, since our laboratory is interested in sterol-related effects on development, it is necessary that we characterize the gut microbiome in the colony of wild-type (Oregon R strain) *D. melanogaster* maintained in our laboratory. To this end, bacteria were isolated under sterile conditions from the gut of larvae maintained on a standard, chemically defined diet containing 0.008% cholesterol. These bacteria were grown on media selective for Acetobacter (ACE media) and Lactobacillus (MRS media), two genera commonly identified in *D. melanogaster* gut. Isolated colonies, stored at -80oC as glycerol stocks, were further assessed for their ability to grow on six types of media: tryptic soy agar, ACE agar, MRS agar, MacConkey Agar, Colistin/Nalidixic Acid Agar, and thioglycolate broth. Colonies that developed on these media were differentiated by Gram staining. The results suggest that our colony of *D. melanogaster* contains a typical (e.g. *L. plantarum* and *A. pomorum*) gut microbiome. Definitive identification awaits sequencing of 16S ribosomal RNA. These data are a first step toward elucidating the details of a potential link between the gut microbiome and sterol-mediated development. Such data should provide insight into metabolic interconnectivity between microbes and diet.

Poster #20

- **Title:** Bioinformatical Investigation of *Artemisia absinthium* and Its Derivative, Dihydroartemisinin
- **Presenter:** Grace M. Pitcock
- **Co-Authors:** Pitcock, G. M., Alzoughool, H. S., Grice, S. K., Redhead, A. C., Simmons, C. L., and Whittom Reiken, A. A.
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Angela Whittom Reiken, Ph.D.
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Artemisia absinthium, known as Wormwood, and its active derivative, dihydroartemisinin, has been an antimalarial drug for many years. Dihydroartemisinin (DHA) has been found to kill one hundred percent of all malarial parasites while also being low in toxicity. Recent studies have found that DHA is also successful in curing certain cancers and improving the immune system as a whole. This study serves as a bioinformatical investigation into the composition and biological targets of DHA to determine if DHA would be a useful treatment for certain cancers. Swiss Target Prediction was used to find the biological targets of the molecule, and Molinspiration was used to calculate the properties of the molecule and the product bioactivity. The investigation found that DHA binds to receptors of damaged cells and forms a carbon radical, and they have a preference to aggregate in infected cells compared to uninfected

cells. The major biological targets of DHA were found to be enzymes with a probability of forty percent followed by Cytochrome P450 at twenty percent. These findings indicate that DHA may be useful in inhibiting cancer cells that increase enzyme or Cytochrome P450 activity and call for additional research into DHA's anticancer properties to determine if it would be useful in treating certain cancer cell lines.

Poster #21

- **Title:** Worm distribution within the environment based on the time of the year and canopy coverage of trees
- **Presenter:** Amy Snyder & Andrew Doubert
- **Co-Authors:** Amy Snyder, Andrew Doubert, Ava Stegall, Ben Wiggins, Braedon Methvin, Eve Mixon, Gracie Kirk, Guy Gordon, Jackson Strong, Javian Ervin, Kate Walker, Kaylee Jones, Kiersten Mengel, Londyn Dorsey, Lydia Paulette, Maddie Leber, Michelle Harvath, Vivian Mcree, and Frank R. Hensley
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Frank R. Hensley
- **Abstract:**
  This study aimed to explore worm activity, the impact of board coverage on worm habitation, and any temporal shifts in biodiversity. We did this by monitoring the organisms beneath flat boards placed across two separate 10 x 60 m fields. Over a 12-week period, boards 122 x 244 cm (4 x 8 ft) were strategically placed, and flipped every 1-2 weeks to expose the soil and assess the organisms beneath them. Data on biotic and abiotic factors, such as temperature, insect and plant species, and other environmental variables, were collected to evaluate community composition, species diversity, and worm counts. Each board was examined six times during the study, with observations focused on changes in the microenvironment. Findings from this research could contribute to ecological management practices and enhance understanding of worm and organism interactions within field ecosystems.

Poster #22

- **Title:** Bioinformatics Investigation of *Withania somnifera* and Its Derivative, Withanolide D
- **Presenter:** Sarah K. Grice
- **Co-Authors:** Grice, S. K., Alzoughool, H. S., Pitcock, G. M., Redhead, A. C., Simmons, C. L., and Whittom Reiken, A. A.
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Angela Whittom Reiken, Ph.D.
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Withania somnifera, commonly known as Ashwagandha, is an adaptogenic herb with a long history of use in traditional medicine, particularly in Ayurveda. Recent research has highlighted its potential anticancer properties, largely attributed to

its bioactive compounds, particularly withanolides, a group of steroidal lactones. Among these, withanolide D has emerged as a key derivative with demonstrated antitumor, antioxidant, and anti-inflammatory effects, suggesting its therapeutic potential in cancer treatment. In addition to its direct antitumor effects, Ashwagandha has been shown to modulate immune responses and reduce the side effects of conventional cancer therapies, such as chemotherapy-induced fatigue and inflammation. This study serves as a bioinformatics investigation into the mechanism of action and biological targets of withanolide D to determine if withanolide D would be a useful treatment for certain cancers. Swiss Target Prediction was used to find the biological targets of the molecule, and Molinspiration was used to calculate the properties of the molecule and the product bioactivity. The investigation found that withanolide D exerts its therapeutic effects through the modulation of various molecular targets and signaling pathways, including NF-κB, Akt/PI3K, p53, VEGF, HDACs, and Bcl-2 family proteins. The major biological targets of withanolide D were found to be nuclear receptors and kinase with a probability of 20 percent followed by oxidoreductase and enzymes at 13.3 percent. These findings indicate that withanolide D may be useful in inhibiting cancer cells that increase nuclear receptor, kinase, oxidoreductase, and enzyme activity and call for additional research into withanolide D's anticancer properties to determine if it would be useful in treating certain types of cancer.

Poster #23

- **Title:** Bioinformatic Insights into the Therapeutic Potential of Thymoquinone, a Key Bioactive Compound in *Nigella sativa*
- **Presenter:** Hamzeh S. Alzoughool
- **Co-Authors:** Alzoughool, H. S., Grice, S. K., Pitcock, G. M., Redhead, A. C., Simmons, C. L., and Whittom Reiken, A. A.
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Angela Whittom Reiken, Ph.D.
- **Research Sponsor(s):** Department of Biological Sciences
- **Abstract:**
  Nigella sativa, commonly referred to as black cumin or Habat al Baraka in traditional Arabic medicine, has been celebrated for centuries for its broad-spectrum therapeutic benefits. Among its bioactive constituents, thymoquinone (TQ) has emerged as a potent compound with promising pharmacological properties, including anticancer, anti-inflammatory, and antioxidant effects. TQ's anticancer potential is particularly compelling, with evidence indicating its ability to target molecular pathways involved in tumor growth, apoptosis, and metastasis. Habat al Baraka has also demonstrated adjunctive benefits, such as reducing the side effects of conventional cancer therapies, including chemotherapy-induced oxidative stress and systemic inflammation. This study leverages bioinformatics tools to explore TQ's molecular mechanisms and therapeutic potential. Using Swiss Target Prediction and Molinspiration, we

identified TQ's primary molecular targets and evaluated its bioactivity profile. The findings revealed that TQ interacts significantly with molecular targets, including nuclear receptors, kinases, and oxidoreductases, with notable involvement in pathways such as NF-κB, p53, STAT3, and PI3K/Akt. These interactions highlight TQ's ability to inhibit cancer cell proliferation, promote apoptosis, and suppress inflammation. The results suggest that TQ holds considerable promise in targeting cancers characterized by heightened activity in nuclear receptors, kinases, and oxidoreductases. Furthermore, its multifunctional properties and favorable pharmacokinetic and physicochemical profiles make TQ a candidate for future drug development. These findings provide a foundation for additional preclinical and clinical research to explore its efficacy across various cancer types, its potential role in personalized medicine, and its ability to enhance patient outcomes when used alongside conventional therapies. Exploring synergistic effects with other bioactive compounds from *Nigella sativa* may further expand its therapeutic potential. Such investigations also pave the way for new formulations that maximize the compound's bioavailability and effectiveness.

Poster #24

- **Title:** Vertebrates distribution within the environment based on the time of the year and canopy coverage of trees
- **Presenter:** Amy Snyder & Andrew Doubert
- **Co-Authors:** Amy Snyder, Andrew Doubert, Ava Stegall, Ben Wiggins, Braedon Methvin, Eve Mixon, Gracie Kirk, Guy Gordon, Jackson Strong, Javian Ervin, Kate Walker, Kaylee Jones, Kiersten Mengel, Londyn Dorsey, Lydia Paulette, Maddie Leber, Michelle Harvath, Vivian Mcree, and Frank R. Hensley
- **Department:** Department of Biological Sciences
- **Research Mentor(s):** Frank R. Hensley
- **Abstract:**

  This study sought to understand how board coverage influenced vertebrate habitation and whether temporal changes in biodiversity occurred over a 12-week period. The primary focus was to assess community composition, species diversity, and vertebrate activity over time. This study aimed to explore vertebrate diversity and activity in a field by monitoring the organisms found beneath flat boards placed across two 10 x 60 m fields. During the observational period, a series of 122 x 244 cm (4 x 8 ft) boards were strategically placed and flipped every 1-2 weeks to expose the soil and observe vertebrate habitation and activity. Researchers collected data on various biotic and abiotic factors beneath the boards, including temperature, plant and insect species, and other environmental variables. Results from this research contributed to ecological management practices and provided deeper insights into the interactions between vertebrates and other biotic and abiotic factors in field ecosystems.

Physical Sciences

Poster #25

- **Title:** Chemical Analysis of Locally Grown Mississippi Produce
- **Presenter:** Christina Raley
- **Co-Authors:** Christina Raley, Jaylen Vance, Ella Bailey, Aamani Kalluru, Younsu Bae, Hanna Bynum, Todd Cox, Amelia Hurt, Lori Madison, Evan Powell, Makayla Stage, Hannah West, Chinaza Nwaiwu, Carlie Masa, Ashton Griffin, Avery Foret, Joshua Berry, Hamzeh Alzoughool, Jessica Carro-Pedreira, Katee Herman, Zarina Lala, Alya Shanklin, Mallory Wilbanks, Swizel Fernandes, Nilay Kantibhai Zalavadiya, Anuradha Ragila, Ashley Carter, Hinaben Patanvadia, Harsh Bharatbhai Patel, Landon Maloney, Dawson Stegall, Karleigh Butler, Pamela Clevenger, Trent Selby, and Scoty Hearst
- **Department:** Chemistry and Biochemistry Department
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476. Produce were provided to students by local Mississippi growers and staff from the Department of Agriculture and Commerce, Mississippi Agriculture and Forestry Museum, Jackson, MS.
- **Abstract:**
  Central Mississippi has a rich agricultural history. Mississippi soil is rich in minerals and nutrients, making it ideal for growing crops. Fruits and vegetables contain many important nutrients, vitamins, and minerals. A diet high in fruit and vegetables is key to health living. Locally grown produce often has a richer flavor and higher nutrient content, making it a smart choice for consumers. The purpose of this project was to train students in chemistry techniques by analyzing the chemical composition of locally grown fruits and vegetables. We collected a wide variety of fruits and vegetables from local farms in central Mississippi. We measured the level of nutrients using an ICP-OES and sugar levels using a refractometer. We also measure other compounds such as capsaicin, a compound that gives peppers a spicy flavor, using a UV-Vis. Overall, our data indicates that Mississippi's locally grown produce is rich in important nutrients and full of flavor.

Poster #26

- **Title:** Pet Food Safety Concerns: Toxic Metal Analysis of Cat Food Products
- **Presenter:** Swizel Fernandes
- **Co-Authors:** Swizel Fernandes, Nilay Kantibhai Zalavadiya, Anuradha Ragila, Ashley Carter, Hinaben Patanvadia, Harsh Bharatbhai Patel, Katee Herman, Zarina Lala, Alya Shanklin, Mallory Wilbanks, Christina Raley, Jaylen Vance, Wilson Hooker, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry

- **Research Mentor(s):** Scoty Hearst
- **Abstract:**
  Toxic metals contamination is a current concern worldwide due to its toxicity, intrinsic persistence, non-biodegradable nature, and cumulative characteristics requiring vigilant surveillance. There is a growing concern about contamination of toxic metals in pet food products due to the great potential for health risks of these elements. Some studies have reported toxic metals in commercial pet foods due to poor quality ingredients used by the pet food industry. The goals of this study were to evaluate the concentrations of toxic metals in cat food products and assess their threat to pet health using consumption safety analysis. Our results will reveal the level of toxic metals in cat food products purchased in our local area and compared those level to the maximum tolerated level. Overall, this data will indicate the consumption safety of various cat food products and their threat to the health of pets.

Poster #27

- **Title:** Toxic Metal Analysis: Consumption Safety of Farm Raised and Wild Caught Salmon
- **Presenter:** Ashley Carter
- **Co-Authors:** Ashley Carter, Stan Baldwin, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):**
- **Abstract:**
  Aquatic pollutants, such as toxic metals are a threat to human and animal health. Heavy metal pollution in aquatic environments is a growing global human health concern requiring vigilant surveillance. Aquatic environments are home to many species of wildlife including fish species harvested for human consumption potentially exposing human to toxic metals. Salmon are an important commercial fish species that can contain toxic metals, including mercury, cadmium, lead, and arsenic. We performed consumption safety testing based on toxic metal analysis of farm raised and wild caught salmon purchased in our local area. Our research indicated that the levels of toxic metals in farmed salmon were lower and below the legal limits as compared to wild caught salmon. Farm raised salmon are grown in an environment, where water and feed standards are controlled to ensure fish quality. Overall, consumption safety analysis revealed farm raised salmon as a healthier choice for consumers as compared to wild caught salmon.

Poster #28

- **Title:** Preparation of Conjugated Polyphenylethynylarene Macrocycles
- **Presenter:** Alana Latorre
- **Co-Authors:** Alana Latorre and Trent D. Selby
- **Department:** Department of Chemistry and Biochemistry

- **Research Mentor(s):** Dr. Trent Selby
- **Research Sponsor(s):** Department of Chemistry and Biochemistry
- **Abstract:**
  The preparation of π-conjugated macrocyclic organic molecules is a focus of our group. The syntheses of several macrocycles, with varying degrees of conjugation will be presented and can all be prepared from the same key intermediate structure, (3-ethynylphenoxy)(tert-butyl)dimethylsilane. This key intermediate was prepared from the commercially available 3-hydroxybenzaldehyde. Protection of the hydroxyl with *tert*-butyldimethylsilyl chloride in the presence of a weak base (imidazole), under microwave conditions gave the protected compound in 94% yield. The aldehyde functional group was converted into the terminal alkyne via Corey-Fuchs olefination reaction conditions in 87% yield. Sonogashira coupling (palladium/copper(I) iodide catalyst) of the terminal alkyne with aryl halides gave polyphenylethynylarenes in high yields. Cyclization of the polyphenylethynylarenes alcohols can be accomplished under dilute conditions via nucleophilic substitution or acylation addition/elimination reactions. Structures of this type are expected to show directed energy and electron transfer and thus should be effective in the preparation of photoreactive materials such as electronic sensors or light harvesting materials.

Poster #29

- **Title:** Synthesis of Propeller-shaped Polyphenylethynylarenes
- **Presenter:** Selah Roberts
- **Co-Authors:** Selah Roberts and Trent D. Selby
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Dr. Trent Selby
- **Research Sponsor(s):** Department of Chemistry and Biochemistry
- **Abstract:**
  A series of “flat” two-dimensional macrocyclic polyphenylethynylarenes were prepared in good yields. The syntheses involved Sonogashira coupling of phenylethynylarenes with the appropriate aryl halides followed by cyclization with ether linkages. Cyclization reduces twisting and promotes electron conjugation throughout the structures. These “flat” molecules are expected to show directed energy and electron transfer within a highly conjugated system and may potentially be effective in the preparation of photoreactive materials such as electronic sensors or light harvesting materials.

Poster #30

- **Title:** Elemental Analysis of Tomatoes Grown Traditionally Versus Hydroponically
- **Presenter:** Ward Adams
- **Co-Authors:** Ward Adams, Anuradha Ragila, Scoty Hearst, and Trent D. Selby
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Dr. Trent Selby

- **Research Sponsor(s):** Department of Chemistry and Biochemistry
- **Abstract:**
  High potassium levels in the blood causes hyperkalemia, a serious medical condition associated with heart disease and kidney disease. Hypernatremia is caused by high levels of sodium in the blood and is associated with heart disease, kidney failure, and diabetes insipidus. Patients with hyperkalemic and hypernatremic follow restrictive diets that reduce potassium and sodium levels in their blood. This food restriction often limits consumption of other important nutrients. Restrictive diets cause a poorer quality of life as certain foods especially vegetables are restricted or cannot be consumed. One such vegetable is the tomato; tomatoes are edible fruits of the Solanum lycopersicum plant and native to South America, and Central America. Tomatoes are consumed in diverse ways: raw or cooked, and in many dishes, sauces, salads, and drinks. In this study, we compare the potassium and sodium content of many varieties of heirloom and hybrid tomatoes using an ICP-OES. The goal of this study was to identify tomato varieties that are low in potassium and sodium to improve quality of life for hyperkalemic and hypernatremic patients. Additionally, selected varieties of tomatoes were hydroponically cultivated to further reduce potassium and sodium levels without reducing other essential elements.

Poster #31

- **Title:** Conventional Strain Energies of Thiasilirane and the Thiasiletanes
- **Presenter:** Avery C. Foret
- **Co-Authors:** Mia K. Hyme, Kayla E. Ryan, and David H. Magers
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** David H. Magers, Ph.D.
- **Research Sponsor(s):** MC CATALYSTS
- **Abstract:**
  The conventional strain energies for thiasilirane, 1,2-thiasiletane, and 1,3-thisiletane are determined within the isodesmic, homodesmotic, and hyperhomodesmotic models to investigate the effect of third-row elements on the strain energies of three- and four-membered rings especially the effect of sulfur and silicon. Previous studies in our group indicate that substitution of silicon in cyclopropane raises the conventional strain energy while substitution with sulfur lowers it. Optimum equilibrium geometries, harmonic vibrational frequencies, and corresponding electronic energies are computed for all pertinent molecular systems using self-consistent field (SCF) theory, second-order perturbation theory (MP2), and density functional theory (DFT). The DFT functionals employed are Becke's three-parameter hybrid functional using the LYP correlation functional, the M06-2X high nonlocality hybrid functional from Truhlar and Zhao, and the ωB97XD functional from Head-Gordan and coworkers which includes empirical dispersion. The basis sets employed are Dunning and coworkers' correlation consistent basis sets: cc-pVDZ, cc-pVTZ, and cc-pVQZ. In addition, single-point MP4, CCSD, and CCSD(T) calculations are performed at the MP2/cc-pVQZ optimum geometries to evaluate the effect of higher levels of electron correlation. Results are compared to the conventional strain energies of small cyclic hydrocarbons and to other heterocyclic systems. We gratefully acknowledge support from the Mississippi College Catalysts, the alumni support group of the Department of Chemistry & Biochemistry.

Poster #32

- **Title:** Comparison of Sugar Content, pH, Nutritional Elements, and Lycopene Levels in Multiple Varieties of Heirloom and Hybrid Tomatoes
- **Presenter:** Anuradha Ragila
- **Co-Authors:** Anuradha Ragila, Alana Latorre, Scoty Hearst, and Trent D. Selby
  Department: Department of Chemistry and Biochemistry
- **Research Mentor(s):** Dr. Trent Selby
- Research Sponsor(s): Department of Chemistry and Biochemistry
- **Abstract:**
  The tomato is an edible berry of the Solanum lycopersicum plant and native to South America, Mexico, and Central America. Tomatoes are consumed in diverse ways: raw or cooked, and in many dishes, sauces, salads, and drinks. Tomatoes are now grown all around the world, where the USA produced close to 10 million tons each year. Tomatoes are low in calories and provide important nutrients like vitamin C and potassium. A raw tomato is 95% water, contains 4% carbohydrates, and has less than 1% each of fat and protein. Tomatoes are also rich in antioxidants such as lycopene, which gives tomatoes' their characteristic color. Lycopene is said to reduced risk of heart disease and certain cancers. In this study, we compare the sugar content, pH, and lycopene levels of many different varieties of heirloom and hybrid tomatoes. The information provided in this study can be useful to those on a restricted sugar diet, such as diabetics. Also, these results can be helpful for those seeking particular varieties with higher levels of antioxidants for added health benefits.

Poster #33

- **Title:** Consumption Safety Analysis of Poultry Products in Clinton Mississippi
- **Presenter:** Wilson Hooker
- **Co-Authors:** Wilson Hooker, Landon Maloney, Dawson Stegall, Karleigh Butler, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Abstract:**
  Emerging contaminants, such as toxic metal contamination, in food products are a threat to human health. Heavy metal pollution is a growing global human health concern requiring vigilant surveillance. Poultry products can contain toxic heavy metals like arsenic (As), lead (Pb), cadmium (Cd), and mercury (Hg). These metals can accumulate in the organs of poultry, especially the liver, kidneys, reproductive organs, and lungs. Consuming poultry that contains these metals can be harmful to humans. Recent reports indicated high levels of Pb in chicken products. The purpose of this study was to assess the consumption safety of poultry products purchased at stores in our local area. We tested a wide variety of chicken products for toxic metals and performed consumption safety analysis. The results of this study will reveal the health quality of poultry products purchased in Clinton, Mississippi.

Poster #34

- **Title:** Analysis of Toxic Metals in Bigmouth and Smallmouth Buffalo Fish of the Mississippi River
- **Presenter:** Karleigh Butler
- **Co-Authors:** Karleigh Butler, Jose Alfonso Xavier Fernandez, Ella Bailey, Javian Ervin, Stephen Mills, Chinaza Nwaiwu, Fritz Valerio, Wilson Hooker, Caroline Armstrong, Christian Leach, Alison Cevallos, Trent Selby, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Abstract:**
  Pollution in the Mississippi River is a growing concern, where emerging contaminants, such as toxic metals are a threat to human and animal health. The Mississippi River is home to hundreds of species of wildlife including fish species harvested for human consumption potentially exposing humans to heavy metals. The river is also used as a source for drinking water and crop irrigation, where pollution from landfills, agriculture, and industrial sources leach into the river potentially causing human exposure to heavy metals. In this study, we examine the bioaccumulation of toxic metals in two species of sucker fish, from the Catostomidae family, inhabiting the Mississippi River: The bigmouth buffalo (*Ictiobus cyprinellus*) and the small mouth buffalo (*Ictiobus bubalus*). These species of buffalo can live for centuries and were choose for their longevity and different diets. Bigmouth buffalo filter feed on algae and zooplankton, while smallmouth buffalo are detritivore and consume organic matter from the bottom of the river. In this study, we collected buffalo from the Mississippi River and analyzed for toxic metals using an ICP-OES. We hypothesized that bioaccumulation of toxic metals would vary between the two species based upon their differing diet. Our results will reveal if filter feeding or bottom feeding leads to greater bioaccumulation of toxic metals in fish tissues.

Poster #35

- **Title:** Enthalpies of Formation of Chloro, Cyano, and Methyl Derivatives of Heterocyclic Aromatics by Homodesmotic Reactions
- **Presenter:** Gracie Bassett
- **Co-Authors:** Gracie Bassett, Dean Damon, Carmen Shumaker, and David H. Magers
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** David H. Magers, Ph.D.
- **Research Sponsor(s):** MC *CATALYSTS*
- **Abstract:**
  Furan, pyrrole, oxazole, isoxazole, imidazole, and pyrazole are all examples of heterocyclic aromatic compounds. They and their derivatives have a variety of uses. 2,5-dimethyl-furan has been proposed as a possible biofuel; pyrrole is a component of both heme and chlorophyll; ibotenic acid, a derivative of isoxazole,

is a powerful neurotoxin; and histidine is a derivative of imidazole. In the current study, we focus on the computation of the standard enthalpy of formation of chloro, cyano, and methyl derivatives of these aromatic heterocycles by homodesmotic reactions. In homodesmotic reactions the number and types of bonds and the bonding environment of each atom are conserved. The enthalpy of all of the reactants and products in each homodesmotic equation is computed using SCF theory, second-order perturbation theory, and density functional theory. The DFT functionals employed are Becke's three-parameter hybrid functional using the LYP correlation functional, the M06-2X high nonlocality hybrid functional from Truhlar and Zhao, and the ωB97XD functional from Head-Gordan and coworkers which includes empirical dispersion. The basis sets employed are Dunning and coworkers' correlation consistent basis sets, cc-pVDZ, cc-pVTZ, and cc-pVQZ. From the resulting enthalpy of reaction, the desired enthalpy of formation is determined by use of reference values for all other systems in the reaction, and the computation of atomization energies is avoided. We gratefully acknowledge support from the Mississippi College Catalysts, the alumni support group of the Department of Chemistry & Biochemistry.

Poster #36

- **Title:** Stabilization Factors in Fluoro and Chloro Derivatives of the Cyclopropyl Carbinyl Cation
- **Presenter:** Hanna K. Bynum
- **Co-Authors:** Hanna K. Bynum and David H. Magers
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** David H. Magers
- **Research Sponsor(s):** MC *CATALYSTS*
- **Abstract:**

  While cyclopropyl carbinyl cation ($C_4H_7^+$) is a local minimum on the potential energy hypersurface, the global minimum is the cyclobutonium cation (lower in energy by approximately 2 kcal/mol). The same is certainly not true if the hydrogens of the CH_2 moiety are replaced with fluorines. In the current study we investigate the factors which stabilize the cyclopropyl configuration in fluoro and chloro derivatives of cyclopropyl carbinyl cation. Specifically, optimum equilibrium geometries, harmonic vibrational frequencies, and corresponding electronic energies are computed for $C_4H_7^+$, $C_3H_5CFH^+$, $C_3H_5CF_2^+$, $C_3H_5CClH^+$, and $C_3H_5CCl_2^+$ with SCF theory, second-order perturbation theory, and density functional theory (DFT). The DFT functionals employed are Becke's three-parameter hybrid functional with the Lee-Yang-Parr correlation functional, the M06-2X high nonlocality hybrid functional from Truhlar and Zhao, and the ωB97XD functional from Head-Gordan and coworkers which includes empirical dispersion. The basis sets employed are Dunning and coworkers' correlation consistent basis sets cc-pVDZ, cc-pVTZ, and cc-pVQZ. Natural Bond Order analysis is employed to help explain the factors contributing to the stabilization of each system. We gratefully acknowledge support from the Mississippi College

Catalysts, the alumni support group of the Department of Chemistry & Biochemistry.

Poster #37

- **Title:** Synthesis of Macrocyclic Diaminopolyphenylethynylarenes
- **Presenter:** Jessica Carro-Pedreira
- **Co-Authors:** Jessica Carro-Pedreira and Trent D. Selby
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Dr. Trent Selby
- **Research Sponsor(s):** Department of Chemistry and Biochemistry
- **Abstract:**
  Conjugated dendrimers are known for their ability to harvest light. Typical dendrimers, or those that are more well known, can lose conjugation because there is no stability in the dendrons to keep them from twisting at single bonds. This instability increases with increasing size of the dendrimer. The loss of conjugation leads to a reduction in the ability of the dendrimers to harvest light. Planar conjugated dendrimers, however, would likely be better candidates for harvesting light due to the functional group linkages in the dendrons. The focus of this project is on using bridged amine or imine linkages to potentially stabilize a planar dendrimer. With these bridged-linkages, the dendrimer cannot lose its conjugation, regardless of size. As a result, the dendrimer's ability to harvest light is not affected or lost, making it more effective and more efficient than three-dimensional dendrimers. Before attempting the lengthy synthesis of such dendrimers, we are preparing smaller model systems in order to optimize reaction conditions and verify the hypothesis mentioned above. To prepare these model compounds, 3-ethynylbenzeneamine was reacted with 1,2-diiodobenzene under Sonogashira reaction conditions. Current work involves cyclizing the diamino molecule through formation of a carbon bridge between the two nitrogen atoms.

Poster #38

- **Title:** Toxic Metal Analysis of *Alligator mississippiensis* specimens from the Mississippi River near Davis Island
- **Presenter:** Landyn Tennyson
- **Co-Authors:** Landyn Tennyson[2], Ana Moller[2], Mckayden Bianca[1], Shelby Ware[2], Madison Barker[3], Caelyn Funches[3], Nia Simmons[3], Andrew Bowens[3], Josiah Calvert[3], Marc Cornelius[3], D'Shanae Duncan[3], Ryiane Johnson[3], Jasir Khadaran[3], Cartazia LaPoole[3], Kerry Lucious[3], Jermain Rushing[3], Demya White[3], Manliang Feng[3], John Barringer[3], Trent Selby[2], and Scoty Hearst[2]*
- **Department:** [1]Animal and Dairy Science, Mississippi State University, Mississippi State, MS, [2]The Department of Chemistry and Biochemistry, Mississippi College, Clinton, MS; [3]The Department of Natural Science, Tougaloo College, Tougaloo, MS
- **Research Mentor(s):** Scoty Hearst

- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
  American alligators (*Alligator mississippiensis*) are important members of river and wetland ecosystems, and are regarded as keystone species. Elevated levels of toxic metals in alligators from many wetland locations across the South Eastern USA have been to linked to infertility and population decline. The level of toxic metals in alligators from the Mississippi River have not be evaluated in decades and remains unknown. Alligator meat is also an important food source consumed by humans potentially exposing humans to toxic metals. Our previous studies indicated that toxic metals were elevated in predatory fish in the Mississippi River near Davis Island. The purposes of this study were to estimate the levels of toxic metals in alligator tissues and evaluate any human consumption hazards. We collected 3 alligators under 6ft in length and measured toxic metals (As, Cd, Cr, Hg, and Pb) in their tissues using an ICP-OES. Human health hazard assessments were performed to estimate consumption hazards from alligator meat from this location. Overall, our data indicated that mercury levels may be of concern in alligators from this location warranting larger scale studies throughout the Lower Mississippi River Basin to fully assess this threat to humans and alligator populations.

Poster #39

- **Title:** Fish as Environmental Sentinels for Metal Contaminants of Human Health Concern in the Lower Mississippi River Basin
- **Presenter:** Chinaza Nwaiwu
- **Co-Authors:** Chinaza Nwaiwu[1], Luke Parker[1], Trent Selby[1], Joseph Kazery[2], Steven Everman[3], Manliang Feng[4], Nicole Phillips[5], Lillian Sisson[1], Alison Cevallos[1], James Lock[1], Matthew Sinclair[1], and Scoty Hearst[1]*
- **Department:** [1]The Department of Chemistry and Biochemistry, Mississippi College, Clinton, MS, [2]The Department of Biology, Mississippi College, Clinton, MS, [3]The Department of Medicine, The University of Mississippi Medical Center, Jackson, MS, [4]The Department of Chemistry, Tougaloo College, Tougaloo, MS, [5]Biological, Environmental, and Earth Sciences, the University of Southern Mississippi, Hattiesburg, MS
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
  Metal pollution in the river systems across the US are a major heath concern for humans, domesticated animals, and wildlife. The level of metal contamination in

fish from the Lower Mississippi River Basin and their threat to public health have not been evaluated in decades. The goals of this study were to measure metal contamination in fish species, evaluate human consumption risk, and estimate bioindicator potential for monitoring studies on a larger scale. Various fish species (n = 203) were analyzed for metal contaminants (Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Ni, Pb, Se, and Zn). Based on human consumption safety results, As, Cd, Cr, Hg, and Pb are a major concern in this location. Non-cancerous Human Health Hazard assessments indicated blue catfish, flathead catfish, gar species, and freshwater drum as species of concern. Consumption of all species tested posed human cancer risks. Decision tree modeling identified Hg, Pb, Zn, Cr, Co, As, and Cd as major drivers of consumption safety. Bioaccumulation factor analysis found Hg and Cd to be bioaccumulative in predatory fish species. Overall, our data indicated that fish can serve as selective environmental sentinels useful for monitoring toxic metal pollutants of public health concerns providing valuable insight to research scientist and monitoring agencies. Our results also warrant larger scale studies throughout the Lower Mississippi River Basin.

Poster #40

- **Title:** Consumption Safety: Toxic Metal Analysis of Hunter Harvested Duck Species
- **Presenter:** Dawson Stegall
- **Co-Authors:** Dawson Stegall, William Janous, Jack Spear, Karleigh Butler, Landon Maloney, Nilay Kantibhai Zalavadiya, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
  Pollution in aquatic environments is a major concern for wildlife and fisheries. Discharge from the river systems and storm water runoff bring high levels of nutrients and environmental contaminants into the aquatic environments. Oil spills, coastal industry, and municipal sites are potential sources of toxic chemicals and pollution from human activities and agriculture being released into the watersheds. The levels of these contaminants in wildlife such as duck species are unknown. Ducks and geese are semi-aquatic game animals harvested by hunters for human consumption. The goals of this study were to measure metal contamination in hunter harvested duck species and evaluate human consumption risk. Our results will reveal the level of metal contaminants in meat from various duck species and the safety risks of these species for human consumption.

Poster #41

- **Title:** Calculation of Conventional Strain Energies of Small Heterocycles of Carbon and Silicon by Model Reactions
- **Presenter:** Eli M. Franklin
- **Co-Authors:** Eli M. Franklin and David H. Magers
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** David H. Magers
- **Research Sponsor(s):** MC *CATALYSTS*
- **Abstract:**
  The conventional strain energies for three- and four-membered heterocycles of carbon and silicon are computed within the isodesmic, homodesmotic, and hyperhomodesmotic models. Isodesmic reactions conserve number and types of bonds. Homodesmotic reactions are isodesmic reactions which also conserve the valence environment around each atom. Hyperhomodesmotic reactions are homodesmotic reactions which conserve the valence environment around each set of two bonded atoms. Computed results for cyclopropane and cyclobutane are compared with experimental values for these systems to demonstrate the reliability of the method. Optimum equilibrium geometries, harmonic vibrational frequencies, and corresponding electronic energies are computed for all pertinent molecular systems using SCF theory, second-order perturbation theory (MP2), and density functional theory. The DFT functionals employed are Becke's three-parameter hybrid functional with the Lee-Yang-Parr correlation functional, the M06-2X high nonlocality hybrid functional from Truhlar and Zhao, and the ωB97XD functional from Head-Gordan and coworkers which includes empirical dispersion. The basis sets employed are Dunning and coworkers' correlation consistent basis sets, cc-pVDZ, cc-pVTZ, and cc-pVQZ. Results indicate that silicon substitution reduces the conventional strain energy of cyclobutane most likely due to a reduction of Baeyer strain (bond angle strain), but increases the conventional strain energy in cyclopropane by destroying the stabilizing factor of sigma delocalization. We gratefully acknowledge support from the Mississippi College Catalysts, the alumni support group of the Department of Chemistry & Biochemistry.

Poster #42

- **Title:** Enthalpies of Formation of Amino and Nitro Derivatives of Benzene and Toluene by Homodesmotic Reactions
- **Presenter:** Caroline B. McCaleb
- **Co-Authors:** Caroline B. McCaleb and David H. Magers
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** David H. Magers
- **Research Sponsor(s):** MC *CATALYSTS*
- **Abstract:**
  Homodesmotic reactions are a subset of isodesmic reactions. Isodesmic reactions conserve bonds and bond types; homodesmotic reactions further

preserve bonding environments. Homodesmotic reactions and isodesmic reactions which are almost homodesmotic can be used to compute standard enthalpies of formation to within one or two kcal/mol of experimental results without having to compute atomization energies. Despite the different zeros of energy, one may set the computed enthalpy of the model reaction equal to the experimental enthalpy for the same reaction. From the computed enthalpy of reaction, the desired enthalpy of formation is determined by use of reference values for all other systems in the reaction. In the current study, the enthalpies of formation of amino and nitro derivatives of benzene and toluene are computed. Such derivatives have been postulated to be intermediates in environmental degradation of trinitrotoluene (TNT). The enthalpy of all of the reactants and products in each homodesmotic equation is computed using SCF theory, second-order perturbation theory, and density functional theory. The DFT functionals employed are Becke's three-parameter hybrid functional using the LYP correlation functional, the M06-2X high nonlocality hybrid functional from Truhlar and Zhao, and the ωB97XD functional from Head-Gordan and coworkers which includes empirical dispersion. The basis sets employed are Dunning and coworkers' correlation consistent basis sets, cc-pVDZ, cc-pVTZ, and cc-pVQZ. From the resulting enthalpy of reaction, the desired enthalpy of formation is determined by use of reference values for all other systems in the reaction. We gratefully acknowledge support from the Mississippi College Catalysts.

Poster #43

- **Title:** Conventional Strain Energy and Hyperconjugation in Cyclopropylborane and Fluoro and Chloro Derivatives
- **Presenter:** Gabrielle D. Winters
- **Co-Authors:** Gabrielle D. Winters and David H. Magers
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** David H. Magers
- **Research Sponsor(s):** MC *CATALYSTS*
- **Abstract:**
  Many studies of strain energies have considered those of cyclopropane and cyclobutane. Not only are these systems the prototypical small, cyclic hydrocarbons, but they generate additional interest because their conventional strain energies are usually reported to lie within one to two kcal/mol of each other despite cyclopropane obviously having more Baeyer strain. This similarity is usually explained by the stabilizing sigma delocalization in cyclopropane. However, another study in our group has shown that cyclopropylborane is even less strained than cyclopropane. This added stability may be due to hyperconjugation of the C-C bonds in the ring with the empty p orbital on the borane. In the current study, we investigate this stabilization by calculating the conventional strain energies of fluoro and chloro derivatives of cyclopropylborane. Specifically, the conventional strain energies of cyclopropylborane, cyclopropyl-fluoroborane, cyclopropyl-difluoroborane,

cyclopropyl-chloroborane, and cyclopropyl-dichloroborane are computed within the isodesmic, homodesmotic, and hyperhomodesmotic models. Optimum equilibrium geometries, harmonic vibrational frequencies, and corresponding electronic energies are computed for all pertinent molecular systems using SCF theory, second-order perturbation theory, and density functional theory (DFT). The DFT functionals employed are Becke's three-parameter hybrid functional with the Lee-Yang-Parr correlation functional, the M06-2X high nonlocality hybrid functional from Truhlar and Zhao, and the ωB97XD functional from Head-Gordan and coworkers which includes empirical dispersion. The basis sets employed are Dunning and coworkers' correlation consistent basis sets cc-pVDZ, cc-pVTZ, and cc-pVQZ. Natural Bond Order analysis is employed to judge the degree of hyperconjugation in each system. We gratefully acknowledge support from the Mississippi College Catalysts.

Poster #44

- **Title:** GCMS Analysis of Social Semiochemicals in Mississippi White-tailed Deer
- **Presenter:** Todd Cox
- **Co-Authors:** Todd Cox, Stephen Mills, William Janous, Joshua Berry, Trent Selby, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Research Sponsor(s):** This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.
- **Abstract:**
  Odocoileus virginianus (White-tailed Deer) are social animals that communicate using semiochemicals. Scraping behavior is an olfactory reproductive communication used by white-tailed deer to establish social networks during the breeding season. Male scraping behavior is a complex scent-marking behavior which advertises sociosexual status and location to potential females as well as to competing males. Female scraping behavior is also a complex scent-marking behavior which signals mate interests, location, and sexual receptiveness. These semiochemical scent markers are produced in body fluids such as urine, saliva, and glandular secretions released on to tree branches or the ground at scrape sites. However, the composition of these chemicals remains unknown. We used a GCMS to analyze tarsal glands and urine samples from male and female white-tailed deer. Our results suggest that volatile aromatic compounds may play a role in social semiochemical communication in white-tailed deer during mating season.

Poster #45

- **Title:** Heavy Metal Analysis of Aquatic Species Inhabiting a Creek Downstream from an Active Gravel Quarry

- **Presenter:** Harsh Patel
- **Co-Authors:** Harsh Patel, Parth Patel, Mohammad Ibrahim, Anuradha Ragila, Hinaben Patanvadia, Pinalba Zala, Nilay Kantibhai Zalavadiya, Joseph Kazery, and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry, Department of Biological Sciences
- **Research Mentor(s):** Scoty Hearst
- **Abstract:**
  Gravel quarries are open mines where the gravel and sand are harvested for commercial uses. The natural vegetation, top soil, and subsoil layers are removed potential leaching heavy metal contaminants into the local environment. Potential environmental concerns for gravel mining include habitat fragmentation, dust, runoff pollution, and water contamination. There are multiple active gravel quarries in Yazoo county, Mississippi. Previous studies in these areas revealed high levels of aluminum in water, soil, and plant samples. We hypothesized that heavy metal contaminates from these gravel quarries were leaching into nearby creek systems and potentially exposing aquatic wildlife to heavy metals such as aluminum. In this study, we collected multiple aquatic species inhabiting a creek containing gravel quarry runoff. We tested these specimens for toxic and trace elements to determine the ideal sentinel species to monitor heavy metal pollutants, such as aluminum, created from gravel mining. We collected crayfish, catfish, minnows, sunfish, bass, and newts. Samples were analyzed using an ICP-OES for Al, As, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Pb, and Zn. Statistics were used to determine the ideal sentinel species to monitor heavy metals in the creek environment. Our preliminary data suggests that crayfish species bioaccumulated high levels of metal contaminants and may be useful as sentinels for monitoring heavy metal pollutants in creek systems.

Poster #46

- **Title:** Lead, It's What's for Dinner: Assessment of Toxic Metals in Cooking Spices from India
- **Presenter:** Hinaben Patanvadia
- **Co-Authors:** Hinaben Patanvadia, Pinalba Zala, Nilay Kantibhai Zalavadiya, Harsh Patel, Anuradha Ragila, Addie Jolly, Jameson Cook, Alana Latorre, Selah Roberts, Gracie Bassett, Ashley Carter, Mitchel Creel, ArKayla Martin, Stephen Mills, Analee Rios, Sohal Sukhbir and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Abstract:**
  Spices are an essential component of any kitchen to support a healthy diet. Spices make food more interesting by adding variety and exciting colors and flavors. Recent studies have found that certain spices from India may contain high levels of heavy metals such as lead, cadmium, and arsenic. Frequent exposure to even small amounts of lead, arsenic, cadmium, and other heavy

metals is toxic and causes health problems over time. Heavy metal exposure in children affects brain development, increasing the risk for behavioral problems and lowers IQ. In adults, heavy metals can contribute to central nervous system problems, reproductive problems, and hypertension, and damage to kidney and immune function. In this study, we compare the level of toxic metals in cooking spices from India. The goal of this study was to identify spices that have high levels of toxic metals and to assess their threat to public health. We tested the following spices for toxic metals: black salt, Pani Puri Masala, Tea Masala, Rajma Masala, Organic Thyme, Organic Masala, Organic Cumin Powder, Turmeric Powder, Maggi Masala, Garlic Powder, Buttermilk Masala, Organic Turmeric Powder, Coriander Turmeric Powder, Jalsha Powder, Kasmiai Chili Powder, Hing, Sambhar Masala, and G.V. Chili Powder. We evaluated the toxic metal content of these spice product samples using an ICP-OES. The outcome of this analysis will reveal the presence and level of toxic metal contaminants in these products and determine their risk to human health.

Poster #47

- **Title:** Evaluation of Heavy Metals in Common Cooking Spices and Their Risk to Human Health
- **Presenter:** Nilay Kantibhai Zalavadiya
- **Co-Authors:** Nilay Kantibhai Zalavadiya, Hinaben Patanvadia, Harsh Patel, Anuradha Ragila, Pinalba Zala, Addie Jolly, Jameson Cook, Alana Latorre, Selah Roberts, Gracie Bassett, Ashley Carter, Mitchel Creel, ArKayla Martin, Stephen Mills, Analee Rios, Sohal Sukhbir and Scoty Hearst
- **Department:** Department of Chemistry and Biochemistry
- **Research Mentor(s):** Scoty Hearst
- **Abstract:**
  Herbs and spices play a large role in cooking and in our daily lives. These seasonings add a little spice to our lives, making meals especially delicious. However along with the added flavor of herbs and spices, something less savory and potentially dangerous could be making its way into our meals. A recent study in Consumer Reports has found that certain spices such as turmeric, chili powder, and cumin may contain high levels of heavy metals such as lead, cadmium, and arsenic. Frequent exposure to even small amounts of lead, arsenic, cadmium, and other heavy metals is toxic and causes health problems over time. Heavy metal exposure in children affects brain development, increasing the risk for behavioral problems and lowers IQ. In adults, heavy metals can contribute to central nervous system problems, reproductive problems, and hypertension, and damage to kidney and immune function. In this study, we compare the level of toxic metals in everyday cooking spices purchased commercially from a local grocery store in Clinton, MS. The goal of this study was to identify spices that have high levels of toxic metals and to assess their threat to public health. We tested the following spices for toxic metals: garlic powder, fajita seasoning, onion powder, rose marry, curry powder, cayenne

pepper, cinnamon, cumin, black pepper, chili powder, and BBQ rub. We evaluated the toxic metal content of these spice product samples using an ICP-OES. The outcome of this analysis will reveal the presence and level of toxic metal contaminants in these products and determine their risk to human health.

Oral Presentations

Mathematics seminar

- Mathematics seminar students conducted oral presentations in MCC 103.
- Mentor: Taylor Poe

AWARDS

Fall 2024 Mississippi College "Research & Reasoning" STEM Symposium

Biological Sciences • Top 4 Presenters

- **Medical Dental Alumni Association Award (Top Division Presenter):**
  - **Elizabeth Braswell** — Master of Science in Medicine Physician Assistant (*Treatment Options for Patent Ductus Arteriosus*)
- **Top Presenters:**
  - **Anna Grace Brister** (*Grapheme-Color Synesthesia is Associated with Enhanced Working Memory to Graphemes, but not Colors...*)
  - **Jaylen Vance** (*Impact of Kratom Extracts on Mouse Behavior Reveals Safety Concerns*)
  - **Shelby Beshears** (*Growth of Drosophila melanogaster Gut Microbes on Selective Media*)

Physical Sciences • Top 4 Presenters

- **Medical Dental Alumni Association Award (Top Division Presenter):**
  - **Wilson Hooker** (*Consumption Safety Analysis of Poultry Products in Clinton Mississippi*)
- **Top Presenters:**
  - **Alana Latorre** (*Preparation of conjugated polyphenylethynylarene macrocycles*)
  - **Avery C. Foret** (*Conventional Strain Energies of Thiasilirane and the Thiasiletanes*)
  - **Gracie Bassett** (*Enthalpies of Formation of Chloro, Cyano, and Methyl Derivatives of Heterocyclic Aromatics by Homodesmotic Reactions*)

Overall Recognition

- **Best in Show (Student-Judged Peer Winners):**
  - **W. Ethan Burch** (*Ketamine vs ECT for Treatment-Resistant Depression*)
  - **Ward Adams** (*Elemental Analysis of Tomatoes Grown Traditionally Versus Hydroponically*)
- **Clinton High School Guest Presenter Recognition:**
  - **Landyn Tennyson & Ana Moller** (*Toxic Metal Analysis of Alligator mississippiensis specimens from the Mississippi River near Davis Island*)

PHOTOS

Fall 2024 Mississippi College "Research & Reasoning" STEM Symposium







