

2021 MAS List of Authors/Abstracts

AGRICULTURE SECTION

Oral Presentations:

M. Mire and G. Zheng, Cooperative Research Programs, Lincoln University of Missouri. **GENETIC MARKERS AND A PCR METHOD FOR DIFFERENTIATING CRYPTIC E. COLI AND E. COLI.** Cryptic *E. coli* and *E. coli* are phenotypically indistinguishable and genetically distinct from each other. Standard methods of enumerating *E. coli* in water quality monitoring are unable to differentiate between the two. Clade-II through Clade-VI (C-II through C-VI) of cryptic *E. coli* were primarily found in aquatic environments, possibly causing false alarms of fecal contamination in water. By using the BLAST program and the draft genomes of 63 strains of *Escherichia* clades, this study found that 36 genes, with $\geq 90\%$ identical nucleotides, were shared by all strains of C-II to C-VI, but not found in any genome of any other bacteria, except in the *E. coli* strains NCTC8196 and NCTC11133, and *E. marmotae* HT073016. Interestingly, the results of genome-based DNA-DNA hybridization (DDH) indicate that these three *Escherichia* strains are highly likely members of C-V, based on a minimum DDH value of 70% to define species. The three strains displayed a DDH value of from 94.6% to 99.2% with *Escherichia* sp. EC5110, a representative strain of C-V. In addition, based on the DNA sequence of a common gene of C-II to C-VI, gene #2097, a classic PCR method has been developed for the rapid and accurate detection of C-II through C-VI, with 100% specificity and sensitivity. The PCR assay may be used to enhance the accuracy of water quality monitoring. Research supported by USDA NIFA's 1890 Capacity Building Grants, award # 2020-38821-31085

S. Thapa. School of Natural Sciences, University of Central Missouri. **TRANSPIRATION EFFICIENCY IN CORN DIFFERS ACCORDING TO THE GROWTH STAGE AND HYBRID.** Previous studies showed that drought-tolerant (DT) hybrids of corn (*Zea mays* L.) were more productive in water-limited environments. Two successive greenhouse experiments were conducted in 2017 to assess the transpiration efficiency (TE) of three corn hybrids (P1151AM, 33D53AM, and P1564HR) at four growth stages (six-leaf, flag leaf, mid-grain filling, and physiological maturity). Two DT hybrids, P1151AM (6.20 kg m^{-3}) and P1564HR (6.17 kg m^{-3}) had higher TE compared to the conventional hybrid, 33D53AM (5.42 kg m^{-3}). The mean TE was the highest (6.27 kg m^{-3}) at the mid-grain filling, followed by the flag leaf stage (5.91 kg m^{-3}), and physiological maturity (5.81 kg m^{-3}), and lowest at the six-leaf stage (5.25 kg m^{-3}). Results showed that DT hybrids had greater TE than the conventional hybrid, which made them suitable in water-limited environments. An adequate supply of water during grain filling is crucial to maximizing corn yield because of the highest TE at mid-grain filling.

I. S. Braden and M. Aide. Department of Agriculture, Southeast Missouri State University. **WATER QUALITY AND SOIL HEALTH AT THE DAVID M. BARTON AGRICULTURE RESEARCH CENTER.** Southeastern Missouri has a variety of characteristics that prove challenging for landowners concerned with maintaining water quality. Water quality is influenced by many factors, such as soil consisting of sandy or clay soils, water tables near soil surface, rocky hills or leveled land, and water source of deep/shallow wells, Mississippi River, or spring-fed streams. Challenges facing today's producers to maintain a sustainable agricultural system are difficult with a variety of soil characteristics found in the same region and sometimes the same farm. Also, it is important to realize that producers in southeast Missouri experience challenges much different from those only a few hundred miles

away. Best management practices are often recommended to provide landowners with opportunities to reduce soil erosion and improve water quality. Several conservation practices have been implemented at the David M. Barton Agriculture Research Center, Gordonville, MO, to improve water quality and soil health. Some of these practices include subsurface irrigation, a bioreactor, a reservoir for irrigation water source, establishing a riparian management zone, establishing vegetative filter strips, planting cover crops, and more. Undergraduate students and faculty have collected data to evaluate these practices for their effectiveness. Results will provide insight into best management practices for water quality improvement along the Mississippi River and area watersheds.

G. Caldwell ^{1,*}, A. Ikem ^{1,2}, and J. Garth. ^{2,1} Department of Agriculture and Environmental Sciences, Lincoln University, ² Cooperative Research Programs, Lincoln University. **THG CONCENTRATIONS OF RAINBOW TROUT (*ONCORHYNCHUS MYKISS*) FROM AQUACULTURE: EFFECT OF SIZE AND ASSESSMENT OF HUMAN HEALTH RISKS.** Globally, aquaculture is one of the fastest-growing animal food production sector¹. Total seafood production was 104 million metric tonnes (mmt), of which 54 mmt arose from capture fisheries, and 50 mmt from aquaculture². Aquaculture in-door production systems are important in the rearing of quality fish to meet the food security of the increasing world population². Rainbow trout (*Oncorhynchus mykiss*) were reared from approximately 75 mm total length to harvest (age = 6 months) in an in-door system and fed a commercially available fish protein-based feed. This work quantified the total mercury (THg) concentrations in ninety *O. mykiss* muscle (fillet) samples to test the effect of size on Hg levels and assess the human health risks via consumption by the adult population in Missouri. The Direct Mercury Analysis method involved thermal decomposition of samples, catalytic conversion, amalgamation, and mercury detection by atomic absorption spectrophotometry at 253.65 nm. The accuracy rates from the analysis of certified reference materials (DOLT-5 and DORM-4) were within the acceptance criteria. THg levels in *O. mykiss* muscle were below the legal limit and the provisional weekly intake value. Arsenic was the major contributor to the non-cancer and cancer risks. A high dietary intake of mercury from fish can pose health problems. 1. Guillen et al., 2019. Marine Policy, 104, 19 -28. 2. FAO (Food and Agriculture Organization of the United Nations), 2018. *The State of World Fisheries and Aquaculture 2018 -Meeting the sustainable development goals*. Rome, Italy.

Poster Presentations:

N. Bhusal and G. Zheng, Cooperative Research Programs, Lincoln University of Missouri. **EFFICACY OF ENDOPHYTIC *BACILLUS SUBTILIS* LCA ON REDUCING POTENTIAL CONTAMINATION OF *ESCHERICHIA COLI* O157:H7 IN ROMAINE LETTUCE.** Outbreaks caused by *Escherichia coli* O157:H7 (*E. coli* O157) were often associated with consumption of romaine lettuce (*Lactuca sativa* var. longifolia) in the United States. This study used an anti-*E. coli* O157, lettuce-endophyte bacterium, *Bacillus subtilis* LCA, as a bio-fertilizer to reduce the potential contamination of *E. coli* O157 in romaine lettuce. We hypothesized that *B. subtilis* LCA would live in lettuce from pre- to post-harvest preventing the potential contamination of *E. coli* O157 from farm to table. To test our hypothesis, *B. subtilis* LCA (about 10⁷ CFU/ml) and *E. coli* O157 (about 10⁸ CFU/ml) PBS-suspensions were inoculated in soil with the following experimental setups: 1) the *B. subtilis* only; 2) the *E. coli* only; 3) the *E. coli* and *B. subtilis*; and 4) the *B. subtilis* was added 2 weeks after *E. coli* inoculation. Spread plate count followed by *E. coli* O157 agglutination test were conducted to measure the presence of *E. coli* O157 in vegetable and soil samples at days 15, 22, and 29.

Preliminary data suggested internalization of *B. subtilis* LCA happened at least 22 days after inoculation and did begin to show *E. coli* O157 inhibition in lettuce; The endophyte showed inhibition against the pathogenic *E. coli* in the soil not later than 15 days after the inoculation. Results of this study suggest that endophytic *B. subtilis* LCA might be used as a bio-fertilizer, reducing potential contamination of *E. coli* O157:H7 in romaine lettuce. Research supported by USDA NIFA's AFRI Competitive Grants, award # 2020-67018-30784

J. Ansari^a, S.H. Anderson^a, S. Bardhan^a, and F. Eivazi^b, ^aSchool of Natural Resources, University of Missouri, Columbia, ^bDepartment of Agriculture/Cooperative Research, Lincoln University. **SOIL ENZYME ACTIVITIES AFFECTED BY SELECTED LAND MANAGEMENT IN MISSOURI RIVER FLOODPLAIN.** The lower Missouri River Floodplain (MRF) region encompasses many different land-use systems including agriculture and riparian forests. The effects of these different land-use systems in the MRF on soil microbial and enzyme activities have been insufficiently studied. The effects of the selected land-use management treatments (agriculture, agroforestry, and riparian forest) located in a floodplain in New Franklin, Missouri on soil enzyme activity were evaluated. Results revealed higher levels of β -glucosidase and β -glucosaminidase activity in agroforestry and riparian buffer treatments relative to agriculture management. Dehydrogenase activity was significantly ($p < 0.0001$) higher in riparian forest area ($0.37 \mu\text{g TPFg}^{-1} \text{soil h}^{-1}$) relative to agroforestry and agriculture sites. The highest β -glucosidase activity of $168 \mu\text{g pNP g}^{-1} \text{soil h}^{-1}$ observed in the agroforestry system while the lowest activity of $78 \mu\text{g pNP g}^{-1} \text{soil h}^{-1}$ attributed to the agriculture system. β -glucosaminidase showed the highest activity of $40 \mu\text{g pNP g}^{-1} \text{soil h}^{-1}$ in both agroforestry and riparian forest treatments compared to that of $23 \mu\text{g pNP g}^{-1} \text{soil h}^{-1}$ in agriculture. Efforts to incorporate these perennial management systems in river-floodplain landscapes will help in increasing soil enzyme activity, and microbial diversity as well as improve the performance of conservation buffers.

H. Baia, T. Nakinib, G. DeSouzab, and F. Fritschic*, ^aSchool of Agricultural Sciences, Northwest Missouri State University, ²Department of Electrical and Computer Engineering, University of Missouri, ^{*3}Division of Plant Sciences, University of Missouri. **USE OF AN X-BOX CAMERA TO MODEL SOYBEAN 3D STRUCTURE AND MORPHOLOGICAL TRAITS.** The world population increase coupled with the depletion of natural resources are a dangerous combination that is threatening humanity and other life around the world. At the current rate, crop production must be doubled by 2050 in order to meet population demand. High throughput phenotyping in agriculture has drawn increasing interest in recent years. This research introduces an unprecedented sensor, Kinect sensor, for 3D assessment of crops on a high-clearance tractor platform. The development of crop canopy 3D models, and calculation of canopy traits such as plant height, number of pods per node, etc can be achieved through light detection and ranging scanners (LIDAR). However, its complexity and high cost makes this technology difficult to implement for research and breeding proposes. The advantage of Kinect sensor besides its price, \$200/unit, is the ability to capture depth images from as many viewing angles as possible. Depth images can then be converted to point clouds, which will be further processed and combined to form a single and complete 3D model of the plant. Those 3D models can help to extract phenotypes of plants such as plant height, canopy area, number of pods per plant, and node, will provide valuable information for agronomists, breeders, geneticists, and physiologist to study their correlation with growth, resistance to biotic and abiotic stresses, and ultimately yield. Except Kinect sensors, some other sensors are also deployed on the platform, including ultrasonic sensors, thermal sensors, and spectrometers to monitor plant height, crop canopy temperature, and canopy reflectance, respectively.

S.E. Svenson, Charles Nemanick Alternative Agriculture Garden, Department of Agriculture, Southeast Missouri State University. **NATIVE PERENNIALS FOR BUTTERFLY AND POLLINATOR GARDENS: SIXTH YEAR PERFORMANCE IN SOUTHEAST MISSOURI.** Perennials native to Missouri were evaluated for survival, growth, and flowering from sixty-four to seventy-six months after planting into a compost-amended urban soil in Cape Girardeau, MO. Twenty-eight container-grown plants of each species were planted in late August 2014 in a butterfly-shaped garden under full sun growing conditions. Two plots per species were planted in each wing of the garden, providing four replicated plots of seven plants of each species for analysis. During the sixth full year after establishment, the following species had 100% survival, excellent growth, and 100% flowering: *Rudbeckia fulgida* var. *umbrosa* and *Rudbeckia missouriensis*. Species having 75% to 86% survival, good growth, and 100% flowering during the sixth growing season included: *Eryngium yuccifolium*, *Eutrochium purpureum*, *Penstemon digitalis*, and *Symphytotrichum oblongifolium*. *Asclepias tuberosa*, *Asclepias incarnata*, *Echinacea pallida*, *Echinacea paradoxa*, *Echinacea purpurea*, and *Zizia aurea* had less than 18% survival, poor growth, and 100% flowering of surviving plants. *Amorpha canescens* and *Veronicastrum virginicum* had less than 50% survival, but living plants had good growth and flowering. *Rudbeckia fulgida* var. *umbrosa*, *Rudbeckia missouriensis*, and *Eryngium yuccifolium* have spread at the location, populating additional area in and around the experimental plots. None of the original *Coreopsis lanceolata* or *Glandularia canadensis* specimens remained alive in the sixth growing season, but both species had populated near-by growing beds. The data will help guide the selection of plant species used for urban or suburban butterfly and pollinator gardens in southeast Missouri.

N. Al-Awwal^a, M. El-Dweik^b, M. Mehdi^b and S.H. Anderson^a. ^a School of Natural Resources, University of Missouri, ^b Cooperative Research, Lincoln University. **NANOPARTICLE IMMUNO-FLUORESCENT PROBES AS A SPECIFIC METHOD FOR THE DETECTION OF VIABLE *E. COLI*.** Development of revolutionary sensitive biosensors for detecting the presence of harmful biological species in the environment is of necessity for countering disease outbreaks. *E. coli* O157:H7 is a serious threat to human health and can cause massive recalls of food products and losses in productivity and profits. This work examined interaction of fluorescence-labeled antibody on amine functionalized gold nanoparticles (GNP) as a model system. The tetramethyl isothiocyanate (TRITC) labeled antibody-Amine functionalized GNP interaction was characterized using UV-Vis spectroscopy and Fluorescent Microscopy imaging. Transmission Electron Microscopy (TEM) was also used to observe the morphology of the gold nanoparticles and to make sure there was no agglomeration of the gold nanoparticles in the system. In contrast to TEM, the fluorescence microscopy imaging revealed the coating of the TRITC labeled antibody on the surface of the gold nanoparticles. The signals were observed using PTI fluorometer. Tests were conducted at near real-time with results obtained using the biosensor assay within 5 min. Results indicated that there was a shift of the wavelength from lower wavelength to higher wavelength (blue to red shift) when conjugated GNP (anti-*E. coli*O157:H7; IgY-TRITC+GNP) are compared to free gold nanoparticles a difference of about 28 nm, also the then GNP in conjugated GNP demonstrated a quenching capability when their emission was compared to that of TRITC labeled antibody using fluorometer. The limit of detection of this method was found to be 10³ cfu/mL with observed fluorescence of about 42,000 counts per seconds (CPS).

M.R. Islam and S.Pathan. Department of Agriculture and Environmental Sciences, Lincoln University. **EVALUATION OF QUINOA VARIETIES FOR YIELD AND YIELD RELATED TRAITS.** Quinoa (*Chenopodium quinoa* Willd.) is a highly nutritious crop that has been cultivated for thousands of years in South America, and recently, it has been cultivated in many countries of the world. However, South American countries like, Peru, Bolivia and Ecuador produce more than 80% of the world production. United States is the largest consumer and importer of quinoa, imported about 80 million pounds of quinoa in 2019. Currently, a very small amount of quinoa being produced in the higher elevations of the U.S. Northwest and almost none at the lower elevation of the Midwest. The primary reason for limited and region-specific domestic cultivation is a lack of cultivars with wider adaptability. To expand quinoa cultivation in USA, farmers need climate resilience high yielding, disease and insect resistant quinoa cultivars. More than 130 quinoa lines were collected from the USDA germplasm bank and evaluated in 2020. Seventy lines were selected based on date of flowering, seed setting, and phenotypic adaptation. These lines will be evaluate in the summer of 2021 under tow environment, rainfed and irrigated (control). Based on two-year field data, best lines will be selected and recommended for Missouri farmers to grow as an alternate crop. Farmers living in drought prone environment may be able to grow quinoa with only a small investment, and increasing farm profitability, crop diversity and sustainability.

S. T. Jhumur and S. Pathan. Department of Agriculture and Environmental Sciences, Lincoln University. **SELECTION OF DROUGHT TOLERANT QUINOA VARIETIES FOR THE MID-WEST.** Quinoa is a nutritious crop that has been cultivated for thousands of years in the South American countries owing to its ability to withstand drought and salt, and its capacity to grow in poor soil with minimum inputs. Today it is cultivated in many countries all over the world including USA, but 80% of the USA's market demand is still met by importing quinoa grains primarily from Peru, Bolivia, Chile, and Ecuador. Quinoa grain is gluten-free, rich in protein, contains all essential amino acids, important minerals and vitamins. Drought is the critical abiotic factor, which impairs plant growth and development and reduces crop yields worldwide. When crops are in the reproductive stages (such as flowering and seed set), they are the most sensitive to drought and heat stress which causing a significant negative affect yield. Quinoa has an exceptional ability to survive under drought stress by resuming leaf formation rapidly after a severe drought and has a low leaf wilting point. It avoids drought stress through a branched and deep root system, small and thick-walled cells to maintain turgor and stomatal regulation, a thicker leaf cuticle epidermis, and deeply sunken stomata to reduce transpiration and turgor maintenance. These unique characteristics make quinoa suitable for growing in water-limited environment with little or no irrigation. The United States is the world's largest consumer and importer of quinoa, but currently, a very small amount of quinoa is being produced in the higher elevations of the U.S. Northwest and almost none at the lower elevations of the Midwest. We have evaluated more than 100 lines from USDA germplasm bank and selected around 30 lines based on their phenotypic traits like yield, maturity, lodging, and disease score. We are planning to evaluate yield potential of these lines under three water regime, such as, control or irrigated, rainfed or normal, and drought-stressed. Our main target is to select top performing quinoa lines under water-limited environment.

J. Smith¹, and B. Valliyodan². ¹Department of Science, Technology and Mathematics, ²Department of Agriculture and Environmental Science, Lincoln University. **COMPARISON OF SOIL MICROBIOME OF ORGANIC AND CONVENTIONAL RESEARCH FARMS AT THE LINCOLN UNIVERSITY OF MISSOURI.** Soil microbiomes are the most complex components of the ecosystem and its diversity is essential towards the precision agriculture for the global food security. Substantial scientific knowledge of the taxonomic and functional diversity of soil microbiome is required to perform crop improvement functions including nutrient use efficiency and tolerance to environmental stresses. In recent years, biodiversity has been declining at alarming rates, especially due to the poor soil management practices including excessive pesticide use in agriculture. Specific objective of this study is to compare the microbiomes of conventional and organics soil to identify and catalogue the diversity and beneficial microbes, which can be utilized in the new sustainable management strategies in crop production. In this study, the soil samples were collected in triplicate from the organic and conventional research farms at the Lincoln University and four dilutions of each samples were prepared to screen for the bacterial species. Aliquots of dilutions 3 and 4 of samples were plated on the bacterial growth medium and the colonies were evaluated leading to the calculation of colony forming units. Selected colonies were screened using the MALDI Biotyper (Bruker, USA) for microbial identification. More than 20% difference in the bacterial population between two locations were identified. The identified colonies were further validated using Biolog, microbial identification and characterization system. Key bacterial species specific to each soil types were identified. These results will help to design applications towards improved soil health and plant growth and development

E. Bardot and I. S. Braden. Department of Agriculture, Southeast Missouri State University. **ONLINE LEARNING IN A PANDEMIC.** As many schools and universities were faced with a quick transition to full online learning for Spring 2020, due to COVID-19, students and teachers were challenged with new formats, a change in classroom space, and lack of social interactions. While these challenges are difficult, instructors and students all over the world were dealing with similar situations. Student learning expectations and course objectives remained the same while instruction methods and techniques changed dramatically. This is a report of various techniques for learning from student and faculty perspectives used in agronomy classes during the pandemic.

J. Smith. Agriculture, Lincoln University. **SOIL MICROBIOME DIVERSITY OF LINCOLN UNIVERSITY'S ORGANIC AND INORGANIC FARMS.** In recent years, biodiversity has been declining at alarming rates. Along with other factors, agriculture has been said to be one of the leading causes of the decrease in biodiversity. The use of pesticides in modern farming is a highly controversial topic that has been linked to a lack of biodiversity in communities. In this study, the soil microbiome diversity of an organic farm is compared to the soil microbiome diversity of an inorganic farm to identify correlations between the choice of soil and biodiversity. The two major research strategies: (1) a quantitative analysis of the colony-forming unit, and (2) identification of the soil microbes in each soil type. This study identifies similarities and differences between organic and inorganic soil to provide an analysis of the microbial community and how this influences soil health.

J. Pierce, D. Dunakey, C. Thomas, A. Spencer, C. Schabbing, S. Murray, and S. Siemers, Department of Agriculture, Southeast Missouri State University. **HORMONE IMPLANTS USED FOR GROWTH COMPARISON IN BEEF STEERS.** Anabolic steroid hormone implants improve average daily gain and feed efficiency and provide a significant economic return for beef cattle producers. The response of weight gain is greater in beef steers that have genetic potential and are properly managed. The purpose of this study was to determine the difference in average daily gain for beef steers administered an implant and those in a control group. Data for trial year one was collected in spring 2020. Trial year two took place in spring of 2021 and consisted of a group of 16, sim-angus cross beef steers were weaned and moved into an enclosed feeding facility at the David M. Barton Agriculture Research Center. Steers (n = 16) were weighed on day one of the study. One week after initial weigh in, eight steers were administered a Synovex-S implant and eight steers were not implanted. All steers continued to be weighed on a weekly basis and average daily gain was calculated using (pounds gained/days between weigh periods). Comparatively, the average daily gain of the implanted group was 3.24 lbs/day and the non-implanted (control) group was 2.55 lbs/day. On average, implanted steers are gaining 0.69 lbs/day more than non-implanted steers. Factors to consider in future research includes herd size, genetics, and environment.

A. Moore, S. Murray, and S. Siemers, Department of Agriculture, Southeast Missouri State University. **CONSUMERS PREFERENCES FOR VARIOUS PASTA-LIKE PRODUCTS.** Plant-based diets have grown in popularity throughout the 21st century. Lifestyle changes, consumer values, and consumer beliefs influence consumers' decisions to adopt a plant-based diet. Recently consumers have begun substituting wheat flour with plant-based products such as zucchini or chickpeas. The purpose of this study was to determine consumer choices for various types of pasta. Furthermore, the study aimed to determine the pasta choices of those who consume beef versus those who identified as vegetarian or vegans. The study was conducted using a survey-based research tool. Participants (N = 1003) consisted of consumers over the age of 18 from across the state of Missouri. Approximately half of the participants were given photos of various pasta types while the second half of participants were given a text description of various pasta types. Participants were asked to select which pasta type they preferred most. Results showed consumers prefer a regular pasta over whole wheat, gluten free, and plant-based pastas. Pasta was selected most frequently amongst those who indicated they were vegan or vegetarian, however the percent of people increased amongst those who selected plant-based pastas as their primary choice. Further research is needed to identify why consumers choose or do not choose various types of pasta.

ATMOSPHERIC SCIENCE SECTION

Oral Presentations:

W. Gilmore. National Weather Service Forecast Office, Little Rock, AR. **SURVEYING STORM DAMAGE USING THE DAMAGE ASSESSMENT TOOLKIT**. Surveying storm damage has historically been a tedious task in order to gather the most accurate data for the Storm Data Publication and future research. This task has included the use of paper maps, separate cameras, radar analysis, and other critical information to gain a complete picture of what happened. Over the past several years, the National Weather Service has been using a GIS-based application that integrates all the items used in past surveys, along with newly available data, into one tool that surveyors can use much more efficiently in the field. This presentation will give a brief overview of the Damage Assessment Toolkit (DAT), how the DAT has led to much quicker release of survey information, and then show examples in real-time on how damage survey points are gathered using the latest DAT.

J. Bongard, and P.S. Market. Atmospheric Science Program, School of Natural Resources, University of Missouri – Columbia. **IDENTIFYING THE PRESENCE OF COLD-AIR DAMMING ASSOCIATED WITH TOPOGRAPHICAL INFLUENCE FROM THE OZARK PLATEAU**. This work focuses on a case study from March of 2014 during which travel conditions along a portion of Interstate 55 in northeastern Arkansas became icy and dangerous for motorists despite no winter precipitation reports. This resulted in shutting down the highway stranding motorists in their vehicles overnight. A brief review of the weather phenomenon known as cold-air damming (CAD) will be given. CAD is induced by local changes in topography and it's commonly associated with drastic elevation changes such as the Front Range of the Rocky Mountains in Colorado or the southern Appalachians in the Carolinas and Georgia. Under specific weather conditions these terrain features help to produce a shallow cold air dome at the surface promoting the type of conditions examined here. The case study presented will be used as evidence that CAD can also be induced by the Ozark Plateau found in portions of Missouri and Arkansas. The main focus will be an investigation of the methods used to analyze this particular case of CAD. Map analyses both on a synoptic and mesoscale as well as soundings, meteograms, and time-height cross plots will be presented to determine how cold-air damming occurred in this unlikely region. The presentation will explain how use of the Froude number and the data taken from computer modeling of the event strengthens the case for CAD in this region. Finally, the presentation will conclude with a brief look at further investigation and future research conducted at the University of Missouri stemming from this case study.

L.J. McGuire, A. Nixon, C.E. Clay, and A.R. Lupo. Atmospheric Science Program, School of Natural Resources, University of Missouri – Columbia. **THE LONG-TERM VARIABILITY OF SOIL MOISTURE AND RECENT SEVERE WEATHER ACTIVITY IN THE CENTRAL USA**. Previous studies have demonstrated that El Nino and Southern Oscillation (ENSO) have a distinct impact on the occurrence of severe weather and the attendant environment in the eastern two thirds of the USA. Typically, La Nina years have been shown to be more active in the central USA. Here, a previous study for severe weather (tornado and hail) activity Missouri and the neighboring states of Iowa, Nebraska, and Kansas is performed for the most recent two decades. The tornado activity study revises an earlier study of the late 20th century by this group. The datasets used in this study were the National Centers for Environmental Prediction / National Center for Atmospheric Research (NCEP / NCAR) re-analyses and the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center (SPC) event archive. The results

demonstrated that recently severe weather activity in this region was higher than that of the late 20th century suggesting interdecadal variability. The interannual variability in the latest two decades is similar to that of the last half of the 20th century. Finally, these results will show that there is a correlation between the in-season soil moisture and severe weather activity, but it is not clear whether the correlation was a lead or lag.

S. Mount, M.A. Est, C.A. Steward and A.R. Lupo. Atmospheric Science Program, School of Natural Resources, University of Missouri – Columbia. **THE IMPACT OF NORTHERN HEMISPHERE FLOW REGIME TRANSITIONS AND BLOCKING ON CENTRAL USA WEATHER: WINTER 2019 AND 2021.** Studies have shown that maxima in the Northern Hemisphere (NH) Integrated Enstrophy (IE) time series can be associated with large-scale flow regime transitions or the onset and decay of blocking events. Others have demonstrated that IE maxima can be identified in ensemble model forecasts as much as 10 days in advance. During February and March 2019, and February 2021, strong IE maxima were associated with changes in the NH flow regimes that brought very cold conditions to the central United States. These colder conditions also were associated with very strong Pacific or Atlantic Region blocking events. Using the NCEP re-analyses, three different teleconnection indexes, and surface temperature data from six different cities in the central USA, these IE maxima and flow regime transitions are identified. The maximum, minimum temperature and precipitation characteristics for these cities during different large-scale flow regime characteristics are determined. The results demonstrate that relatively warm conditions occurred through the first part of February 2019 before a period of anomalously colder (up to 20° F below normal) and drier weather, with more snow, persisted into early March. This period was bookended by major changes in the NH IE time series and a strong simultaneous NH blocking episode. Following this period, the temperature regime returned to values that were closer to normal. In 2021, the results were similar and a strong stratospheric warming event and polar vortex intrusion caused record cold over much of the United States from the Rockies to the Appalachians. Finally, these flow regime changes were anticipated by an ensemble model.

BIOCHEMISTRY, BIOMEDICINE, & BIOTECHNOLOGY SECTION

Oral Presentations:

D. Morrone, Department of Basic Sciences, University of Health Sciences and Pharmacy in St. Louis. **REDUCED ALPHABET PROTEINS: GENERATION, BIOCHEMICAL CHARACTERIZATION, AND EVOLUTIONARY IMPLICATIONS.** The genetic code has an evolutionary history building up to today's commonly utilized 20 amino acids found in most proteins. Several lines of evidence indicate that the evolutionary ancestors of today's proteins likely contained fewer than 20 different amino acids. Further, the various amino acids were likely added into the genetic code in a general order. Several approaches are available for making reduced alphabet libraries which contain fewer than 20 different amino acids and represent various stages of ancestral proteins along the evolutionary path of the genetic code. This talk will present the findings of the generation and biochemical characterization of reduced alphabet proteins composed strictly of 5, 9, and 16 different amino acids assembled into reading frames with residues arranged in a random order. It was found these proteins can be solubly expressed, to varying degrees, in *E. coli*. Expressed proteins were purified and subject to biochemical characterization for secondary structure content. These experiments demonstrate that ancient evolutionary proteins of fewer than 20 amino acids are plausible, and perhaps could hold potential biological function.

M. Asare, T. Shanko, E. Bisetegn, K. Fernandez, and M.G. Kumar, Department of Biology and Chemistry, Cottey College. **ANALYSIS OF THE MOLECULAR EFFECTS OF ACUTE DRUG TREATMENTS ON THE AQUATIC CYANOBACTERIA *MICROCYSTIS AERUGINOSA*.** Ecological risks of pharmaceutical pollutants are an emerging issue that is becoming more widespread due to excessive use of over-the-counter drugs all over the world. Cyanobacteria, which survived billions of years of evolution, provide a unique model system to study environmental pollution. It has been shown that pharmaceutical compounds, such as ibuprofen (a NSAID), caffeine (a stimulant), acetaminophen (an analgesic), sulfamethoxazole (an antibiotic), are present at alarming concentrations (at μM level) in surface waters in different parts of the world. The goal of the present research is to investigate the molecular effects of these drugs on the growth, pigment and toxin production, and morphology of *Microcystis aeruginosa* (UTEX LB 2385). The bactericidal nature of the drugs in freshwater medium with alternate light and dark cycles were measured by growth analysis and hemocytometer cell counting. Our data suggests that the IC_{50} and IC_{15} values are $250 \mu\text{M}$ and $0.025 \mu\text{M}$ respectively when a total number of 31.5×10^5 cells were treated with ibuprofen for 168 hours with comparable results for other drugs. Further work is underway to determine the pigments and toxin concentration by spectroscopy and ELISA analysis. This analytical approach aims to determine the acute effects of pharmaceutical stresses on aquatic microorganisms.

Poster Presentations:

C. Rivas, C. Nichols, K. Kendrick, J. Wang, and R. J. Ulbricht, Department of Biomedical Sciences, Missouri State University. **SEX DEPENDENT EFFECTS OF INDUCED ACUTE INFLAMMATION ON RNA EDITING AND GLUCOSE METABOLISM.** The first line of defense against bodily insults, like pathogen invasion, is the innate immune system. Innate immunity sets in motion countless cascades that result in inflammation. Inflammation simultaneously affects multiple processes like metabolism and gene expression. Males and females react differently to inflammation. To further understand sex differences in inflammation, we examined how inflammation affects RNA editing and glucose metabolism. Adenosine deaminase acting on RNA (ADAR1) is upregulated by inflammation and catalyzes RNA editing, a process where nucleotides encoded by the genome are modified. RNA editing can change the proteins encoded by a messenger RNA, altering their functions. We anticipate that inflammation will alter RNA editing, however, potential sex-dependent differences in the rates of RNA editing are unexplored. To look at how inflammation affects physiology, we also determined sex-dependent differences in glucose metabolism. Mice injected with lipopolysaccharide (LPS), an agent known to cause inflammation, were subjected to glucose tolerance testing to see how well they metabolized sugar, as well as RNA editing analysis from tissues such as brain and heart. Female mice treated with LPS showed greater changes in RNA editing levels and increased sugar metabolism during inflammation. This work will provide further insights into known sex-dependent disparities in auto-immune diseases.

E. Randazzo and K. Strodtman, Department of Physical and Biological Sciences, Columbia College. **CLONING 4-CARBOXYMUCONOLACTONE DECARBOXYLASE FROM *BRADY-RHIZOBIUM DIAZOEFFICIENS* USDA 110.** *Bradyrhizobium diazoefficiens* is a bacterium that forms symbiotic relationships with plants such as the soybean. The host plant provides an environment for the bacterium and the bacterium aids the plant in a variety of chemical processes, including nitrogen fixation in the roots. The gene *blr5669* in *B. diazoefficiens* codes for the enzyme 4-carboxymuconolactone decarboxylase. This enzyme is utilized in a variety of pathways in the bacterium including benzoate degradation, aromatic compound degradation, normal metabolism, and microbial metabolism in diverse environments as a carbon-carbon lyase. *Blr5669* was recombinantly cloned and expressed in *Escherichia coli* following common biotechnology practices. The gene was amplified using PCR, ligated into a pGEM-T Easy Vector, and transformed into *E. coli* cells. Recombinant clones were then verified by colony PCR and restriction digestion to ensure integration via fragment sizing. Future work includes cloning the gene for expression into pET28 and the creation of a deletion mutant to assess the role of 4-carboxymuconolactone decarboxylase in nitrogen fixation.

M. McGregor and K. Strodtman, Department of Biochemistry, Columbia College. **PURIFICATION AND CHARACTERIZATION OF PSJM1 AND PSJM2 OF *BRADYRHIZOBIUM DIAZOEFFICIENS*.** *Bradyrhizobium diazoefficiens* has a symbiotic relationship with *Glycine max*, which allows for atmospheric nitrogen fixation. Previously work has created single and double knockout's in the gene paralogs (*blr0927-28* & *blr2333-34*) for the enzyme protocatechuate-3,4 dioxygenase (*pcaHG*). One of these paralog knockouts, KNS1 (Δ *blr2333-34*), is responsible for phenolic compound metabolism in the free-living state, while the other, KNS2 (Δ *blr0927-28*), induces a Fix- state in the bacteroid-soybean symbiosis. To better understand the function of phenolic metabolism in the symbiotic state the genes *blr0927* and *blr0928* were PCR amplified and ligated in the pET28b expression vector creating the vectors pSJM1 (*blr0927*) and pSJM2 (*blr0928*) respectively. Initial induction gave no discernable band for

pSJM1 or pSJM2. pSJM1 was induced and purified via Ni-IDA Agarose column paired with imidazole elution on FPLC. This resulted in a peak on the FPLC graph at 47 minutes corresponding with elution of the target protein. SDS polyacrylamide gel electrophoresis will be used with Coomassie Brilliant Blue stain to verify the sizes of pSJM1 as well as to verify if the collected fractions were the pSJM1 protein.

K. Espen, K. Strodman, C. Babayco, Department of Physical and Biological Sciences, Columbia College. **WASTEWATER FLOODING INDUCED CHANGES IN THE SOIL MICROBIOME AND ENZYMATIC ACTIVITY WITHIN THE EAGLE BLUFFS CONSERVATION AREA.** Eagle Bluffs Conservation Area provides a year-round wetland habitat using the effluent from the Columbia Regional Wastewater Treatment Plant as a water source. As a result, portions of the Conservation Area are periodically flooded with nutrient rich wastewater. This study reports changes in the extracellular enzymatic activity and microbial ecology of soil samples taken between May and September 2020. Enzyme activity was measured spectroscopically through the release of p-nitrophenol from labelled substrates by three hydrolases: β -glucosidase, phosphatase, and N-acetylglucosaminidase which are used to acquire carbon, phosphorous, and nitrogen, respectively. Additionally, dehydrogenase activity was measured by monitoring the degradation of 2,3,5-triphenyltetrazolium to 1,3,5-triphenylformazan. To determine how the composition of the microbial community was affected by flooding events, microbial DNA was extracted and quantified from the soil. The 16S region of the extracted DNA was amplified using barcoded primers. The amplified 16S PCR product was pooled and sequenced using an Oxford Nanopore MinION sequencer, followed by deconvolution and identification using the 16S workflow in EPI2ME. Based on enzyme activities, carbon was not a limiting factor during the sampling period and flooding by wastewater reduced phosphorous limitations. Dehydrogenase activity decreased following wastewater flooding events, indicating that carbon is being acquired from wastewater. From the 16S sequencing data, it is clear that there are shifts in the microbiome resulting from the introduction of wastewater. Taken together, the introduction of wastewater changes the ecological balance of the microbial population by introducing alternative nutrient sources and affecting the distribution of phyla of the microbiome.

L. Berliew, M. Schad, and N. K. Sharma, Department of Biology and Environmental Health, Missouri Southern State University. **EXPLORING THE POTENTIAL OF FLAVOPEREIRINE AGAINST BREAST CANCER AT THE MOLECULAR LEVEL.** Breast cancer is one of the deadliest forms of cancer and is the second most common cause of death for women after lung cancer. Many potential drugs do not work well due to the resistance and complexity of the molecular pathways that trigger the growth and division of breast cancer cells, highlighting the need for continuous urgent exploration of drugs and molecular targets in the breast cancer. The objective of the present study is to determine the potential use of Flavopereirine in controlling breast cancer. Breast cancer cells were exposed to the varying concentration of drug along with negative control to analyze the effect of drug on cancer cell viability. We have found 1 micromolar concentration of Flavopereirine to inhibit about 50% cell viability using XTT assay. Thereafter, cells were grown with drug and whole cells were harvested to analyze the effect of drug on gene expression. RNA from the drug treated and control cells was isolated, followed by cDNA synthesis. We have performed quantitative real-time PCR to analyze the expression of various genes involved in cell survival and cell death pathways. Our preliminary results indicate that this drug enhances the expression of genes involved in apoptosis of breast cancer cells.

C. Nichols, B. N. James, T. S. Tebbe, B. M. Macander, and R. J. Ulbricht, Department of Biomedical Sciences, Missouri State University. **TISSUE-SPECIFIC CHANGES IN RNA EDITING DURING INDUCED INFLAMMATION.** A-to-I RNA editing is a process in which adenosine (A) nucleotides are deaminated by editing enzymes, ADAR1 and ADAR2, to become inosines (I) in select RNA transcripts. Inosine is read as guanosine during translation and by sequencing. During inflammation, ADAR1 is upregulated and plays a role in immunity. The effect of increased ADAR1 on RNA editing is unknown. We are interested in RNA editing levels when ADAR1 is induced. We are interested in both ADAR1 and ADAR2 targets since ADAR1 is known to compete with ADAR2 for binding to RNA, inhibiting ADAR2's ability to bind and edit its targets. We used lipopolysaccharide (LPS) to induce inflammation, thereby increasing the amount of ADAR1. Organs were dissected four hours after LPS injection and RNA was isolated from these tissues. RT-PCR was used to amplify regions around editing sites of known editing targets. The amplicons were then sequenced and analyzed by measuring the amounts of unedited nucleotides (A) and edited nucleotides (G) at select editing sites. We found decreased levels of RNA editing of sites edited by ADAR2 in the heart and no changes in RNA editing in the brain. This indicates a complex system where RNA editing is regulated in a tissue-specific manner. While the induced inflammation is global, the tissue-specific changes in editing may provide a mechanism by which tissues adapt to inflammation in unique ways. Overall, this work will uncover information on how infection and inflammation alter the physiology of each organ.

Y. Zhang, W. Liu, and R. Wang, Department of Chemistry and Center for Research in Energy and Environment, Missouri University of Science and Technology. **METALLIZATION OF DNA NANOSTRUCTURES AS BUILDING BLOCKS FOR FABRICATING NANO-ELECTRONIC CIRCUITS.** The self-assembling property of DNA, forming the geometrically arbitrary motifs at nanometer scale, makes DNA nanostructures a promising material in the field of fabrication, especially in development of electronic circuits. However, the low intrinsic conductance of DNA structures seems to be a serious limitation for their use in fabricating nanoelectronics. The metallization of DNA structures turns out to be a promising and reliable strategy to increase the conductance of DNA nanostructures and brings a spark of life into the technical world of nanoelectronics. Here, we aim to employ DNA origami as template to direct the growth of feature-rich metal nanomaterials and make progress towards realization of complex nanoelectronics from biological nanostructures. Different shapes of DNA origami nanostructures were synthesized and coated with a thin and electrically conductive silver layer by photochemical reduction of diamine silver on mica and silicon surfaces. The resulting properties of metal coated DNA hybrid structures were investigated. Comparing with chemical reduction method, this photoreduction strategy is simpler, and faster, while provides a much cleaner continuous and uniform metal layer on DNA templates.

H. Short, K. Strodtman, Department of Physical and Biological Sciences, Columbia College. **CLONING 3-OXOADIPATE ENOL-LACTONASE FROM *BRADYRHIZOBIUM DIAZOEFFICIENS* USDA 110.** *Bradyrhizobium diazoefficiens* is a well-studied rhizobial model species that infects the legume soybean (*Glycine max*) providing nitrogen fixation. 3-oxoadipate enol-lactonase or pcaD (Blr5668) performs functions as a hydrolase by catalyzing the production of 3-oxoadipate from 3-oxoadipate enol-lactone with the addition of water. This reaction involving 3-oxoadipate enol-lactonase becomes important in the benzoate degradation pathway, which eventually feeds into the citric acid cycle (TCA) and could potentially help to support nitrogen fixation. 3-oxoadipate enol-lactonase also functions as a hydrolase in both general metabolism and microbial metabolism. This experiment was conducted by cloning the gene into the pGEM T-EZ vector. The result was a properly integrated Blr5668 gene in the pGEM vector and was verified by

colony PCR and insertion dropout from the construct following EcoRI digestion. Future work includes cloning the gene into pET28 for enzymatic characterization and creating a deletion mutant to assess the role of *pcaD* in nitrogen fixation.

E. Bisotto and N. K. Sharma, Department of Biology and Environmental Health, Missouri Southern State University. **ANALYSIS OF MOLECULAR TARGETS OF SHH INHIBITOR LDE-225 IN BREAST CANCER CELLS.** Breast cancer is one of the most common cancer in females around the world because it affects more than one in ten women worldwide. In the United States, breast cancer is the second leading cause of cancer related deaths among women aged 40–55. Sonic Hedgehog pathway (Shh) is one of the hedgehog pathways and its aberrant activation has been linked to the growth and spread of many cancers. In this research project, we have used LDE-225 as Shh inhibitor to control the growth of breast cancer cell line MCF 7. We have analyzed the cell viability by XTT assay by using different concentration of LDE-225. We have found 5 micromolar concentration of LDE225 effective for about 40% loss in cell viability. In order to analyze the effect of LDE225 on gene expression, we have isolated RNA and performed quantitative real-time PCR. We have observed significant reduction in Bcl2 expression and significant increase in Bak expression. We have not found any significant change in Akt expression. We are further analyzing the expression of genes involved in cell survival and cell death pathways.

BIOLOGY SECTION

Oral Presentations:

T. Roy. Department of Biology, Missouri Western State University. **A CLOSER LOOK AT THE EVOLUTION AND DIVERSIFICATION OF THE “ROSINWEEDS” (GENUS: *SILPHIUM*; FAMILY: ASTERACEAE).** The Asteraceae family is a widespread flowering plant family that is distributed and spread throughout the world. The genus *Silphium* is native to the Eastern United States and small parts of Canada, with a wide variety of species native to the Midwestern United States. There are four species native to Missouri – *S. integrifolium*, *S. perfoliatum*, *S. terebinthinaceum*, and *S. laciniatum*. The species *Silphium perfoliatum* has properties that make it an eligible source for future biofuels, spurring our phylogenetic research of the genus. The first goal of this study was to investigate the evolutionary relationships among members of this group through the analysis of nucleotide sequence data from the Internal Transcribed Spacer (ITS) and External Transcribed Spacer (ETS) regions of nuclear ribosomal DNA (nrDNA), as well as the chloroplast loci *rbcL* and *trnL*, and a Bayesian method of tree building. Another goal was to focus on the placement of the Missouri native species in the phylogenetic trees obtained from our analyses. We also looked at the timing of diversification for this group in temperate North America.

V. Morales, A. Mosher and A. Russell. Department of Biology, Missouri State University. **IMPORTANCE OF BEE DIET BREADTH AND CONSERVATION ACTIONS.** Animal diet breadth varies along a continuum, from extreme specialization (foraging on a few or one food type) to extreme generalization (foraging on many different food types). Greater diet breadth is frequently associated with reduced extinction risk. Pollinators such as bees are essential in natural and agricultural landscapes and many species are declining rapidly. Most bee species are thought to be highly specialized to feeding on the pollen of specific plant species, which could increase their extinction risk. Currently, we are experiencing a pollination crisis, with perhaps the majority of pollinator species declining at a rapid rate. However, we currently lack a consolidated accounting of how pollen diet breadth varies across the approximately 20,000 bee species. In this study, we are conducting a literature search to determine the pollen diet breadth of as many bee species as possible. Over 1700 bee species and their pollen hosts have been recorded in our database so far. Our records indicate that of these bee species, around 5% are extreme specialists (monolectic) and a further 73% are strongly specialized (oligolectic); only around 22% of the bee species are extreme generalists (polylectic). On average, bees used 1.4 plant families, 2.8 genera, and 2.5 species as pollen hosts. Diet breadth across all bee species ranged from 1-49 plant families, 1-96 genera, and 1-60 species. Characterizing diet breadth across the bees not only aids in conserving bees, but helps guide conservation of the plants on which bees forage.

T. Santana-Baez¹, E. McHugh¹, D. Monismith², Jr., J. Campbell¹ and A. Campbell¹. ¹Department of Natural Sciences, Northwest Missouri State University. ²557th Software Maintenance Squadron, Tinker Air Force Base. **COMPERATIVE GENOMICS OF CADMIUM-RESISTANCE ISOLATES WITHIN *COMAMONADACEAE* ISOLATES FROM CONTAMINATED SOILS OF PICHER, OK.** The abandoned town of Picher, Oklahoma was the site of acting mining as part of the Tri-State Mining District of Kansas, Missouri and Oklahoma. Mining and smelting activities in this area led to extensive heavy-metal contamination that ultimately resulted in the evacuation of the town. Isolations from soil samples produced cadmium-resistant alphaproteobacteria from the family *Comamonadaceae*. Genomes

of two isolates have been sequenced: *Comamonadaceae* sp. EM25 and *Comamonadaceae* sp. EM38. EM25 seems to be closely related to the genus *Mitsuaria* whereas EM38 was found to be related to genera *Xenophilus* and *Xylophilus*. Their genomes contain multiple copies of genes CadR-PbrR, which encodes efflux pumps for cadmium, lead and zinc resistance. Comparative genomics also shows that EM38 might represent a new species.

Poster Presentations:

S. Boss and T. Roy. Department of Biology, Missouri Western State University. **A FRESH LOOK AT THE PHYLOGENETIC RELATIONSHIPS WITHIN THE GENUS *SILPHIUM***. The genus *Silphium*, commonly known as the “rosin-weeds”, belongs to the sunflower family Asteraceae with around 23 species. It is native to North America and some species have shown to be a potential source for future biofuel research. Additionally, the genus’ phylogeny was last studied twenty years ago and requires further review with newer methods of analysis. We used the bioinformatics programs MrBayes on XSEDE and BioEdit to understand the evolutionary relationship among the different species, taxonomical sections, and subsections within the group. We utilized the nuclear ribosomal DNA sequences, as well as the chloroplast regions *rbcL* and *trnL* regions for our study.

E. Par. Department of Biology, Missouri Western State University. **A TANGLEGRAM METHOD OF INVESTIGATING THE INCONGRUENCE BETWEEN NUCLEAR AND ORGANELLAR DNA DATA WITHIN THE MINTS (SUBFAMILY: LAMIOIDEAE; FAMILY: LAMIACEAE)**. Lamiaceae is one of the most species-rich angiosperm (flowering plant) families, characterized by a suite of interesting morphological characters. Lamiaceae is further divided into seven subfamilies, of which Lamioideae is the second largest subfamily and exhibits a remarkable diversity of morphology, habitat, and migratory habitats. Lamioideae is comprised of ten tribes (subgroups), of which Gomphostemmatae and Pogostemoneae belong to mostly Central Asia and the Mediterranean region with many of their members being extensively used in medicinal and cultural purposes. Some of those members have further invaded temperate North America and established themselves in various habitats, presenting an ideal system for investigating the evolutionary relationships, diversification, and speciation patterns. Our previous study has shown substantial incongruence between the phylogenetic trees derived from the nuclear and organellar DNA datasets. In this study, we have tried to investigate this further with a tanglegram method. These analyses show incongruence between phylogenetic trees derived from the nuclear and the chloroplast DNA data.

A. Haddock, S. Buehre, J. Poush, M. Tai, L. Tinoco, A. Zahnd and C. Barta. Department of Biology, Missouri Western State University. **COULD THE CAPACITY TO EMIT ISOPRENE AFFECT PLANT SENESCENCE IN A WARMING CLIMATE?** Isoprene emission from vegetation is an important biosphere-atmosphere interaction and a key constraint to the chemical properties of the troposphere, affecting its oxidative capacity. Isoprene reactions may allow for ozone formation and indirectly affect greenhouse gas accumulation, reinforcing global warming. Isoprene emission is controlled by the physical environment and affected by exposure to environmental stress. A warming climate has been hypothesized to prolong growth seasons, with yet unknown consequences on plant life cycle, onset of senescence, and seasonal variations in isoprene emission from the vegetation. To gain a better understanding of a hypothesized relationship between isoprene emission capacity, senescence progression and leaf abscission at the end of the growing season, in a changing climate, the current study investigated seasonal changes in the emission capacity, hormone status and plant oxidant-antioxidant balance, in correlation with

changes in micro-climate in pin oaks (*Quercus palustris*) in Missouri from 2015 to 2020. We found that high and sustained isoprene emission capacities in oaks have been associated with a delay in senescence-associated pigment and membrane degradation, as well as altered levels of key phytohormones responsible for triggering the senescence and abscission of leaves at the end of the fall season. We hypothesize that the sustained isoprene emission in strong emitters, up to very late in the cold season, may contribute to delaying senescence-associated membrane degradation and reactive oxygen species accumulation, potentially attributable to isoprene's antioxidant functions *in planta*.

C. Barta, S. Buehre, A. Haddock, B. Jenkins, D. Lindstrom, H. Meers, R. Prawitz, M. Tai, L. Tinoco and A. Zahnd. Department of Biology, Missouri Western State University.

GIBBERELIC ACID SUPPLEMENTATION DECREASES THE NEGATIVE ALLELOPATHIC EFFECTS OF AMUR HONEYSUCKLE (*LONICERA MAACKII*) LEAF EXTRACTS ON MUSTARD (*BRASSICA RAPA* L. VAR. *RAPA*) SEED

GERMINATION AND GROWTH. Invasive species are a threat to biodiversity and a relevant concern for species conservation and restoration. The synthesis and release of a variety of allelopathic chemicals into the environment is a competitive strategy employed by invasive species, which directly or indirectly negatively affect native species. Decomposing leaves of Amur honeysuckle (*Lonicera maackii*) have been shown to leach a variety of phenolic molecules into the soil, with devastating inhibitory effects on native species in the region. Nevertheless, the action mechanism of inhibition has not been studied to date. In this work we explored the mechanism of inhibition by honeysuckle leaf extracts in germinating standard (control, *Rbr*), gibberellin (GA) synthesis deficient (Rosette-Dwarf, *ros*) and GA overproducing (Tall, *ein*) mutants of field mustard (*Brassica rapa* L. var. *rapa*), in a bioassay. Honeysuckle leaf extracts significantly decreased the germination of mustard seeds. The inhibitory effect was stronger with increasing extract concentrations, and most pronounced in the *ros* mutants, whose germination was arrested even at the lowest tested extract concentration. The *ein* seeds were able to overcome inhibition, with only a delay in their germination, at the highest extract concentrations. We observed a similar relationship when control seeds were exposed to extracts in the presence of exogenous GA (up to 100 μ M), with the strength of inhibition decreasing with increasing GA amounts. We hypothesize, that the allelochemicals in the honeysuckle leaf extract alter the hormonal balance in germinating mustard seeds, effect which however, can be alleviated by elevated GA concentrations.

D. Klewer and L. Miller. Department of Biology, College of the Ozarks. **TARDIGRADE DISTRIBUTION IN OZARK LICHENS, BARRY & TANEY COUNTY, MISSOURI, U.S.A.** Tardigrades remain an under documented group in Missouri and in the United States. In this study, lichen samples from fallen tree branches were collected in Barry and Taney County, Missouri. We investigated the biodiversity and the distribution of tardigrades with regards to lichen species where they were found. Tardigrades were collected from 61 samples of lichens from Southwest Missouri. Twelve species of lichens were examined from tree bark and independent branches. A total of 178 tardigrades representing 9 species were identified. Tardigrade communities varied with respect to lichen morphology. *Teloschistes chrysophthalmus*, a fruticose lichen, had a strong correlation with *Ramazzottius sp.*; a tardigrade species which has a unique arrangement of claws. Our preliminary data suggests that there is an association between tardigrades and lichen substrate morphology. Additionally, this work establishes the first recording of tardigrades in Barry County, Missouri and documents the collection of the tardigrade *Barbaria bigranulata*; the first record for the collection of this tardigrade in the state of Missouri.

A. Mosher¹, D. Papaj², S. Buchmann², T. Eltz³ and A. Russell¹. ¹Biology Department, Missouri State University. ²University of Arizona. ³University of Bochum. **NO TRICK ANTERS: POSSIBLE MANIPULATION OF A POLLEN FORAGING BEHAVIOR BY PLANTS.**

Flowering plants often manipulate the foraging behavior of their pollinators to exploit them. For example, flowers might produce cues facilitating pollen pickup by pollinators, while simultaneously reducing their foraging effectiveness. Generalist bees foraging on flowers frequently use a pollen foraging behavior termed floral buzzing, which involves vigorous vibration of the anthers. By manipulating the intensity or occurrence of floral buzzing (associated with pollen collection), a flower might exploit the bees to collect less pollen than would benefit it. We therefore tested how chemical cues associated with the anthers (the male flower reproductive parts) mediated floral buzzing by the generalist bee, *Bombus impatiens*. We found that floral buzzing was elicited by anther chemical cues by using crude solvent anther extracts applied to artificial flowers. Surprisingly, the occurrence of floral buzzing, but not the intensity (measured in decibels) was affected by the concentration of anther chemical cues. Our results also suggest that anther chemical cues eliciting the buzzing behavior are of low volatility: buzzing was elicited to a similar degree by extracts left to volatilize on artificial anthers for increasing lengths of time. In ongoing work, we are assessing which components of the crude solvent extract elicit floral buzzing. Altogether, our results suggest that by eliciting the buzzing behavior on anthers directly via low volatile chemicals, flowers potentially manipulate bee pollen foraging behavior.

W. Cavanagh, V. Lee and D. Duvernell. Biological Sciences, Missouri University of Science and Technology. **ESTABLISHMENT OF A COMPREHENSIVE MITOGENOME DATABASE OF MISSOURI FISHES.** Environmental DNA (eDNA) is organismal DNA found in the environment. eDNA metabarcoding involves the isolation and high throughput sequencing and identification of eDNA for the purpose of characterizing organismal communities. It can be a useful biomonitoring tool when utilized along with a high-quality reference library of DNA sequences. Most eDNA metabarcoding efforts target mitochondrial genetic markers because mitochondrial DNA occurs in eukaryotic organisms in far higher abundance than nuclear DNA. Genetic markers that have low intraspecies but higher interspecies variation allow for quick identification through alignment of eDNA sequences to annotated reference sequences. The lack of a verified and comprehensive reference database can result in failure to account for species that are present, or even misidentification of closely related species. This study focuses on the establishment of a complete mitogenome reference database for the fishes of Missouri. A recent search of the public GenBank sequence database revealed that only 60% of Missouri fishes were represented by a complete mitogenome accession. We have collected tissues for mitogenome sequencing to augment existing Missouri species coverage. We used long PCR to amplify complete mitogenomes in four segments of ~5000 bp each, and DNA libraries were constructed for Illumina DNA sequencing. Low coverage regions of assemblies were supplemented with targeted Sanger sequences to generate complete, high-quality reference mitogenomes. Taxonomic identification of specimens was verified by phylogeny construction, and BLAST search to GenBank of COI gene sequences, which include high taxonomic coverage resulting from the BarCode of Life initiative.

K. Madigan and T. Martin. Department of Physical and Natural Sciences, Columbia College. **SYNERGISTIC *IN VITRO* EFFECTS OF CARVACROL AND CIPROFLOXACIN ON *ENTEROBACTER CLOACAE*.** Antibiotic resistance is becoming a rising threat to global health. To decrease the dependence on antibiotics to treat infections, it has been worthwhile to investigate any synergistic effects between common antibiotics paired with antimicrobial medicinal plants, which have more natural ways to treat infections with fewer side effects. In this experiment, carvacrol extract from the oregano plant was combined with ciprofloxacin and its antimicrobial effect was observed on *Enterobacter cloacae*, a bacterium found culprit in many hospital-acquired infections. As these infections progress to the bloodstream, mortality rates rise as high as 43.6%, with previous antibiotic treatment being a risk factor impacting prognosis. Furthermore, *E. cloacae* is found to quickly acquire resistance mechanisms to many antibiotics due to antibiotic pressure from hospital treatment, so finding ways to treat this infection without use of large doses of antibiotics is essential. It was found that carvacrol at a concentration of 16 µg/mL, along with ciprofloxacin at 62.5 µg/mL, effectively inhibited growth of *E. cloacae in vitro*. Further studies need to be performed to determine the minimum inhibitory concentration (MIC) of this combination of antimicrobials, and to determine any therapeutic boundaries with this possible treatment.

N. Sommer¹, W. Obert¹, D. Moser², S. Hamilton-Brehm^{2,3} and J. Campbell¹. ¹Department of Natural Sciences, Northwest Missouri State University. ²Desert Research Institute. ³Department of Microbiology, Southern Illinois University. **ISOLATION OF OLIGOTROPHIC BACTERIA FROM TERRESTRIAL WATER SOURCES IN THE MOJAVE DESERT.** Bacteria are the most dominant form of life on Earth, but only a small percentage of known bacteria have been cultivated in a laboratory setting. There is still much to be learned about bacteria that inhabit the environment around us. Permanent springs in the Mojave Desert near Death Valley provide a unique environment from which to isolate novel bacteria. Bacteria were enriched and purified from these springs on dilute media to selectively grow oligotrophic bacteria. Isolates were identified using 16S rRNA gene sequencing. We isolated nine genera from 4 phyla, including *Pseudomonas*, *Agrococcus*, *Novosphingobium*, and *Acidovorax*. These isolates add to our knowledge of microbial biodiversity in terrestrial waters of arid regions.

V. Davenport. Biology Department, Missouri State University. **A COMPARISON OF CHITOSAN DERIVATIVES AND THEIR POTENTIAL FOR BIOMEDICAL APPLICATIONS OF INTRA-CELLULAR DELIVERY.** Chitosan derivatives have gained research interest for their antimicrobial properties and potential in vaccine delivery. In the present study, we observed four different samples. Chitosan-phosphonium with 23.8% degree of substitution (DS) (EPBC1), chitosan-phosphonium with 16% DS (EPBC2), chitosan-ammonium with 25% DS (EABC1) and chitosan-ammonium with 17.6% DS (EABC2). We plan to treat each to HeLa cervical cancer cells in a series of experiments to determine the most compatible. XTT viability assays showed derivatives to have low effect to cell survival, the most notable effect being at high treatment concentrations (143 µg/mL) and larger % DS. This is to be followed by reactive oxygen species (ROS) apoptosis analyses to determine/compare the safety of each derivative. Fluorescent microscopy confirmed transfection of purified bacterial plasmids (TPST1-eGFP fusion protein targeted to trans-Golgi membrane, and GFP-EEA1 marking early endosome) into HeLa cell. We plan to follow this in order to determine efficacy of each derivative in improving HeLa cell transfection. Collectively, we hypothesize derivatives with lower levels of DS to have better HeLa cell compatibility and transfection efficacy. We hope these results to suggest promising chitosan derivatives for future biomedical delivery tools.

A. Peters and K. Kim. Biology Department, Missouri State University. **NANOPARTICLE EFFECTS ON HUMAN THYROID CANCER CELLS.** Cancer affects millions of people each year. Chemotherapy and radiation treatment methods are extremely toxic to the body and can cause more harm than intended. Nanoparticles are an underdeveloped drug that could be a possible solution. Nanoparticles contribute significantly to the technologies in agriculture and food development but there is little understanding to how nanoparticles impact human health. Metal Oxide Nanoparticles (Me-Nps), such as Zinc Oxide, Copper Oxide, Titanium Dioxide and Tin Oxide, have been treated in model organisms and plants in some studies. A general trend through these Me-Nps is the antimicrobial activity and toxicity. To better understand the toxicity of these Me-Nps in human cells, we conducted XTT cell viability and Reactive Oxygen Species (ROS) assays on human thyroid cancer cells (ML-1). After a preliminary XTT assay, ZnO and CuO was determined to have the greatest effect on ML-1. ZnO treated at 22.8 μ g/mL and CuO treated at 45.8 μ g/mL decreased cell viability drastically. The production of superoxide in the cell when treated with CuO and ZnO was measured by ROS via flow cytometry. Interestingly, both nanoparticles decreased superoxide radicals compared to the control. Our next step will be to conduct an apoptosis and RNA transcriptome analysis to better understand which genes are affected by these nanoparticles. Furthermore, conducting similar experiments on non-cancer cells, such as fibroblasts, will give us a better idea if these Me-Nps can target cancer cells specifically.

C. Horstmann and K. Kim. Department of Biology, Missouri State University. **AN INVESTIGATION ON TRANSCRIPTOME PROFILE ALTERATIONS AND TOXICITY OF CDSE/ZNS AND INP/ZNS QUANTUM DOTS IN BAKER'S YEAST.** Our research focus is on the effects of quantum dots (QDs), CdSe/ZnS and InP/ZnS, in *Saccharomyces cerevisiae*. Although QDs have many potential and promising applications, there is much we still don't understand about their toxicity and long-lasting effects on the environment. We tested our QDs toxicity by conducting a series of experiments including cell viability assays, ROS detection assays, confocal microscopy, and RNA-seq to identify differentially expressed genes in QD-treated yeast. We found CdSe/ZnS had no statistical effect on the growth of yeast, and InP/ZnS displayed a dose-dependent effect on yeast growth. Our ROS detection experiment revealed that both QDs significantly alter ROS levels. Additionally, we found CdSe/ZnS-exposure increased the number of Vps10-GFP puncta and InP/ZnS-exposure decreased the number of puncta in each budding cell. Finally, our RNA-seq data identified hundreds of differentially expressed genes from exposure to our QDs. Altogether, we concluded that CdSe/ZnS and InP/ZnS QDs exhibit modest and unique cytotoxic effects on the budding yeast.

M. Zhang and K. Kim. Biology Department, Missouri State University. **Cd AND InP QUANTUM DOT'S IMPACTS ON ML-1 THYROID AND HELA CELLS AND THEIR INNER TRAFFICS.** The study of interaction of engineered nanoparticles, including quantum dots (QDs), with cellular constituents has provided new insights into the treatment of cancer. Although QDs are useful in many biomedical applications, their impacts on human cells are largely dependent on the size of and functional groups attached to QDs as well as the types of cells used. To address the potential harmful effects and transit routes of red and green CdSe/ZnS and InP/ZnS QDs, we explored late-stage ML-1 thyroid cancer and HeLa cells by measuring levels of cell viability, oxidative stress, and apoptosis. Our viability test revealed that HeLa cells had higher sensitivity to red and green CdSe/ZnS and InP/ZnS QDs, while no changes for ML-1 cells in viability were observed compared to the non-treated control (NTC). Both HeLa and ML-1 cancer cells showed no significant difference in production of superoxide compared to NTC.

Therefore, we concluded the significant reductions in cell viability of HeLa cells were not due to superoxide. For the future experiments, we will employ an apoptosis analysis to examine if the cell viability reduction is primarily due to cell apoptosis. To better understand the QD-mediated effects between different human cancer cell lines and QDs, the trafficking routes of QDs in ML-1 and HeLa cells will be observed using transfection and immunohistochemistry techniques.

R. Bruner and N. Sharma. Department of Biology and Environmental Health, Missouri Southern State University. **INHIBITORY POTENTIAL OF SORAFENIB ON PANCREATIC CANCER CELL LINE AsPC-1.** Pancreatic cancer is one of the deadliest cancers with very poor survival rates. Drug resistance is one of the main problems with pancreatic cancer. In spite of advancement in technology, there is still need for more efficient drug molecules for pancreatic cancer. In the present study, we have examined the effect of Sorafenib on the pancreatic cancer cell line AsPC-1, a standard human pancreatic cancer cell line for research. Using 96 well plates, we have examined the effect of different concentrations of drug on the cell viability of pancreatic cancer cells. We have observed that cell viability decreased with increasing concentration of the drug. We have further selected a 10 micromolar dose of drug to treat the cells for RNA isolation. RNA was extracted from the treated and control cells using Trizol method. cDNA was synthesized from RNA using reverse transcriptase. We have performed real-time PCR and are currently analyzing various genes involved in metastasis and cell death pathways.

M. Courtade, E. Bisotto and N. Sharma. Department of Biology and Environmental Health, Missouri Southern State University. **ANALYZING THE MOLECULAR TARGETS OF BEZ235- A PI3 KINASE INHIBITOR IN PROSTATE CANCER CELL LINE LNCap.** Prostate cancer is the most common type of non-skin cancer found in and it is the second leading cause of cancer death in men in Western societies. The PI3K (phosphoinositide 3-kinase)/mTOR (mammalian target of rapamycin)/AKT pathway is one of the main molecular pathways that is abruptly activated in prostate cancer. In the present study, we have analyzed the effect of BEZ235 on the growth on prostate cancer cell line LNCap by using XTT assay. We have found that 1 micromolar concentration of BEZ 235 was quite potent on LNCap cells. We have further treated the cells with BEZ235 and isolated RNA for quantitative gene expression analysis. BEZ 235 enhances the apoptosis of LNCap cells, as analyzed by apoptosis markers. We are further analyzing the expression of the genes involved in PI3 kinase pathways impacted by BEZ235.

CHEMISTRY SECTION

Oral Presentations:

M. Hadjian, Department of Chemistry, Truman State University. **IN VITRO EFFECTS OF SALINITY AND NORDIHYDROGUAIARETIC ACID ON AMYLOID-BETA 1-28 AGGREGATION.** Alzheimer's Disease is a neurodegenerative disorder ranked as the sixth leading cause of death in America. Molecular hallmarks of the disease include the formation of amyloidogenic plaques and tau protein fibrils. Recent literature has suggested that nordihydroguaiaretic acid (NA)—a polyphenol with potent antioxidant properties—may stifle the aggregation of amyloid-beta ($A\beta$) and serve in potential therapy. A monomerized sample of $A\beta$ 1-28, a truncated fragment of the full peptide, was incubated with 25 μ M NA. The aggregation of this treated sample was then monitored over the course of 14 days utilizing a Thioflavin T fluorescence assay and compared to untreated peptide. Similar analyses were performed for saline $A\beta$ 1-28 samples to speed up the rate of aggregation. Aggregation was significantly attenuated in all treated samples, with this effect being most profound in the non-saline sample (experiencing a total drop in maximum fluorescence intensity). Increasing sample salinity generally sped the rate of aggregation of $A\beta$ 1-28 and nullified the therapeutic effect of NA. This indicates that certain limitations to the therapeutic effect of NA are present at physiological conditions, warranting additional investigation.

V. Winkler, Department of Chemistry and Biochemistry, Truman State University. **THE EFFECT OF CURCUMIN ON THE FIBRIL FORMATION OF AMYLOID- β FRAGMENTS 1-16, 1-28, AND 1-40.** Alzheimer's disease involves the formation of interneuronal plaques that are heavily composed of fibrils of the 39-43 residue protein, amyloid- β ($A\beta$). Therefore, potential therapeutic measures have focused on disruption of $A\beta$ fibril aggregation. One such product is the polyphenol curcumin, found naturally in *Curcuma longa*; however, little is currently known about the quantitative efficacy of curcumin on $A\beta$ fibril formation or its mechanism of action. A fluorescence assay was utilized to determine the fibril formation over time of different $A\beta$ fragments, particularly 1-16, 1-28, and 1-40, as well as probe the effects of curcumin on fibril formation. While curcumin did not significantly affect formation of $A\beta$ 1-16 fibrils, there was an observed effect by curcumin on fibril formation for $A\beta$ 1-28 and $A\beta$ 1-40, suggesting that curcumin may affect $A\beta$ fibril formation within the peptide residue range of 17-40. However, the fluorescence of curcumin when bound to $A\beta$ was found to impact the methodological viability of fibril quantification, which shall be further analyzed. Future studies will also fixate on utilization of additional assays in order to better quantify this observed qualitative impact of curcumin on the rate of $A\beta$ fibril formation.

L. M. Kehoe, M. R. Sly, B. P. Salunkhe, T. J. Schuman, K. Woelk, Missouri University of Science and Technology. **CHEMICAL-SHIFT RESOLVED HIGH-RESOLUTION NUCLEAR MAGNETIC RESONANCE RELAXOMETRY OF POLYMER HYDROGELS.** Polymers are materials that derive their mechanical properties from the entanglement of their long molecular structures. Polymer gels are a special class of polymers formed by crosslinking the polymer chains or physically entangling them. A class of entangled polymer gels that is of particular interest for enhanced recovery of fossil fuels is polyacrylamide hydrogels. They receive their characterizing name "hydrogel" from the high water content they encumber when swollen with water. Due to the limited mobility of polymer chains, high-resolution 1D NMR spectra of polymer hydrogels often show broad resonance signals, providing limited information about the microscopic structure. On the contrary, the resolution of

longitudinal NMR relaxation times (T_1) can be used to probe into mechanical properties and microscopic environments around the NMR active nuclei. The simultaneous resolution of chemical shift and longitudinal relaxation time in two-dimensional contour plots provides a new NMR technique that makes it possible to obtain moiety-specific information about mobility, glass transition, and activation energy of motion in the targeted polymer gels. For example, chemical shift vs. T_1 time contour plots of polymer hydrogels show several distinct relaxation times for the water resonance at 4.5 ppm, indicating that water molecules are found in very different environments. A strong signal of long T_1 time (3.5 s) indicates that most water molecules have a mobility similar to free water, while a weaker signal at a shorter T_1 time (1.0 - 1.2 s) refers to water molecules with limited mobility, such as being bound to the polymer

A. Taushanzhi, K. Taushanzhi J. L. Hayes, State Fair Community College. **WATER CHEMISTRY OF CENTRAL MISSOURI (AND BEYOND) A GROWTH IN DATA ANALYSIS.** The change to remote learning has generated new learning strategies. State Fair Community College (SFCC) adopted a collaborative approach in which multiple individuals partook in weekly testing water utilizing an inexpensive pH meter, dual probe temperature and conductivity/water hardness and a commercial multi-test dip strips kit. The strips tested 14 other parameters besides pH and water hardness. Students analyzed tap water, bottled water, filtered tap water, aquarium water, surface water, and other water (mostly beverages). For 6 months nearly 100 first semester chemistry students collected and analyzed samples each week. The samples were collected from a large geographical region (from West Virginia to Hawaii) however the bulk of the samples were collected in Missouri. More than 1,800 samples were recorded on a cloud spreadsheet. The large data set (19 parameters per sample) was analyzed to seek trends and compare results between geographical regions and/or sample sources. Perhaps the most enlightening evaluation of the data comes from comparing the paired pH and water hardness values recorded.

J. Rhoad, D. Freeman, D. Morrow, S. Culver, J. Dorris, Department of Chemistry, Missouri Western State University. **STUDIES IN THE CONFORMATIONAL PREFERENCES OF FLEXIBLE MONOSACCHARIDES.** In our continuing efforts to better understand conformational preferences of flexible carbohydrate rings, we have compared coupling constants based on updated Karplus relationships with Boltzmann distribution from energy scan calculations at the B3LYP/6-311(d,p) level of theory with three-bond coupling constants that have been revealed at higher resolution (~ 0.1 Hz) using the proton NMR 2D J-resolved coupling experiment.

O. Sharifi, Department of Chemistry, Missouri Southern State University. **INDUCING APOPTOSIS ON CANCER CELL LINES VIA INHIBITION OF HIF-1 AND NADH-UBIQUINONE OXIDOREDUCTASE USING ACETOGENINS.** Cancer cells take in glucose at many times the rate of normal cells due to the Warburg effect and oxidative phosphorylation. One method of removing cancer cells has been by inhibiting ATP production by the cancer cell. The resulting effects range from reducing angiogenesis to inducing apoptosis. Methods of chemotherapy can fail in achieving this due to the P170- glycoprotein's contribution to drug resistance for the cancer cell. The goal for this experiment is to use literature from previous experiments to set the foundation for exploring different cancer cell lines which the class of polyketides known as acetogenins may be effective against, and open more routes in the exploration of the compound itself. Paw Paw twigs were collected in May of 2019 which was close to peak month for bioactivity. The plant material was shredded and dried in an oven at 40°C and ground. The dried plant materials was then repeatedly extracted with

ethanol/methanol. Using this processed crude compound, the brine shrimp lethality bioassay (BST) will be performed with aqueous methanol soluble fractions. The BST will be used to assess the cytotoxicity of the extracts. Further purification will be achieved via chromatography using a Sephadex column. The isolated compound will then enter the testing phase on cancer cells. Cancer cells will be treated with doses of extract (or pure compound), and cell growth as well as cell death will be monitored at different time points (24,48 & 72 hours). Gene expression of key molecules will be analyzed by real time PCR and Western blot.

B. Dhital, Department of Chemistry, Westminster College. **INTEGRATING COMPUTATIONAL CHEMISTRY INTO THE PHYSICAL CHEMISTRY CURRICULUM: CHALLENGES AND OPPORTUNITIES.** The field of computational chemistry has emerged into new capabilities due to recent advances in computational software and hardware, and students require a solid background in theoretical and practical aspects of computational chemistry. However, the limited access of computational facilities, the cost of hardware and software, and concerns about increasing the course material, it is often difficult to integrate into undergraduate physical chemistry curriculum. Nevertheless, increased number of inexpensive web-based computational platforms available to individual students facilitate the simple inclusion of computational modeling exercises into the modern undergraduate course. In this presentation, several free software and web-based computational platform available to provide an opportunity for undergraduate students to perform computational chemistry experiments without purchasing expensive software and their computational capabilities will be discussed. Additionally, several approaches that are important for integrating computational chemistry into curriculum for undergraduate students, including designing experiments, engaging and training students will be reviewed.

Castelblanco Riveros C. A.; Skelly E.; Matthews D. L.; Urbanek, M. T.; Nwanonyi, C. C.; Meziani, M. J Department of Natural Sciences, Department of Natural Sciences, Northwest Missouri State University. **EFFICIENT AND SIMPLE SYNTHESIS OF COMPOSITE RESIN INCORPORATING METAL AND MAGNETIC NANOPARTICLES.** An efficient route for the immobilization of silver and magnetic nanoparticles in anion exchange resin beads with different loading is proposed. Morphology and structure of the resulting resin nanocomposites were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), fourier transform infra-red (FTIR), and thermogravimetry analysis (TGA). The results confirmed the presence of smaller diameter metal NPs and Fe₃O₄ incorporated into the resin beads having an average diameter on the order of 10 nm with a few nanoclusters of 20-100 nm. The Ag-loaded resins were tested for antibacterial activity in vitro against Escherichia coli (E. coli) as a model microbial contaminant in water, and results showed excellent bacterial inhibition. The resin form offers greater ease of handling, long term storage at room temperature, reusability in repeated reactions, and reduces the risk of environmental contamination.

Poster Presentations:

C. C. Nwanonenyi, M. T. Urbanek, E. Skelly, C. A. Castelblanco Riveros, D. L. Matthews D. L.; Meziani, M. J. Department of Natural Sciences, Northwest Missouri State University, Maryville, Missouri. **HIGH-QUALITY BORON NITRIDE NANOSHEETS BY A SUPERCRITICAL FLUID EXFOLIATION.** Boron nitride nanosheets (BNNs) have attracted a great deal of attention in recent years for their being highly thermally conductive yet electrically insulating and their extreme thermal and chemical stabilities, excellent for many demanding thermal management and other applications. For such applications, high-quality BNNs that are thinner, larger in lateral dimension, and of less surface and edge defects are desired, yet their facile production still remains a significant challenge. Herein, we report a simple, rapid, and one-pot exfoliation using supercritical processing to produce high quality BNNs. Morphology and structure of the resulting BNNs were characterized by X-ray diffraction (XRD), scanning and Transmission electron microscope (SEM and TEM), fourier transform infra-red (FTIR), and thermogravimetry analysis (TGA).

A. Sorrell, Department of Chemistry, Central Methodist University. **DIET-INDUCED OBESITY, INFLAMMATION, AND ORGAN DAMAGE IN MICE.** Diet-induced obesity is a global concern that has a multitude of causes. Obesity also leads to a lot of comorbidities ranging from simple joint pain to heart problems to autoimmune diseases. Obesity is also known for causing chronic inflammation, which can cause our immune system to function improperly which directly ties into our current pandemic of COVID-19. It is important to see how obesity plays a role in the immune system of these patients. In this study we used lean and diet-induced obese mice tissues from a previous study to determine the protein expression of inflammation markers IL-1 α , IL-1 β , IL-6, and MMP-7 in the livers and kidneys. We also took a look at organ damage by immunohistochemistry to see how obesity affected different structures within the livers and kidneys. Results from IL-1 α and IL-6 were inconclusive, but IL-1 β and MMP-7 were successful at showing an increase in protein expression within the obese tissues of liver and kidney.

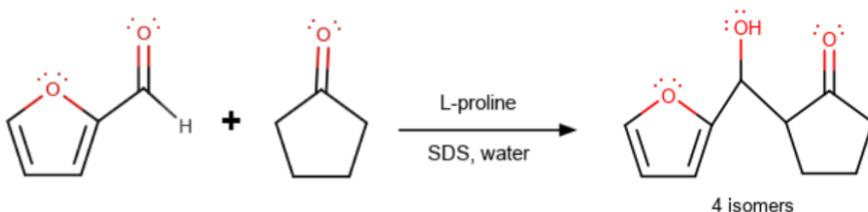
K. Thapa, S. Han, W. Liu, and R. Wang Department of Chemistry, Missouri University of Science and Technology. **EFFECT OF IMMOBILIZED METHYLENE BLUE ON THE DNA ORIGAMI AS ELECTRON CARRIERS IN MICROBIAL FUEL CELL.** Microbial fuel cells (MFCs) are biological fuel cells that can produce electricity using electrons produced during bacterial metabolism. Electrons generated are transported to the electrode either directly by microbes through cytochromes and nanowire structures or in an indirect way using redox-active electron mediators. Escherichia coli has often used bacteria in MFC and reported to have good performance, however, it uses the indirect method for electron transfer. It is found that E. coli can use Methylene Blue (MB) as an electron mediator bridge which carries the electrons to the electrode surface. Even though the electron mediators show good ability to increase the current production in MFCs, the low solubility, high toxicity, and difficulty in accessing the bacterial electron source, are still major bottlenecks in the practical application of MFCs. MB is one of the most promising electron mediators because of its good solubility and redox characteristics. But its electron transfer efficiency and biological incompatibility could still be improved. DNA origami, with its ability to self-assemble into programmable multidimensional structures, have shown promise as a carrier for small organic molecules like proteins and drugs and poses natural biocompatibility. Since MB can couple DNA bases through π - π -stacking, in this study MB were immobilized on 3D triangle DNA origami, and the effect of DNA origami as

electron mediator carriers in MFC is observed. The performance of MFCs with MB and MB/DNA origami complex treated electrodes were compared with controls using cyclic voltammetry, power density, and voltage output capability. Our results suggest that the DNA origami was effective in increasing the electron transfer efficiency and could be a very useful mechanism for scaling up the MFC capacity and application.

G. Tucker, K. Garrison, Department of Chemistry, College of the Ozarks.

ELECTROCHEMISTRY OF AN α -GALACTOSIDASE ENZYME-IMMOBILIZED CARBON PASTE ELECTRODE BIOSENSOR. This research presents progress made towards the development of an electrochemical biosensor to study the electrochemistry of the α -galactosidase enzyme, through immobilization of the enzyme upon the surface of various modified carbon paste electrodes (CPE's). The ability to monitor concentrations of α -galactosidase is important because of the enzyme's implications with regard to human health, as deficiency can result in the Lysosomal Storage Disorder Type II known as Fabry's disease. The α -galactosidase enzyme was studied after immobilization to the surface of a variety of CPE's, including plain CPE's, as well as those chemically modified with 10% wt/wt palladium on activated charcoal and copper (II) phthalocyanine. The CPE's fabricated were composed of graphite powder with mineral oil binder before the addition of the chemical modifiers. The sensitivity and selectivity of the CPE's were characterized using cyclic voltammetry. Two methods of enzyme immobilization were used in this study. The first is a 10-minute immersion of the electrode surface in a 5% α -galactosidase solution. The second method involves attachment of the enzyme to the electrode surface by covalently bonding protein residues present in the enzyme to either amine or carboxylic acid functional groups attached to the surface of the electrode through an aryl diazonium salt reduction.

F. Cooper, J. Eason, Department of Chemistry, College of the Ozarks. **ALDOL REACTION OF CYCLOPENTANONE AND FURFURAL CATALYZED BY L-PROLINE WITH GREEN STEREoselective METHOD.** Aldol reactions are an integral synthetic method for producing carbon-carbon bonds between aldehydes and aliphatic ketones. Furfural is a promising candidate for studying aromatic cross aldol addition reactions, because of its possible use in agricultural and pharmaceutical synthesis. The purpose of this study was to react furfural with cyclopentanone via an L-proline/water mediated catalyst and to determine the stereoselectivity of the reaction by NMR and computational molecular modeling analysis. A secondary goal was to complete the synthesis of the mono-substituted alkene dehydration product. A synthetic method has been proposed along with a method of purification and identification. Antibacterial analysis and reacting other ketones is also explored.



G. Wooden, Department of Chemistry, Missouri Southern State University. **SYNTHESIZING MODIFIED QUINOLINE IMIDAZOLE ANALOGUES.** Malaria is a parasitic disease that continues to be an important public health concern for developing countries where transmission regularly occurs. Antimalarial drug resistance is one of the greatest challenges to malaria control that has arisen within the 21st century. Synthesizing new compounds that are not subject to said resistance is critical to solve this problem. The work presented here involves a one-step process

to attach a imidazole head group to a quinoline ring. This work is a continuation of Jacqueline Ballay's work on an honors project. Prior work to synthesize simplified versions of reversed chloroquine analogues involved several steps and included a modified version of a known pharmacophore, that helped reverse chloroquine resistance. This work involves nucleophilic aromatic substitution via a benzyne intermediate, which should help the process to be more efficient. Attaching a library of different head groups to the same imidazoline ring will allow deployment of many different synthesis reactions. IR was used to analyze the compounds and product purity was checked using TLC.

CONSERVATION SECTION

Oral Presentations:

P. Klawinski, Department of Biology, William Jewell College. **COVID-19 MAY REDUCE ROADKILL IN MISSOURI.** The COVID-19 pandemic has altered the activity patterns of humans in ways that may be beneficial to wildlife in that reduced automobile traffic may reduce the number of wildlife killed on highways. In April of 2020, I began monitoring wildlife killed on Highway 210 between Liberty, MO, and Richmond, MO (26 miles) every other Sunday. All animals were identified to species (when possible) and removed from the road to avoid being counted twice. Roadkill levels were low during April and May, a time period which would normally see increased roadkill due to the movement of amphibians to breeding grounds and the increased movement of reptiles. Roadkill levels were highest during the summer and declined during the winter, as one might expect. The distribution of roadkill was non-random in space and correlated with habitat features that serve as movement corridors. Efforts were made to identify where animals were initially struck and the pattern of roadkill indicates that the majority of animals killed on roads are killed on the shoulder of the road, indicating that drivers may be purposefully leaving the driving lanes in order to kill animals that are in the process of crossing the road. Data from 2021 will reveal whether the low levels of roadkill early in the year are due to seasonality of roadkill or reduced travel patterns of humans in 2020.

A. Cozens, M. Perkins, T. Boman and R. Heth, Department of Biology and Environmental Health, Missouri Southern State University. **ESTABLISHING BASELINE LEVELS OF MICROPLASTICS IN BENTHIC SEDIMENT OF THE SPRING RIVER WATERSHED, MO.** Microplastic research is still novel and attempts to document microplastics in the environment. Microplastic research primarily focuses on marine and coastal environments with recent interest in freshwater systems. Further, freshwater microplastic research endeavors in the benthic zone are sparse in comparison to the water column. The goal of this study was to establish a baseline level of microplastics in benthic sediment of waterways within the Spring River Watershed of southwest Missouri. Sediment samples were collected from 16 different stream locations within the watershed between December 2020-January 2021. Sample locations were selected based on proximity to urban and non-urban areas. All samples were collected at stream baseflow conditions from riffle/run habitats. A validated two-step separation protocol was followed for collected sediment. Preliminary results of this study indicate microplastics are not a component of the benthic sediment of the Spring River Watershed. Future research will include the exploration of other validated methods to confirm study methodology and the collection of sediment samples from pool habitat.

T. Peternell, T. Boman, M. Perkins, and R. Heth, Department of Biology and Environmental Health, Missouri Southern State University. **DETERMINING MICROPLASTIC CONCENTRATIONS IN THE WATER COLUMN OF THE SPRING RIVER WATERSHED, MO.** Microplastics are an environmental issue of growing concern. Microplastics are commonly defined as any plastic particles 5 mm in diameter or less. Research on microplastics has heavily focused on marine environments. While some research has taken place in freshwater systems, it has primarily focused on large rivers or lakes. This study was conducted in the Spring River Watershed, MO, which is essentially a rural river system with approximately 9% area classified as urban/developed. The goal of this research was to establish baseline concentrations of microplastics within the water column of multiple stream types. Samples were collected at 16 separate stream locations within 10 sub-watersheds between

December 2020 and January 2021 at baseflow conditions. Microplastics were detected in all streams sampled with a total microplastic concentration ranging from 0.3-4.8 particles m⁻³. The most abundant microplastics types found in samples were characterized as fibers and fragments. These made up 79.5% and 19.9% of all microplastic particles, respectively. These results indicated no relationship existed between microplastic concentration and catchment size or land use. Microplastic pollution exists in small, rural waterways, but the mechanisms behind microplastic concentration variation are still unknown.

Poster Presentations:

J. Brooks¹, D. Duvernell¹, and L. Berkman², ¹Department of Biological Sciences, Missouri University of Science and Technology, ²Missouri Department of Conservation. **POPULATION GENETICS OF MISSOURI TOPEKA SHINERS (*NOTROPIS TOPEKA*)**. Topeka Shiners (*Notropis topeka*) are a federally endangered fish species that remains in 2 watersheds in Missouri: Sugar Creek and Moniteau. Fish were taken from each population and propagated in the Neosho National Fish Hatchery (NFH) and the Lost Valley Fish Hatchery (LVFH). Both hatcheries have been used for supplementing remnant populations and also for establishment of Nonessential Experimental Populations under the Endangered Species Act. Genetic analysis was used to determine: (1) If the two geographically distinct populations, Moniteau and Sugar Creek, were also genetically distinct and (2) if genetic diversity and composition had changed over generations in the hatchery. For this study, 285 samples were taken from LVFH and 115 samples were taken from NFH. LVFH samples constitute four groups: Moniteau-strain hatchery-grown, wild Moniteau-strain, their offspring, and Sugar Creek-strain hatchery-grown. Genetic analysis with microsatellites was processed through Genetix and revealed differences among hatchery stocks and among wild and hatchery fish. Further analysis will determine breeding structure within the hatchery and possible changes across hatchery generations given the size of holdover populations. Wild Moniteau-strain Topeka shiners were distinct from Hatchery Sugar Creek-strain Topeka shiners. Moniteau-strain hatchery fish had lost some of their distinctiveness from the Sugar Creek-strain, but some of the distinctiveness was restored by interbreeding with wild Moniteau-strain fish introduced into the hatchery population.

GEOGRAPHY SECTION

Poster Presentations:

S. Tesfaye and A. Dudenhoeffer, Department of Agricultural, Environmental, and Human Sciences, Lincoln University. **MAPPING THE PATH OF THE MAY 22, 2019 ELDON-JEFFERSON CITY TORNADO USING GIS PRINCIPAL COMPONENT ANALYSIS.** On the evening of May 22, 2019, an EF-3 tornado with 160 mph winds struck central Missouri causing considerable damage. Moderate resolution satellite imagery (Sentinel 2 and Landsat OLI) were used to identify and map the extent of the tornado's path. Of the two satellite imageries utilized the 20m spatial resolution, 6 spectral band (red edge-near infrared-mid infrared) Sentinel 2 imagery was found to be very informative. Of the different image processing techniques applied, principal component analysis (PCA) was the most revealing. Neither the higher (10m) nor lower (60m) spatial resolution Sentinel 2 imagery were helpful in identifying the path of the tornado. Landsat 8 OLI's 7-spectral bands with 30m spatial resolution (minus the cirrus band) failed to reveal or capture the path of the tornado. The Northeast trending tornado path--evident on the false color composite image generated from PCA (Sentinel 2, 20m)--starts in Eldon and ends in Jefferson City, Missouri with a total length of ~27.3 miles and width ranging from 35 to 400 meters.

GEOLOGY & GEOSCIENCES SECTION

Poster Presentations:

D. DeHart and D. Gouzie. Department of Geology, Geography, and Planning, Missouri State University. **TEMPERATURE AND DISCHARGE MONITORING OF SPRINGS IN THE SPRINGFIELD PLATEAU, MISSOURI.** The goal of this project is to investigate the correlation between discharge and drainage basin area with the hope of being able to create a simple equation relating the average discharge from a spring, to the drainage area feeding that spring. This is helpful in the event of a pollution event occurring within a spring and land managers wondering where the pollution may have come from and can travel to. We will be using the equation $Q=KA^C$, to estimate discharge, (“Q”) in ft³/sec. We will be graphing upstream drainage areas (“A”), against baseflow (“Q”), and plotting each spring on the graph. We hope to find a good line of correlation. If there is a good line of best-fit, the slope of that line will equal our (“K”) factor within the full equation. This equation has been used in various other hydrologic studies and practices to estimate discharge amounts in various locations (Galster & Pazzaglia & etc., 2006). Initial data shows that baseline flow for Doling Park and Jones Spring Cave are 4ft³/sec for Doling Park, and 7.2ft³/sec for Jones Spring. Doling Park has shown it is much more radical and has little relation in temperature trends to Jones Spring. This data so far gives us some insight on the similarities and differences between 2 of our locations.

R. Gomez and M. Gutierrez. Department of Geology, Geography, and Planning, Missouri State University. **WATER QUALITY ANALYSIS OF THE SPRINGFIELD PLATEAU AQUIFER.** The Springfield Plateau groundwater province is an aquifer that runs through southwestern Missouri and parts of Oklahoma and Arkansas. It overlies the Ozark confining unit and is mainly recharged by precipitation. This karst aquifer is unconfined, which makes it vulnerable to waste contaminants from animals or other surface activities, that can percolate through the soil and fractured limestone. Little research has been reported on this aquifer since it is not used for drinking supply or irrigation. There are karst features that have form, such as springs that feed into streams that sustain the nearby biota The objective of this study is to evaluate the ground water quality through analysis of the nitrates and selected major ions in samples collected from springs and streams in Polk county Missouri. I will be collecting about 40 samples and will analyze for pH, alkalinity, turbidity, sulfate, chloride, and nitrate. The results will show the extent of contamination of groundwater (springs) and their impact to receiving streams. Also, since I will be collecting samples at intervals of 1-2 months, I will determine seasonal changes in water quality.

PHYSICS & ENGINEERING SECTION

Poster Presentations:

S. Longworth, Department of Chemistry, Missouri State University. **SEARCH FOR – AND GROWTH OF – ATOMIC-CAGE THERMOELECTRICS.** We are growing zinc-rich atomic-cage materials in order to discover novel thermoelectrics. Thermoelectric materials convert thermal energy directly into electrical energy by utilizing the Seebeck effect, wherein a voltage is generated by a thermal gradient. Thermoelectrics are particularly useful in that they can be used to harness waste heat generated in the production and consumption of other energy processes. The cage structure of the material, comprising heavy ions “rattling” within void spaces of the crystal, allows for an increase in the thermoelectric efficiency of the material by interfering with heat conduction via lattice vibrations and allowing for conduction via electrons. Crystals are grown in alumina crucibles that are vacuum-sealed in quartz ampoules using excess zinc as a self-flux; the composition and structure of prepared crystals is investigated using energy dispersive spectroscopy (EDS) and single-crystal x-ray diffraction (XRD). We have successfully grown four new materials: $\text{NbCu}_2\text{Zn}_{20}$, $\text{NdZn}_{11-x}\text{Cu}_x$, $\text{Gd}_2\text{Zn}_{17-x}\text{Cu}_x$, and $\text{YbZn}_{11-x}\text{Cu}_x$ with atomic cage structures that are promising candidates for thermoelectricity. Crystals of these materials will be sent to the National High Magnetic Field Laboratory in Tallahassee, FL to be tested for thermoelectric properties. Supported by Missouri State University and NASA Missouri Space Grant Consortium.

B. Mason, R. Smith, T. Valdez, W. Trail, T. Stein, Department of Chemistry and Physics, Southwestern Oklahoma State University, **A STUDY OF FIN SHAPE ON 3D PRINTED ROCKETS.** High-power model rockets can travel at speeds of more than 1,000 miles per hour. Their flight characteristics are heavily dependent on the design of the fins, yet most are very simplistic, or inefficient copies from their larger counterparts. In this study we will carry out a systematic exploration of fin design using a 3D printer to build complete rockets that differ only in fin shape. We are going to start by varying the leading-edge shape of each fin on four similar 3D printed rockets. We will fly them with the exact same amount of propellant. We will be using an Arduino microcontroller connected to accelerometers to gain data on each flight that we can then analyze and interpret.

R. Hiner, W. Trail, Department of Chemistry and Physics, Southwestern Oklahoma State University, **LAUNCHING DROSOPHILA MELANOGASTER IN HIGH POWER ROCKETS.** We are exploring the effects of large short accelerations on the foraging behavior of fruit flies through the use of high power rocketry with accelerations as large as 50g or more. These accelerations, which last up to several seconds, are dependent on the motor type and characteristics of the rocket, and are easily measured and modeled. Three containers carrying approximately 20 fruit flies each were flown in a high powered rocket. Their survivorship was then determined and they were subjected to a typical foraging behavior experiment where they chose between higher and lower concentrations of sucrose solution. The survivorship and ability to choose the higher solution of sucrose was not significantly different to controls in both the lab and field.

R. Horn, Department of Chemistry and Physics, Southwestern Oklahoma State University, **FLUIDIZED BED.** A fluidized bed is a tool used to produce the physical phenomenon known as fluidization. Fluidization is the process by which a fluid, such as highly compressed air, is

passed through a granulated solid such as sand or fine glass beads, which lowers the average density of the aggregate causing it to possess the behavioral properties of a liquid. Fluidized beds are typically used in industrial settings, however ours will be used for outreach and experimental purposes. This project will be large enough to provide a great hands-on learning opportunity, while still being small enough to be approachable for high school students attending SWOSU's Physics Day events. We hope that providing involved, hands-on activities and experiments will spark an interest in STEM programs that many high school students may not have been exposed to. In the future, we hope to conduct experiments testing things such as the buoyancy force of various objects, the effect of using different substrates in the bed, and other ideas yet to be determined.

SCIENCE EDUCATION SECTION

Oral Presentations:

B. Hinrichs, C. Allen, and J. Adams. Department of Physics, Drury University. **STUDENT UNDERSTANDING OF ENERGY OF DIFFERENT SYSTEMS: COMPARING MODELING WITH TYPICAL INSTRUCTION.** A major goal of physics education research is to improve student comprehension. A group of physics education researchers from the University of Washington attempted to increase comprehension on the subject of energy and systems by using tutorial-based education. However, by their own metrics, they failed. The purpose of our research was to determine if a continuous, explicit focus on systems and models in the classroom would improve student comprehension of energy and systems. We gave the same simple pendulum problem used by the University of Washington researchers to assess their students to several classes at Drury. The problem asked what the change in the total energy was for two systems: one that included the pendulum alone, and one that included both the pendulum and the Earth. Three Drury classes were taught energy and systems in an interactively-engaged classroom implementing a more traditional curriculum. Three other Drury classes were taught using University Modeling Instruction (UMI), which has an explicit focus on systems and models. Two out of three of the UMI classes passed the Washington group metric, while zero Drury control and zero Washington group classes passed said metric. These results and their implications will be the subject of this oral presentation. This research was supported by the Drury Society of Physics Students.

D. Morrone. Department of Basic Sciences, University of Health Sciences and Pharmacy in St. Louis. **STUDENT DESIGN AND TESTING OF FLUORESCENT-DHFR FUSION ENZYMES AS A VISUAL LEARNING TOOL IN BIOCHEMISTRY LABS.** Biochemistry lab experiments may often seem to students like abstract exercises in mixing clear solutions of small volumes. The fact that most enzymes and proteins in solution are colorless contributes the lack of intuitive understanding and visual cues in some biochemistry experiments. However, many studies have shown that adding a visual component to the learning process improves understanding and comprehension of the material. As a result, we had students engage in a guided-inquiry exercise whereby they were challenged to make visually detectable fusion enzymes for a biochemistry lab. Visually detectable enzymes allow students to monitor the expression, cell lysis, and chromatographic purification of their target protein. In essence, students would now have a visual tag to see where their protein is located in test tubes or on chromatography columns. Students undertook an exercise to design various fluorescent protein fusions with dihydrofolate reductase (DHFR), an enzyme found in all studied organisms that supports nucleic acid synthesis. These engineered DHFR fusion enzymes exhibit very high expression, remain soluble and stable for many weeks, are visible in ambient light and are not biochemically compromised in their activity. Further, these colored fusion enzymes can be used for inhibition studies to investigate molecules for antimicrobial or therapeutic potential. Students who use these visually traceable enzymes demonstrate learning gains on assessments as well. We report on the development, characterization, and usage of these novel visible enzyme fusions that make excellent learning tools in biochemistry labs.

G. Bhattacharyya. Department of Chemistry, Missouri State University. **JUDGING GENERALIZABILITY USING “EXPERIENCE CONGRUENCE”**. Though instructors at all levels are encouraged to use evidence-based practices, judging the applicability of published research results to one’s own context remains a major challenge. Inevitably, faculty often focus on the differences in demographic characteristics between the students in their academic context to those of the students where the data were collected. This presentation reports the results of a survey of 1326 students from three introductory-level, first-year chemistry courses (a total of ten sections with ten different instructors) at two universities with significantly different student populations. The survey asked students to choose the hardest and easiest from five groups of topics typically taught in first-year chemistry courses. Remarkably, when separated by lecture section, overlaid frequency plots of students’ choices of hardest topic revealed a singular pattern. The trend transcended universities, courses, textbooks, instructors, and demographics. The only common parameter between the samples was the chemistry topics they learned. The correspondence in content, as such, constituted an “experience congruence”. Based on these data, I propose that instructors might consider experience congruence – in lieu of sample or population characteristics – as a criterion for judging the generalizability of educational data.

Poster Presentation:

M. McGregor. CSAFE, Iowa State University. **FIREARM AND TOOLMARK SOPs ASSESSED TO DETERMINE VARIETY IN FORENSIC LABORATORIES**. This study aims to show a small sample of labs from across the United States and their SOP requirements of firearm and toolmark examiners and how they differ from proposed OSAC standards. The 2009 NAS report Strengthening Forensic Science in the United States: A Path Forward called for improvement in quality assurance standards in forensic science over a decade ago, showing a need for better SOPs in laboratories across the United States. 15 laboratories were selected for the study and 5 areas were determined for focus. These areas included examination of bullets, firearms, cartridges, toolmarks, and tools. Firearm examination was most similar to proposed guidelines at 95% of requirements being met. L4 had an SOP with all requirements met in comparison to proposed standards. L9 had 17 total differences from proposed standards, while most labs averaged 6 differences. The 15 labs had 89 differences from the proposed standards. Quality and standardization of lab manuals can help ensure equal justice served across the United States and support examiners while testifying in court. Some sort of standardization is important to ensure common practice, especially since overall laws across the states tend to be similar. The recommendation, like that of the 2009 NAS report, is that firearm and toolmark SOPs be improved to include more detailed description of the examination processes since no current published standard seems to exist between labs in the United States.

SOCIAL AND BEHAVIORAL SCIENCES SECTION

Oral Presentations:

C.E. Boston¹, M. Brooks¹, J. Peterson², and T. Spencer³, ¹Department of Social and Behavioral Science, Lincoln University, ²Missouri State Museum, ³Department of Science, Math, & Technology, Lincoln University. **PRELIMINARY FINDINGS OF CERAMIC ANALYSES FROM THE DON CARLOS SITE.** Ceramic analyses provide archaeologists multiple means of studying the past to gain insights about prehistoric and historic people and cultures. One purpose for studying ceramics is to distinguish the identity of users and makers of ceramics, including gaining insights into the users' socioeconomic status. This is particularly pertinent to historical archaeological analyses where documentation of ceramic types and costs to consumers are readily available through multiple historic sources. This presentation will provide the preliminary findings of the ceramic analyses as they relate to socioeconomic status of the Don Carlos family who were an early pioneer family to mid-Missouri. Ceramic artifacts collected from their second home, located outside of modern-day Prairie Home, Missouri, were analyzed for ceramic type, form, and use to determine socioeconomic status. The results demonstrate that the family led a lower middle class lifestyle, which may or may not be accurately reflective of their social standing in their community. Issues concerning ceramic analyses based on the available comparable data sets and use wear and disposal of utilitarian items will be addressed as it pertains to results interpretation. These results will fill in gaps in the historical record about the Don Carlos family and resource availability and use concerning ceramics in the area.

M. Unnvik, Department of Psychology, Central Methodist University. **THE EFFECTS OF DISGUST ON POLITICAL ORIENTATION.** This study examines the relationship between disgust, personality, and political orientation. The object of the study is to explore the factors that predict what political ideologies people will adhere to, and how the primary emotion disgust affects self-reported political beliefs and behavior, controlling for regional and demographic factors such as gender and ethnicity. An ethnically diverse group of 383 participants (72% male) was recruited through Amazon Mechanical Turk. They first took Politeness and Orderliness scales and a disgust sensitivity scale, and then half of them were shown disgusting images in the disgust salience condition. Finally, the participants took four political ideology scales and were asked about their voting behavior and party affiliation. Based on substantial theoretical and empirical support from the literature, the predicted relationship between disgust sensitivity and political orientation was that higher disgust sensitivity would be associated with higher conservatism; the expected effect of the disgust salience of the experimental condition was that those who are high in disgust sensitivity would have an amplified adherence to conservatism. [The results are under review and will be reported at the conference].

A. Carrasco, Department of Psychology, Central Methodist University. **AUDIO LEVEL VARIATION EFFECTS ON SUSCEPTIBILITY TO THE MCGURK EFFECT.** Previous studies have established that seeing lip movement can influence the perception of speech sounds (the McGurk effect) and recent research has demonstrated that the addition of visual text (e.g. subtitles) reduces susceptibility to the McGurk effect when visual and auditory cues are incongruent. The present study examines the effect of varying audio levels (i.e. volume) on susceptibility to the McGurk effect among college students. Participants are assigned to quiet (45 dB) normal (60 dB) or loud (75 dB) audio conditions and asked to indicate the sound they hear during trials using incongruent (i.e. /ba/ sound and /ga/ lip movement) auditory and visual stimuli. It is hypothesized that the louder the audio during the presentation, the fewer errors

participants will make in correctly identifying speech sounds and that the quieter the audio the more susceptible participants will be to the McGurk effect. Data collection is ongoing and study results will be presented at the conference. Results of this study may have implications for volume settings for oral presentations as well as for media enjoyment.

A. Powell, Department of Psychology, College of the Ozarks. **PTSD, YOGA, AND TELEHEALTH.** In light of the recent pandemic, mental health and healthcare transitioning to more telehealth based options can contribute to client wellbeing. Previous studies have explored the efficacy of yoga-based interventions for the treatment of PTSD symptoms. In this study, I plan to examine the relationship between yoga-based telehealth interventions in the reduction of PTSD symptoms. This intervention will be contrasted with a control group (n = 20) engaging in non-telehealth, yoga-based interventions for the reduction of PTSD symptoms. Subjects will be enlisted from Veteran Affairs “Vet Centers,” police precincts, and fire stations in Southwest Missouri. These subjects will be screened for PTSD symptoms; 40 will be selected from this group with mild to severe symptoms of PTSD. This group will then be split into the telehealth yoga intervention (TYI; x = 20) and the control, a non-telehealth yoga intervention (NTYI; n = 20). The intervention will be a 20 minute session of hatha yoga with an additional 5 minute savasana 3 times a week for 6 weeks. Breath work, mindfulness and bodily awareness as engaged in yoga will be encouraged. In this quasi-experiment, we will measure client’s anxiety, depression, connection to self and others, and PTSD symptoms through subjective scales and commentary, as well as salivary cortisol. This study could shape future treatments for individuals with PTSD as telehealth interventions become more common.

M. Akers, Department of Psychology, College of the Ozarks. **MASKING: NORMATIVE OR INFORMATIONAL INFLUENCE?** As masks are now a part of the “new normal,” I will test the influences that are in action and see why people are wearing masks. Are they genuinely worried about the pandemic? Or are they being pressured by normative or informational influences? I will test to see which the more influential influencer is. For those wearing masks, are they doing this because they assume that those who are advocating masks know better than them, so they are wearing the mask because they believe in their effectiveness, even though they may not properly take care of their masks (informational influence)? Or are they under normative influence and don’t want to be perceived as different or irresponsible because they do not want to wear a mask and they believe that masking is pointless, so they are publicly complying? This will be tested through a survey on a private college campus. Factors to account for include possible strict rules by campus, city, or state, and enforcement of such rules. The survey will ask the participants a forced choice question to assess the normative and informational social influences in effect. The survey will then ask what percentage of the time (i.e., 20%) the participants wear their masks, and what percentage of the time they wear their masks correctly.

B. Jurgensmeyer, Department of Psychology, College of the Ozarks. **MEASURING PERCEIVED INFLUENCE OF GROUP ATTITUDES ON INDIVIDUAL SELF-DISCLOSURE TO SOCIAL GROUP.** Why do certain group attitudes influence an individual’s decision to either self-censor or self-disclose personal information? Attitudes are global evaluations one toward different issues. The purpose of this research will be to analyze the attitudes of various college social groups and how that impacts how an individual communicates about personal struggles. For this study, self-censorship is defined as the decision to not express sensitive personal information that conflicts with a general attitude of one’s social circle. Self-disclosure is the sharing of sensitive information to one’s social circle. This study will measure the perceptions of individuals towards their friend groups and whether they choose to self-censor

or self-disclose to the group. A survey will be used that measures external traits of the social group (e.g. Gender, ethnicity, age, size), internal traits of social group (e.g. beliefs, values, and attitudes, perceived level of closeness), and willingness to self-disclose to friend group. The survey will be given to college students enrolled in a psychology course. It is hypothesized that participants who perceive their social circle to have differing attitudes on sensitive issues than that of the participant will have higher levels of self-censorship than self-disclosure.

R. Powers, Department of Psychology, College of the Ozarks. **THE BENEFITS OF ANIMALS ON PROSOCIAL BEHAVIOR ON CHILDREN WHO HAVE EXPERIENCED TRAUMA.** This study explores how working with animals promotes prosocial behavior in adolescents who have experienced trauma. Prosocial behavior is any behavior that is done voluntarily with the intention of benefiting others. Working with animals in this study will be anything from reading and talking to the animal, to feeding and taking care of them, interacting with the animal in some capacity. The hypothesis that adolescent prosocial behavior will increase based on involvement with animals will be explored on the campus at a residential adolescent youth facility in Southwest Missouri. The youth will be assigned to two groups for three weeks: one with no animal involvement and one group directly involved in the care of the animals. Both groups will complete the Prosocialness Scale for Adults (PSA) at the beginning of the experiment and at the end. Results will be computed by comparing the pre and post scores and the difference between the two groups.

K. Peters, Department of Psychology, College of the Ozarks. **SOCIAL MEDIA AND ITS IMPACT ON ADOLESCENTS' SELF.** Adolescents' emerging self-understanding and self-knowledge are impacted through many different facets of their life. In the past 20 years, the rise of social media has changed the environment that children grow up in. Technology allows people to easily and constantly connect with peers and other people all around the world. Media also allows for information to be spread quickly and travel further than it previously could. Understanding how social media impacts an adolescent's self-concept will enable people to be better equipped to understand themselves and the future generations. The study would be conducted with 2 groups of adolescents with an age range of 13-17. Each group will take the Rosenberg Self-Esteem Scale as well as Allan and Gilbert's Social Comparison Scale to determine their beginning self-esteem scores and their tendency to compare themselves to others. One group will then be asked to post and be actively involved on their personal social media profiles for 3 months while the other group will be limited to 1 hour of social media time per day for 3 months. After time has passed, the adolescents will take the same surveys to see if there is any change in their scores. Their scores will be compared with their pre-experiment survey scores to determine any change that happened.

B. Martin, Department of Psychology, College of the Ozarks. **THE EFFECT OF SOCIOECONOMIC STATUS ON ATTACHMENT.** This research study will examine if socioeconomic status relates to attachment. Studies show the stress of poverty may adversely affect parenting techniques. For this study, I will select 45 children from different socioeconomic backgrounds and test their attachment styles. I will request permission from parents at a local daycare for participation in the study. When I speak to parents, I will include information and a consent form for them to sign for their child and themselves. The strange situation procedure will be used to measure the forms of attachment in each child. There will also be a measurement of socioeconomic status. The system used for measuring the socioeconomic status will be based upon the income of the parents. I will give a brief survey to the parent/guardian asking their annual income. The categories will be, 20,000 or below, between 20,000 and 30,000, and so on.

E. St. John, Department of Psychology, College of the Ozarks. **EFFECT OF THE LEVEL OF STEREOTYPE THREAT ON INTERRACIAL INTERACTION.** The study tests the impact of stereotype threat on students' responses to a video on racism from a person of color and from a white person. A group of 30 volunteers from an Introduction to Psychology class will be split into 2 groups of 15. Both groups will be emailed a stigma consciousness questionnaire to measure how much they feel racial stigmas impact them. One group will be emailed a video on race with a speaker of color, the other will be sent a video on race with a White speaker. After watching the video, the participants will fill out a social identities and attitudes scale (SIAS). The next week, the groups will be emailed the video opposite of the week prior and fill out the same questionnaires. The two sets of SIAS scores will be tested for differences relative to the videos watched.

J. Yelton, School of Social Sciences and Languages, University of Central Missouri. **LESLIE SPIER IN THE PACIFIC: REMNANTS OF A FAILED ANTHROPOLOGICAL EXPEDITION.** This paper is part of a research project on the importance of a family of Boasian anthropologists, the Spiers. Leslie Spier (1893-1961) was one of Franz Boas' students, an exemplary ethnologist with a material-culture focus. Spier attempted a research expedition to the Gilbert and Ellice Islands (Kiribati and Tuvalu) in 1929. Originally envisioned as a 10-12 month study, Spier instead spent only a few weeks at Suva and Levuka in Fiji and neighboring islands. The reason for the project's failure is unclear. Spier never published anything related to trip, and the trip is nearly invisible in the published history of Boasian fieldwork. The McClure Archives and University Museum, University of Central Missouri, had become the repository of most of the Spier family papers, which include Leslie Spier's annotated Pacific maps, photographs, associated records, and ethnographic items that he collected. From these, we can argue that he saw the islands as a place where he could document historic diffusion patterns among three cultural areas—Melanesia, Micronesia, and Polynesia. His preparatory work at Fiji reveals an interest in what he would have considered as types of houses, boats, and fishing equipment that reflected cultural-area origin. The ethnographic items also reflect what he must have seen as cultural types: Fijian kava bowls and associated coconut-shell cups, decorated tapa cloth, examples of basketry, and various tools.

Poster Presentations:

E. Clary, M. Csongradi, and L. Wilson, Department of Psychology, Central Methodist University. **THE EFFECT OF RACE ON JUROR'S DEATH PENALTY SENTENCING.** Unfortunately, the 13th Amendment and the abolition of slavery didn't mean the end of systemic racism. Our study was intended to reexamine a specific but crucial segment of this complex problem, which is the role of race in the criminal justice system. We wanted to know how race affects juror's decision making regarding the death penalty in 2021, after recent events. Our participants are undergraduate students attending a small, midwestern university. Participants will be randomly assigned to one of three groups. Each group will receive the same information about the defendant, such as height, age, weight, body type, and details of the crime committed. Group one will be informed that their defendant is African-American. Group two will be informed that their defendant is White. The third group will not be informed of the defendant's race. Our hypothesis is that if the defendant is African-American, the participant-jurors will be more likely to recommend the death penalty. Data collection is planned and results of our study will be presented at the conference.

A. Brooks, Department of Psychology, College of the Ozarks. **ENNEAGRAM AND HUMOR PRODUCTION.** The Enneagram Personality Test has become wildly popular not only within the realm of psychology but also throughout the media as well. In this study, we attempted to measure how humorous people were predicted to be based off of the Enneagram number they scored. We assumed that Type 7: The Enthusiast would score the highest in humor productivity based upon the extroverted tendency these people typically have. Type 2: The Helper was hypothesized to have the lowest humor productivity based upon their willingness to serve others and turn the spotlight on others instead of themselves. A self-survey was given to 74 undergraduate students who were given extra credit as an incentive. The self-survey measured Enneagram type across humor productivity questions. ANOVA revealed no significance in how many times someone makes others laugh per day measured across their Enneagram type. Those who made people laugh more were Type 7: The Enthusiast, while those least likely to make people laugh were on average Type 5: The Investigator. Chi-square revealed a significant relationship between Enneagram type and students feeling like they are the source of entertainment in their friend group. Type 7: The Enthusiast and Type 8: The Challenger rated themselves highest whereas Type 3: The Achiever rated themselves the lowest. Participants were also asked how strongly they identified with their Enneagram type and how many times they made others laugh per day. Pearson's correlation revealed no relationship between these factors.

A. Brooks, Department of Psychology, College of the Ozarks. **ALTRUISM AND ATTRACTION.** One aspect of positive prosocial behaviors is altruism—behaving in a way that benefits others without any expectation of reciprocity. A few skeptics criticize altruistic behavior being possible for humans to accomplish, as many times there is gratification in giving or doing something kind. Thus, gratification cancels out altruism because the person feels good when giving. However, doing something kind for someone and then feeling satisfaction about doing so is good to promote and not criticize. It is said, “that which is beautiful, is good” so perhaps attraction or aesthetically good things induce positive behavior. The current study will examine if attractiveness affects altruism. For the purpose of this research, attractiveness will be defined as a general sense of aesthetically pleasing versus unattractive or disgust. Thirty participants will be recruited from introduction to psychology course randomly selected (with extra credit incentive) to take the altruism self-survey at the beginning of a week. Later in the week group 1 will come back to see a PowerPoint slideshow of ‘attractive pictures,’ these images resemble that of which is beautiful. Group 2 will be shown a slideshow of things that resemble ‘disgust.’ The control group will just take the self-survey without any stimuli. All three groups will take the self-survey twice. The group that sees the images of attraction will score higher on their altruism self-survey compared to their initial score. The group seeing the images of disgust will score lower compared to the first survey. The control group is expected to remain consistent. The pre and post test scores for each group will be compared and the between group scores will be compared.

C. Woody, Department of Psychology, **THE EFFECTS OF SOCIAL MEDIA ON ONE'S PSYCHOLOGICAL ENTITLEMENT.** Social media is a very prevalent pastime in today's culture. While it can seem like a healthy activity, it can decrease one's subjective well-being the more it is used. There are many possible causes for this, and a sense of psychological entitlement is one of those. Entitlement is defined as the extent to which someone believes they deserve something. The question of this study is how much social media affects our psychological entitlement. This increase in entitlement could be caused by advertisements fostering the notion that we deserve more than we have. Additionally, it could be caused by seeing pictures of people, or hearing of people, in more desirable situations than our own and us believing we

deserve the same thing. I believe that the more time that is spent on social media, the more a person's psychological entitlement level will increase. Inversely, the less time someone spends on social media, the lower that person's level of psychological entitlement will be. Before doing an experiment, a correlation study will be conducted to see if there is a possibility of this relationship. About thirty subjects will record how much time they spend on social media per day over the course of one week. Then, the subjects will complete the Psychological Entitlement Scale (PES). These two modes of data will be compared to see if a correlation exists.