
# 60th Annual Meeting

## Missouri Southern State University

## April 21-22, 2023

# Table of Contents

# General Information

**Schedule of Events and Locations**

| Time | Event | Location |
|---|---|---|
| **Friday** | | |
| 7:00 – 8:30 PM | MAS Social | North End Zone (NEZ 205) |
| **Saturday** | | |
| 8:00 – 9:00 AM | Onsite Registration and Poster Set-up | Reynolds Hall Lobby |
| 9:00 – 9:45 AM | In-Person Poster Session A | Reynolds Hall/Nixon Hall |
| 9:45 – 10:30 AM | In-Person Poster Session B | Reynolds Hall/Nixon Hall |
| 10:45- 11:45 AM | Keynote Speaker, Chad Pregracke, Founder of Living Lands and Waters | Taylor Performing Arts Center |
| 11:45 – 1:00 PM | Meet with the Speaker and Lunch | MSSU Dining Hall or Other |
| 1:00- 1:30 PM | Business Meeting (all welcome to attend) | Reynolds Hall 111 |
| 1:30 – 4:30 PM | Oral Presentations | See Section programs below |

**Oral and Poster Presentation Rooms and Areas**

| | Oral | Poster |
|---|---|---|
| Agriculture | Nixon 210 | Nixon 210 |
| Atmospheric Sciences | Reynolds 235 | ----- |
| Biochemistry/Biomedicine/Biotechnology | Reynolds 317 | Reynolds 3rd Floor |
| Biology | Reynolds 111 | Reynolds 1st Floor |
| Chemistry | Reynolds 315 | Reynolds 3rd Floor |
| Computer Science & Math | Nixon 211 | ----- |
| Conservation | Reynolds 225 | Nixon 2nd Floor |
| Geography | ----- | Nixon 1st Floor |
| Geology and Geosciences | Reynolds 325 | Nixon 2nd Floor |
| Physics & Engineering | Reynolds 325 | Nixon 1st Floor |
| Science Education | Reynolds 306 | Nixon 1st Floor |
| Social & Behavioral Science | Reynolds 204 | Nixon 1St Floor |

**Letter from the MAS President**

On behalf of the Missouri Academy of Science (MAS) and Missouri Southern State University (MSSU), I would like to welcome you to the 60th Annual Meeting in Joplin! MAS was founded in 1934 to serve as a regional outlet for a broad range of scholarship. We welcome poster and oral presentations in agriculture, atmospheric science, biochemistry, biomedicine, biotechnology, biology, chemistry, computer science, mathematics, conservation, geography, geology, geosciences, physics, engineering, science education, and social and behavioral sciences. In addition to presentations by academic and professional scientists, we are particularly proud of the findings communicated by undergraduate and graduate students. Thank you all for supporting the MAS by sharing your work with the broader scientific community in our region.

Our meeting opens on Friday, April 21, with the Missouri Junior Academy of Science State Competition. Middle- and high-school students will have the opportunity to showcase the work that they have completed over the past year. I want to thank these students, their families, and their mentors for the effort that has gone into these research projects. I hope that you will be able to attend the Junior Academy and support our next generation of scientists. An awards ceremony held on Friday will highlight the most outstanding projects presented. We will also have admission teams from colleges across Missouri available to speak with students and their families about higher education opportunities. In addition, we will have a social event on Friday night starting at 7:00 pm. If you are in town, please join us at the North End Zone for refreshments and entertainment!

The Senior Division of the MAS will begin on Saturday, April 22, with poster sessions in the morning. We are excited to host Mr. Chad Pregracke, founder of Living Lands and Waters who will deliver our plenary session. After the plenary session, you are welcome to eat at MSSUs dining hall or enjoy the many food options available in Joplin. Our afternoon will start with our business meeting followed by oral sessions beginning at 1:30 pm. We hope that you will be able to attend all of these events.

I would like to close by thanking everyone involved in preparing for and making this meeting a success. On behalf of all participants, I want to sincerely thank MSSU President Van Galen and Provost Toms for inviting us to hold our meeting on the MSSU campus. Thank you to Dr. James "Tiger" Gordon for serving as our Senior Division Director. Thank you to Dr. Teresa Boman and Dr. Katie Kilmer for serving as Junior Division Directors as well as our local hosts. I also want to thank members of the MAS Executive Committee, the Business Manager, and the Section Chairs/Vice Chairs for their efforts in making each MAS conference possible.

Again, thank you to all attending and participating in this year's meeting. I hope that you enjoy the presentations, and I hope to see you all at next year's conference in St. Joseph!

Best Wishes,

Shayna Burchett
MAS President (2022-2023)

**About the Missouri Academy of Science**

Scientists of the State of Missouri organized in 1934 to form the Missouri Academy of Science. By April 6, 1934, a Constitution and By-Laws were prepared and on August 14, 1934, the organization was incorporated.

The purposes of this Academy were presented in the fourth "article of agreement" as follows: "This corporation is organized, not for profit but to promote the increase and the diffusion of scientific spirit, and of promoting cooperation between the scientific interests of Missouri. It proposes to accomplish these purposes:

a. By holding meetings for the presentation of scientific papers embodying the results of original research, teaching experience, or other information of scientific interest.
b. By fostering public interest in scientific matters, through open meetings, press releases, and in such other ways as seem feasible.
c. By encouraging local scientific organizations in every possible way.
d. By promoting acquaintance in harmonious relationships between scientists in Missouri and among all who are interested in science.
e. By supplying, so far as finances permit, a medium for the publication of results of original work, particularly those of special interest in this state.
f. By concerning itself with legislation on scientific matters and providing an opportunity for discussion of such legislation.
g. By working in any and all other ways which may prove feasible, for the advancement of science in Missouri."

The Academy held its organizational meeting on April 13-14, 1934, with 250 people attending. At the December 1934 meeting more than 400 people registered and by May 1935, there were approximately 750 members of the Academy. Statewide interest at a high level continued until activities made necessary by World War II disrupted Academy affairs except for some activity in the College Section.

Post-war revival of Academy activities started at a meeting on April 20, 1963, at Drury College. From the group of twelve persons who initiated the reactivation of the Academy in 1963, the membership has grown steadily to more than 800. Activities of the Academy have expanded to include the awarding of modest grants for projects proposed by high school and college students and sponsoring the establishment of a Junior Academy of Science.

The Missouri Academy of Science is a non-profit organization and is supported solely by membership dues and donations. That is why we appreciate each new member and the current members who renew so faithfully each year. It is because of their interest that the Academy continues its success as a fine scientific organization.

# Section Programs

**MISSOURI ACADEMY OF SCIENCE**

**Agriculture Section**
**Nixon Hall Room 210**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | W. Bartelette, C. Hughes, C. Larson, N. Navarrete-Tindall, A. Sparer, Department of Agriculture and Environmental Sciences, Lincoln University. **NATIVE PLANT TASTING: COMMUNITY RESPONSE TO ECOFARM TOUR.** |
| 1:50 | T. Maidens, Department of Biology, Central Methodist University. **THE IMPACT OF MORAXELLA STRAIN DIVERSITY ON THE ANTIMICROBIAL, COMMERCIAL, AND AUTOGENOUS VACCINATION TREATMENTS FOR INFECTIOUS BOVINE KERATOCONJUNCTIVITIS IN CATTLE.** |

**MISSOURI ACADEMY OF SCIENCE**

**Agriculture Section**
**Nixon Hall Room 210**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | C. Schroeder, N. Bathula, S. Sprague, Bai, H., and O. Perez-Hernandez, School of Agricultural Sciences, Northwest Missouri State University. **EFFECT OF TOP DRESS FERTILIZER NITROGEN AND PHOSPHORUS IN THE EMERGENCE AND GROWTH OF GIANT FOXTAIL (*Setaria faberi*) AND COMMON LAMBSQUARTERS (*Chenopodium album*).** |
| B | N. Batthula, C. Schroeder, S. Sprague, H. Bai, and O. Perez-Hernandez, School of Agricultural Sciences, Northwest Missouri State University. **EFFECT OF STARTER FERTILIZER NITROGEN AND PHOSPHORUS IN THE EMERGENCE AND GROWTH OF GIANT FOXTAIL.** |
| A | R. Johnson[1], B. Odam[1], T. Knoernschild[2], and S. Thapa[1], [1]Department of Agriculture, University of Central Missouri, [2]Channel Seeds, Warrensburg. **SOYBEAN ROOT NODULATION AND GROWTH AS AFFECTED BY DIFFERENT NITROGEN RATES.** |
| B | B. Odam, R. Johnson, B. Nevils, T. Hume, and S. Thapa, Department of Agriculture, University of Central Missouri. **MYCORRHIZAL SEED TREATMENT IMPROVES YIELD AND HARVEST INDEX IN CORN.** |
| A | A. Adeyeye and T. Wuliji, College of Agriculture, Environmental and Human Sciences, Lincoln University. **COMPARISON OF GROWTH PERFORMANCE FOR LAMBS FED ON GRAZING PASTURES ONLY AND GRAZING WITH SUPPLEMENTARY FEEDING.** |
| B | T. Wuliji, R. Lourencon, N. Tu, and D. Davis, College of Agriculture, Environmental and Human Sciences, Lincoln University. **ULTRASOUND SCANNING EVALUATION OF CARCASS TRAITS IN WEANING AND POST-WEANING ORGANICALLY RAISED MEAT SHEEP.** |
| A | C. Ke[1] and T. Wuliji[2], College of Agriculture and Food Science[1], University of Missouri, College of Agriculture, Environmental and Human Sciences[2], Lincoln University. **EDS - A QUICK AND REAL-TIME MEASUREMENT OF ELEMENTAL DISTRIBUTION IN THE SURFACE SOIL OF FARMLANDS.** |

B M. Mire and G. Zheng, Cooperative Research, Lincoln University.
**GENES ASSOCIATED WITH ENVIRONMENTAL *ESCHERICHIA COLI.***

A M. Mire and G. Zheng, Cooperative Research, Lincoln University.
**BIOCONTROL OF ROOT ROT AND STEM CANKER OF INDUSTRIAL HEMP.**

**MISSOURI ACADEMY OF SCIENCE**

**Atmospheric Science Section**
**Reynolds Hall Room 235**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | C.A. Steward, N.I Fox, School of Natural Resources, University of Missouri, Columbia. **NOWCASTING WITH AN X-BAND RADAR IN MID-MISSOURI.** |
| 1:50 | E. Travis, School of Natural Resources, University of Missouri – Columbia. **ATTEMPTING TO NOWCAST CONVECTIVE INITIATION USING VERTICALLY INTEGRATED DOPPLER-DERIVED DIVERGENCE**. |
| 2:10 | K. Vigil[a,b], R. Walsh[a], J. Brost[a], M. Foster[a], and T. Nelson[a.c], [a]National Weather Service Operations Proving Ground, [b]Cooperative Institute for Severe and High-Impact Weather Research and Operations, [c]Cooperative Institute for Research in the Atmosphere. **ESTIMATING TORNADO INTENSITY IN REAL TIME: AN OPERATIONS PROVING GROUND VIRTUAL DEMONSTRATION**. |
| 2:30 | W. Gilmore, National Weather Service-Little Rock, Arkansas. **THE DECEMBER 10TH, 2021 SEVERE WEATHER OUTBREAK: AN ARKANSAS PERSPECTIVE.** |
| 2:50 | C.C. Buonanno, National Weather Service-Little Rock, Arkansas. **THE WINTER STORM SEVERITY INDEX: AN OVERVIEW AND RECENT APPLICATIONS.** |
| 3:10 | P. S. Market, University of Missouri - Columbia. **ARE COMMERCIAL IN-CASE DEVICES FOR STRINGED INSTRUMENT HUMIDIFICATION RELIABLE?** |
| 3:30 | J. Bongard and P. S. Market, University of Missouri – Columbia. **ESTIMATING TOPOGRAPHIC INFLUENCE OF OZARK PLATEAU INDUCED COLD-AIR DAMMING THROUGH WRF MODELLING TECHNIQUES.** |

**MISSOURI ACADEMY OF SCIENCE**

**Biochemistry, Biomedicine, & Biotechnology Section**
Reynolds Hall Room 317

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | A. Cortright, and M. Ghosh-Kumar. Department of Biology and Chemistry, Cottey College. **QUANTITATIVE ANALYSIS OF MICROCYSTINS IN WATER BODIES FROM SOUTH-WEST MISSOURI.** |
| 1:50 | J. Cox and J. Smith. Department of Biomedical Sciences, Missouri State University. **CHARACTERIZATION OF THE OVEREXPRESSION OF RECA HOMOLOGS DMC1 AND RAD51 IN *TETRAHYMENA THERMOPHILA*.** |
| 2:10 | S. Harris and K. Kim. Department of Biology, Missouri State University. **APOPTOTIC PATHWAY PROTEIN EXPRESSION VARIANCE IN METAL OXIDE AND QUANTUM DOT TREATED HELA CELLS.** |
| 2:30 | D. James and J. Wang, Department of Biomedical Sciences, Missouri State University**. $P2Y_2$ RECEPTOR INVOLVEMENT IN ENDOTHELIAL CELL PERMEABILITY.** |
| 2:50 | K. Kendrick, S. Moore, C. Barron, and R. Ulbricht. Department of Biomedical Sciences, Missouri State University. **INFLAMMATION, SEX, AND TISSUE DEPENDENT GENE EXPRESSION AND RNA EDITING IN MICE.** |
| 3:10 | I. Lee, C. Rippe, A. Brown, and C. Lupfer. Department of Biology, Missouri State University. **CUL3 NEGATIVELY REGULATES NLRP12-MEDIATED INHIBITION OF THE NF-κB SIGNALING PATHWAY.** |
| 3:30 | E. Liimatta, E. Schmoll, and J. Smith. Department of Biomedical Sciences, Missouri State University. **CHARACTERIZATION OF THE NOVEL UV RESISTANCE PHENOTYPE IN *TETRAHYMENA THERMOPHILA* WITH RAD23 DELETED.** |
| 3:50 | C. Tong[a], N. Kanwar[a], B. Seelig[a], and D. Morrone[b], [a]Department of Biochemistry, Molecular Biology, and Biophysics, University of Minnesota [b]Department of Basic Sciences, University of Health Sciences and Pharmacy in St. Louis. ENGINEERING **AN ARTIFICIAL RNA LIGASE THROUGH NUCLEIC ACID BINDING DOMAIN ADDITION.** |
| 4:10 | O. Okafor and K. Kyoungtae. Department of Biology, Missouri State University. **THE EFFECT OF QUANTUM DOTS ON ENDOCYTOSIS, EISOSOME, AND VACUOLE ORGANIZATION.** |

4:30 P. Sheridan, D. Hirst, C. Jerome, M. Govardhan, T. Nguyen, and A. Barry. Department of Biology, Missouri Southern State University. **DISCOVERY OF CHILAIDITI'S SYNDROME DURING DISSECTION OF AN 88-YEAR-OLD MALE WHOLE BODY DONOR.**

**MISSOURI ACADEMY OF SCIENCE**

**Biochemistry, Biomedicine, & Biotechnology Section**
**Reynolds Hall 3rd Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | Asa Borup. Department of Chemistry, Missouri Southern State University. **OPTIMIZATION & SYNTHESIS OF PROPARGYLIC ETHERS FOR USE IN THE SYNTHESIS OF METABOTROPIC GLUTAMATE RECEPTOR ANTAGONISTS.** |
| A | M. Brummett, Z. Zimny, and A. Agah. Department of Chemistry, Park University. **NEOPLASTIC RESPONSE EVALUATION USING THE DISC BIOASSAY.** |
| A | J. Drecker, H. Matheney, M. Havlicek, and A. Hulme. Department of Biomedical Sciences, Missouri State University. **SPTBN1 INVOLVEMENT IN REVERSE TRANSCRIPTION OF HIV-1 IN CHME3 CELLS.** |
| A | K. Getchell*, M. Shah*, K. Barnes, C. Tindell, and J. Staudinger. Kansas City University- Joplin. **VALIDATION OF A SALIVARY CORTISOL ELISA ASSAY IN THE BIOMEDICAL RESEARCH LABORATORY (BMRL) AT THE MISSOURI SOUTHERN STATE UNIVERSITY-KCU RESEARCH CONSORTIUM (MKRC).** |
| A | M. Gregory, R. Moon, P. Brooks, J. Smith, and A. Brodeur. Department of Biomedical Science, Missouri State University. **HYPOCHLOROUS ACID AS AN ANTIMICROBIAL TREATMENT PREVENTING INFECTION IN COMPOUND FRACTURES.** |
| A | J. Hart, *C. Punzo, and K. Walton. Department of Biology, Missouri Western State University. **THE EFFECTS OF PREBIOTICS ON THE SUSCEPTIBILITY TO DEXTRAN SODIUM SULFATE-INDUCED COLITIS IN MICE.** |
| A | D. Hirst, U. Nguyen, P. Sheridan, C. Evenson, D. Patel, S. Kuhnert, K. Kilmer, and A. Barry. Department of Biology, Missouri Southern State University. **THE CATECHOLIMINERGIC COMPONENT WITHIN CERVICAL VAGUS NERVE INFLUENCES HEART REMODELING: A PILOT STUDY.** |
| A | K. Kim, S. Dhaliwal, C. Crawford. Department of Biology, Missouri State University. **THE MECHANISM OF YEAST DYNAMIN RECRUITMENT TO THE LATE ENDOSOME.** |
| A | N. Le[a], J. Routh[a], C. Kirk[a], Q. Wu[b], R. Patel[b], C. Keyes[b], K. Kim[a]. [a]Department of Biology, Missouri State University, [B]Jordan Valley Innovation Center. **THE INTRACELLULAR TRAFFICKING OF CDSE/ZNS QDS AND ITS IMPACT ON YEAST ACTIN DYNAMICS.** |

A R. Pecka, *C. Fry, *M. Baum, A. Piskulic, M. Surls, H. Whitacre, and A. Hulme. Department of Biomedical Sciences, Missouri State University. **SPTBN1 AND ACTIN STAINING IN MICROGLIAL CELLS TO BETTER UNDERSTAND HIV REPLICATION.**

A D. Silva, S. Antonopoulos, and P. Durham. Department of Biology-Jordan Valley Innovation Center, Missouri State University. **COPPER OXIDE NANOPARTICLES CAUSE TOXCICITY, STIMULATE EXPRESSION OF P-ERK AND P-P38, AND INHIBIT ATF2 AND C-JUN PROMOTER ACTIVITY IN THE WIDR HUMAN COLON EPITHELIAL CELL LINE.**

B E. Braun and N. Lee. Department of Biology, Missouri State University. **IDENTIFICATION OF QUANTUN DOT BINDING PROTEINS.**

B C. Dattel, S. Hira, A. Mahroke, E. Hayes, S. Reddy, A. Parker, and J. Staudinger. Kansas City University- Joplin. **SUBSTANCE USE DISORDER, THE ORAL MICROBIOME, AND ASSOCIATED MEDICAL AND DENTAL HEALTH OUTCOMES: FUTURE OPPORTUNITIES TO PREDICT AND PREVENT DISEASE IN AN UNDERSERVED POPULATION.**

B K. Franklin, R. Jani, N. Gugnani, and A. Burris. Department of Biology and Environmental Health, Missouri Southern State University. **EFFECT OF AMINO ACID DEPRIVATION ON PROTEASOME LOCALIZATION AND MITOCHONDRIAL MORPHOLOGY.**

B A. Brawley, H. Goehl, J. Griffin, N. Lopez, *M. Patel, S. Reardon. Department of Biology, Culver-Stockton College. **ANNOTATION OF MYCOBACTERIOPHAGE HASHROD.**

B N. Gugnani, R. Jani, K. Franklin, and A. Burris. Department of Biology and Environmental Health, Missouri Southern State University. **EFFECT OF NUTRIENT DEPRIVATION ON PROTEOSOME TRANSLOCATION IN A PETITE YEAST STRAIN.**

B S. Hira[a], A. Parker[a], S. Giang[a], C. Dattel[a], E. Goodrow[a], A. Mahroke[a], K. Hillyer[a], K. Bierman[a], K. Dawson[a], B. Stevens[a], C. Reagen, J[a]. O'Keefe[a], J. Mazhil[a], H. Maher[c], H. Eckhart[b], J. Eldred[b], D. Beck[b], G. Budd[b], K. Boyington[b], A. Morgan[b], E. Gonzalez[b], K. Rose[b], M. Armstrong[b], M. Smith[b], N. Gilstrap[b], M. Bailey[b], R. Smith[b], N. Fry[b], & E. Roman[b], and J. Staudinger[a]. [a]Kansas City University, Department of Basic Science, [b]Missouri Southern State University, Department of Social Work, [c]High-Rise Yoga. **IMPROVING HEALTH OUTCOMES IN STUDENT ATHLETES AT MSSU, A PARTNER INSTITUTION IN JOPLIN MISSOURI.**

B R. Jani, K. Franklin, N. Gugnani, and A. Burris. Department of Biology and Environmental Health, Missouri Southern State University. **EFFECT OF GLYCEROL AND RAFFINOSE ON PROTESOME LOCALIZATION FOLLOWING NITROGEN AND GLUCOSE STARVATION.**

B C. Knight and J. Wang. Department of Biomedical Sciences, Missouri State University. **EFFECT OF $P2Y_2$ RECEPTORS ON LEUKOCYTE BEHAVIOR IN VIVO UNDER ACUTE INFLAMMATION IN TRANSGENIC MALE MICE.**

B N. Nalley, S. Antonopoulos, and P. Durham. Department of Biology-Jordan Valley Innovation Center, Missouri State University. **EFFECTS OF PRENATAL AND POSTNATAL COPPER OXIDE NANOPARTICLE EXPOSURE ON DISTAL COLONS AND MICROBIOME.**

B M. Scharnhorst, S. Antonopoulos, and P. Durham. Department of Biology-Jordan Valley Innovation Center, Missouri State University. **INVESTIGATION OF COPPER OXIDE NANOPARTICLES ON CRYOPRESERVED TRIGEMINAL GANGLION USED TO ESTABLISH PRIMARY CULTURES OF NEURONAL AND GLIAL CELLS.**

**MISSOURI ACADEMY OF SCIENCE**

**Biology Section**
**Reynolds Hall 111**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | T. Roy, Department of Biology, Missouri Western State University. **UTILIZATION OF HERBARIUM SPECIMENS TOWARDS PLANT BIODIVERSITY CONSERVATION RESEARCH.** |
| 1:50 | T. Boman and M. Perkins, Department of Biology and Environmental Health, Missouri Southern State University. **A LONGITUDINAL STUDY TO ESTABLISH ANNUAL CONCENTRATION OF MICROPLASTICS OF TURKEY CREEK, SPRING RIVER WATERSHED, MISSOURI.** |
| 2:10 | C. Bennett and M. Kilmer, Department of Biology and Environmental Health, Missouri Southern State University. **EFFECTS OF MICROPLASTIC EXPOSURE ON SURVIVAL, DEVELOPMENT AND REPRODUCTION IN *DAPHNIA MAGNA*.** |
| 2:30 | J. Radey and M. Kilmer, Department of Biology and Environmental Health, Missouri Southern State University. **EFFECTS OF ALTERED WATER TEMPERATURE ON SURVIVAL AND REPRODUCTION OF *DAPHNIA MAGNA*.** |
| 2:50 | A. Pendel and A. Lough, Department of Biology, Central Methodist University. **USING NESTED POLYMERASE CHAIN REACTION TO IDENTIFY FISH MISLABELING.** |

**MISSOURI ACADEMY OF SCIENCE**

**Biology Section**
**Reynolds Hall 1st Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | D. Garten, E. Loder, S. Antonopoulos, and P. Durham, Department of Biology-Jordan Valley Innovation Center, Missouri State University. **IDENTIFICATION AND PREVENTION OF FRESHWATER BIOFOULING ON FLEXIBLE SENSOR SUBSTRATES.** |
| A | G. Dieringer and L. Cabrera R., Department of Natural Sciences, Northwest Missouri State University. **POLLINATION AND BREEDING SYSTEM IN *PENSTEMON PALLIDUS* (PLANTAGINACEAE).** |
| A | T. Cook[a], C. Root[a], C. Lindqvist[b], and T. Roy[a], [a]Department of Biology, Missouri Western State University, [b]Department of Biology, University of Buffalo. **THE ECONOMIC, CULTURAL, AND CONSERVATIONAL IMPORTANCE OF THE "LAMIOID MINTS".** |
| A | C. Root, T. Cook, and T. Roy, Department of Biology, Missouri Western State University. **A DEEP DIVE INTO THE GENUS *SILPHIUM*.** |
| A | M. Castagna, J. Burrow, C. Stewart, and A. Russell, Department of Biology, Missouri State University. **TAKE IT OR LEAF IT: IS LEAF SHAPE A RELIABLE POLLINATOR LEARNING CUE?** |
| A | D. Miles, H. Whaley, A. Faust, and L. Kissoon-Charles, Department of Biology, Missouri State University. **WINTER TEMPERATURES DRIVE CHANGES IN AQUATIC VEGETATION IN AN OZARK SPRING-FED POND**. |
| A | M. Gibson and A. Elias, Department of Biology, Missouri Western State University. **FRESHWATER FISH SPECIES IDENTIFICATION USING DNA BARCORDING.** |
| A | B. Blede and S. Lankford, Department of Biological and Clinical Sciences, University of Central Missouri. **ACCLIMATION TO ELEVATED TEMPERATURE RESULTS IN CONFOUNDING RESULTS IN LAKE STURGEON (*ACIPENSER FULVESCENS)***. |
| A | C. Bell, M. Firsching, C. Redman, S. Vogt, and C. Ganong, Department of Biology, Missouri Western State University. **MULTIANNUAL TRENDS IN AQUATIC MACROINVERTEBRATE DIVERSITY IN MISSOURI WESTERN STATE UNIVERSITY CAMPUS PONDS.** |

A A. Kinzel, Department of Natural Sciences, Northwest Missouri State University. **A COMPARISON OF PLASTIC CONSUMPTION BETWEEN TWO DARKLING BEETLE SPECIES.**

A H. St. Dennis[a], C. Bigler[a], N. Cummins[a], E. Ludwig[a], D. Duvernell[a], R. Hrabik[b], [a]Department of Biological Sciences, Missouri University of Science and Technology; [b]Missouri Department of Conservation. **MOLECULAR GENETICS AND PHYLOGEOGRAPHY OF *NOTROPIS DORSALIS*.**

A R. Mailey, J. Zhu, O. Buschhaus, J. McGhee, A. Campbell, and J. Campbell, Department of Natural Sciences, Northwest Missouri State University. **PCR AMPLIFICATION OF LARGE REGIONS OF THE MITOCHONDRIAL DNA OF BULLFROGS (*LITHOBATES CATESBEIANA*) FROM NODAWAY COUNTY, MO.**

B A. Agunbiade, C. Coretti, H. Shoemaker, A. Kempf, J. Potter, S. Powell, and M. Grantham, Department of Biology, Missouri Western State University. **SEQUENCES IN A FRESHWATER VIROME FROM AN URBAN POND MAP TO SALMON GILL POXVIRUS**.

B S. Buehre, M. Grantham, T. Roy, Department of Biology, Missouri Western State University. **SARS COV-2 OMICRON VARIANT EVOLUTION IN MAJOR CITIES ACROSS THE UNITED STATES.**

B I. Dimaggio[a], T. Santana Baez[a], E. McHugh[a], D. Monismith, Jr.[b], J. Campbell[a] and A. Campbell[a], [a]Department of Natural Sciences, Northwest Missouri State University, [b]Independent researcher. **COMPARATIVE GENOMICS OF THE BACTERIAL GENUS *XENOPHILUS*.**

B Z. Zayour, J. Campbell, and A. Campbell, Department of Natural Sciences, Northwest Missouri State University. **BIOINFORMATICS ANALYSIS OF THE POTENTIAL PATHOGENENICITY AND HOST ASSOCIATION OF ORAL AND RUMINANT SELENOMONADS**.

B C. Stewart, A. Russell, B. Mirza, and R. Afagwu, Department of Biology, Missouri State University. **HOW FLOWER LONGEVITY AFFECTS EPIPHYTIC BACTERIA ABUNDANCE AND COMMUNITY COMPOSITION.**

B W. Durstock, S. Urushidani, and B. Mirza, Environmental Services Department, Missouri State University. **A MICROBIAL SOURCE TRACKING STUDY TO IDENTIFY FECAL CONTAMINATION IN A KARST WATER SYSTEM.**

B C. Roman, B. Edwards, and B. Mirza, Department of Biology, Missouri State University. **SELECTION OF *BRADYRHIZOBIUM* AND *SINORHIZOBIUM* IN SOYBEAN ROOT NODULES WITH DIFFERING pH ENVIRONMENTS.**

B D. Garten, S. Antonopoulos, S. Woodman, and P. Durham, Department of Biology-Jordan Valley Innovation Center, Missouri State University. **DIETARY GRAPE SEED EXTRACT SUPPLEMENTATION INHIBITS NOCICEPTION AND MEDIATES GABAERGIC CHANGES IN A PRECLINICAL MODEL OF CHRONIC TMD**.

B E. Loder, S. Antonopoulos, and P. Durham, Department of Biology-Jordan Valley Innovation Center, Missouri State University. **GRAPE SEED EXTRACT PREVENTS GUT MICROBIOME DYSBIOSIS AFTER PRENATAL AND POSTNATAL DIETARY EXPOSURE TO COPPER OXIDE NANOPARTICLES.**

B A. Mesz, T. Santana Baez, E. McHugh, D. Monismith, Jr., A. Campbell, and J. Campbell, Department of Natural Sciences, Northwest Missouri State University. **PHYSIOLOGICAL AND BIOCHEMICAL CHARACTERIZATION OF NOVEL SPECIES OF *MITSUARIA* AND *XENOPHILUS***

B A. Postlewait[a], Z. Locke[a], D. Moser[b], S. Hamilton-Brehm[c], and J. Campbell[a], [a]Department of Natural Sciences, Northwest Missouri State University, [b]Division of Earth and Ecosystems Sciences, Desert Research Institute, [c]Department of Microbiology, Southern Illinois University. **ISOLATION OF *ACIDOVORAX, SPHINGOMONAS* AND *SEDMINIBACTERIUM* FROM TERRESTRIAL WATER IN THE NEVADA DESERTS.**

B Z. Locke[a], A. Postlewait[a], D. Moser[b], S. Hamilton-Brehm[c] and J. Campbell[a], [a]Department of Natural Sciences, Northwest Missouri State University, [b]Division of Earth and Ecosystems Sciences, Desert Research Institute, [c]Department of Microbiology, Southern Illinois University. **CULTIVATION OF *PSEUDOMONAS, ALKALIHALOBACILLUS, SPHINGOPYXIS* AND *MESORHIZOBIUM* FROM SUBSURFACE WATER IN THE NEVADA DESERT**.

**MISSOURI ACADEMY OF SCIENCE**

**Chemistry Section**
**Reynolds Hall Room 315**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | A. McGovern, B. Roy, G. Thurmon, and S. Burchett Department of Science and Mathematics, Central Methodist University. **IMPACTS OF 3 DIMENSIONALLY PRINTED POLYLACTIC ACID STRUCTURES ON DAMSEL FISH BEHAVIOR AND WATER QUALITY.** |
| 1:50 | K. Miles[1], R. Brown[2], and K. Woelk[1],[1]Department of Chemistry, [2]Department of Chemical Engineering, Missouri University of Science and Technology. **MATERIALS' PROPERTIES ANALYZED BY TRANSVERSED MAGNETIC RESONANCE RELAXATION STUDIES.** |
| 2:10 | G. Mebratu, S. Burchett, Department of Chemistry, Central Methodist University. **GRIGNARD SYNTHESIS OF THE RECRUITMENT PHEROMONE OF THE EUROPEAN ELM BEETLE AND ALARM PHEROMONE OF VARIOUS ANT SPECIES**. |
| 2:30 | J. Durbin, A. McGovern, Department of Chemistry, Central Methodist University. **EFFECTS OF POLYLACTIC ACID ON SALTWATER QUALITY**. |
| 2:50 | M. H. Dahanayake[1] , Z. Wu[1, 2, 3], X. Chen[3] , R. Weerasooriya[1] and A. C. A. Jayasundera [2, 4, 5], [1]National Institute of Fundamental Studies, Hanthana, Kandy, Sri Lanka, [2]Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka, [3]Industry and Equipment Technology Institute, Hefei University of Technology, PR China, [4]Department of Chemistry, Faculty of Science, University of Peradeniya, Sri Lanka, [5]Division of Mathematics and Science, Missouri Valley College, Marshall, MO, 65340, USA, **LIFE-CYCLE ASSESSMENT ON ECOTOXICITY IMPACT OF MICRO- AND NANO-PLASTICS IN A GROUNDWATER TREATMENT SYSTEM**, |
| 3:10 | Rishabh Srivastava[1,2], Himanshu Chaudhary[2], and Ram K. Gupta[2], [1]Department of Physics, Pittsburg State University, Pittsburg, KS 66762, USA, and [2]National Institute for Materials Advancement, Pittsburg State University, Pittsburg, KS 66762, USA. **FACILE SYNTHESIS OF METALLIC-$P_2O_7$ ON NICKEL FOAM FOR TUNED MORPHOLOGICAL AND ELECTRONIC ENHANCEMENT TOWARD BIFUNCTIONAL ELECTROCATALYST AND SUPERCAPACITOR APPLICATION**. |

3:30 Arjun Chaudhary[1,2] and Ram K. Gupta[1,2], [1]Department of Chemistry, Pittsburg State University, Pittsburg, KS 66762, USA, and [2]National Institute for Materials Advancement, Pittsburg State University, Pittsburg, KS 66762, USA.
**SUNFLOWER OIL-BASED ADHESIVE FOR WOOD APPLICATION AS AN ALTERNATIVE TO PETROLEUM-BASED WOOD ADHESIVES.**

**MISSOURI ACADEMY OF SCIENCE**

**Chemistry Section**
**Reynolds Hall 3rd Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | R. Herndon [1], G. Riddle [2], and K. Woelk[3]. [1] Department of Civil engineering, [2] Department of Physics, [3]Department of Chemistry, Missouri University of Science and Technology. **WHERE THE RUBBER MEETS THE ROAD**. |
| A | J. Centrella and L. Strawsine, Department of Chemistry, Westminster College. **TWO ADVENTURES IN CHEMICAL ANALYSIS OF CONTAMINATED ENVIRONMENTAL WATERS**. |
| A | J. E. Isert[a], C. Saiz[a], W. H. Rice[a], G. Guirgis[b], and G. S. Grubbs[a], [a]Department of Chemistry, Missouri University of Science and Technology, [b]Department of Chemistry and Biochemistry, College of Charleston. **THE ROTATIONAL SPECTRUM AND STRUCTURAL DETERMINATION OF 1-ETHYL-1-FLUOROSILACYCLOPENTANE.** |
| A | H. Bahn, A. Hermelink, Z. Mayes, K. Woelk, Department of Chemistry, Missouri University of Science and Technology. **INVESTIGATING INDUSTRIAL METHANOL PRODUCTION WITH NUCLEAR MAGNETIC RESONANCE.** |
| B | E. Eguaosa, M. Siebert, Department of Chemistry and Biochemistry, Missouri State University. **FINDING SUSTAINABLE ALTERNATIVES FOR PETROLEUM: THEORETICAL INVESTIGATIONS ON THE CRACKING PROCESS OF METHYL LINOLEATE.** |
| B | B. Hiller, L. Gilbert-Saunders. Department of Chemistry, Missouri Southern State University. **THE EFFECTS OF BENZALONIUM CHLORIDE ON *MEDICAGO SATIVA* AND *ELODEA CANADENSIS*.** |
| B | S.J. Adeoye and Dr. M.R. Siebert, Department of Chemistry and Biochemistry, Missouri State University. **A THEORETICAL STUDY INTO THE PYROLYSIS OF BIODIESEL.** |
| B | Josie R. Glenn[a], J. E. Isert[a], Gamil A. Guirgis[b], and G. S. Grubbs II[a], [a]Department of Chemistry, Missouri University of Science and Technology, [b]Department of Chemistry and Biochemistry, College of Charleston. **STRUCTURAL DETERMINATION OF 1-ETHYLSILACYCLOPENTANE.** |

B S. E. Akindele, D. J. Echezona, C. A. Castelblanco Riveros, and M. J. Meziani, Department of Natural Sciences, Northwest Missouri State University, 800 University Drive, Maryville, MO 64468, USA. **EFFICIENT AND SIMPLE SYNTHESIS OF COMPOSITE RESIN INCORPORATING SILVER AND MAGNETIC NANOPARTICLES AND THEIR ANTIBACTERIAL ACTIVITY.**

**MISSOURI ACADEMY OF SCIENCE**

**Computer Science & Mathematics Section**
**Nixon Hall 211**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | J. Adams, H. Ali, S. Barker, H. Sadiq, J Smith and J. Woodard, University of Health Sciences and Pharmacy. **PREDICTING DEPRESSION AND ALZHEIMER'S DISEASE USING MACHINE LEARNING TECHNIQUES: MODEL ACCURACY AND EVALUATION.** |
| 1:50 | L. Stumpf, Department of Engineering and Information Technology, University of Missouri. **USER EXPERIENCE AND USER INTERFACE DESIGN STUDY: THE IMPACT OF GAMIFICATION ON LEARNING MANAGEMENT SYSTEMS FOR STUDENTS WITH LEARNING DISABILITIES**. |

**MISSOURI ACADEMY OF SCIENCE**

**Conservation Section**
**Reynolds Hall Room 225**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | J. D. McGhee. Department of Natural Sciences, Northwest Missouri State University. **SUMMER POPULATION PARAMETERS OF THE GRAY TREEFROG COMPLEX IN NORTHWEST MISSOURI.** |
| 1:50 | C. Burandt, T. Wilson, N. Walker, F. Supnet, and A. Newton. Department of Biology, Missouri Western State University. **SURVEY OF POLLINATOR ANIMALS ON A RECENTLY RESTORED CAMPUS PRAIRIE.** |
| 2:10 | A. Bair and J. B. Kimmons. Department of Natural Sciences, Park University. **DIETARY ASPECTS OF AN URBAN TURTLE COMMUNITY IN A MISSOURI RIVER TRIBUTARY: A STABLE ISOTOPE AND FECAL APPROACH.** |
| 2:30 | J. Messick. Department of Biology and Environmental Health, Missouri Southern State University. **USING DRONES TO ESTIMATE BLACKBIRD DENSITY.** |
| 2:50 | J. Thomas and J. Willand. Department of Biology and Environmental Health, Missouri Southern State University. **ASSESSING FLORISTIC QUALITY OF REMNANT PRAIRIE PLANT COMMUNITIES IN SOUTHWEST MISSOURI.** |

**MISSOURI ACADEMY OF SCIENCE**

**Conservation Section**
**Nixon Hall 2nd Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | D. Ashley[1], M. Mills[1], C. Ganong[1], D. Drake[1], C. Chevalier[1], and D. Woods[2], [1]Biology Department, Missouri Western State University, [2]Ozark Underground Laboratory. **APPLIED LEARNING EXPERIENCES WITHIN THE CONTEXT OF KARST CONSERVATION, MANAGEMENT AND EDUCATION.** |
| A | V. Farber[1], and M. Kilmer[2], [1]Joplin High School, [2]Department of Biology and Environmental Health, Missouri Southern State University. **GENERATIONAL EFFECTS OF EXPOSURE TO POLYETHYLENE MICROPLASTICS ON THE AQUATIC MICROCRUSTACEAN, *DAPHNIA MAGNA*.** |

**MISSOURI ACADEMY OF SCIENCE**

**Geography Section**
**Nixon Hall 1st Floor**

| **SESSION** | **AUTHOR/TITLE OF POSTER PRESENTATION** |
|---|---|
| **A** | S. Rector[1], and C. Blodgett[2], [1]Department of Classics, Archaeology, and Religion, [2]Department of Geography, University of Missouri – Columbia. **DEVELOPING A WORKFLOW FOR PROCESSING UAV-BASED ARCHAEOLOGICAL LIDAR DATA.** |

**MISSOURI ACADEMY OF SCIENCE**

**Geology and Geosciences Section**
**Reynolds Hall Room 325**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 2:30 | C.E. Boston[a], M. Taylor[b], T. Taylor[b], [a]Department of Social & Behavioral Sciences, Lincoln University, [b]Independent Scholar. **APPLICATIONS FOR INFRARED SCANNING IN HISTORICAL ARCHAEOLOGICAL RESEARCH**. |
| 2:50 | J. McDaniel, and D. Gouzie, Department of Geography, Geology and Planning, Missouri State University. **ANALYZING POTENTIAL CHEMICAL VARIABILITY AND ITS RELATIONSHIP TO ENGINEERING PROPERTIES IN THE BENTONVILLE FORMATION, SPRINGFIELD, MISSOURI**. |

**MISSOURI ACADEMY OF SCIENCE**

**Geology and Geosciences Section**
**Nixon Hall 2nd Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | D. DeHart, J. McDaniel, and T. Dogwiler, Department of Geography, Geology and Planning, Missouri State University. **ASSESSMENT OF HISTORICAL AND CURRENT REGIONAL GEOMORPHIC PARAMETERS IN OZARK STREAMS TO SUPPORT BANK STABILIZATION.** |
| A | A.Momberg[1], D.Gouzie[2], Department of Geology, Geography, and Planning, Missouri State University. **CAN BOOKS BE TOXIC?** |

**MISSOURI ACADEMY OF SCIENCE**

**Physics and Engineering Section**
**Reynolds Hall Room 325**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | S. Bhardwaj[1,2] and R. Gupta[2,3]. [1]Department of Physics, Pittsburg State University, Pittsburg, Kansas 66762, USA. [2]National Institute of Material Advancement, Pittsburg State University, Pittsburg, Kansas 66762, USA. [3]Department of Chemistry, Pittsburg State University, Pittsburg, Kansas 66762, USA. **$NI(OH)_2$ AND NIO-BASED MOF AS EFFICIENT ELECTRODE MATERIALS FOR OVERALL WATER SPLITTING AND SUPERCAPACITOR.** |
| 1:50 | D. Marsh and R. Bajracharya. Department of Chemistry and Physics, Missouri Southern State University. **STUDENT AND EXPERT UNDERSTANDING OF INFINITY AND APPLICATIONS AT THE MATHEMATICS-PHYSICS INTERFACE.** |
| 2:10 | G. Ochoa[1], S. Kulkarni[2], O. Girish[3], H. Hernandez[4], J. Lu[5], C. Russell[6], S. Risin[7], and R. Freed[8]. [1]Western Kentucky University. [2]Dougherty Valley High School. [3]Walters Middle School/Mountain House High School. [4]Victor Valley College. [5]Irvine High School. [6]Missouri Valley College. [7]University of California at Berkley. [8]Institute for Student Astronomical Research. **MEASUREMENTS OF THE POSITION ANGLE AND SEPARATE FOR WDS 14082+3645 WITH SPECKLE INTERFEROMETRY AND OPTICAL TELESCOPES.** |

**MISSOURI ACADEMY OF SCIENCE**

**Physics and Engineering Section**
**Nixon Hall 1st Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | E. Allen, M. Davis, T. Spudich, R. Gerald, and J. Huang. Department of Electrical and Computer Engineering, Missouri University of Science and Technology, Rolla MO 65409-0040, USA. **SPECTROSCOPIC AND INTERFEROGRAPHIC METHODS DEPLOYED IN TANDEM FOR DETECTING VOLATILE ORGANIC COMPOUNDS USED TO DIAGNOSE DISEASES AND IDENTIFY EXPLOSIVE MATERIALS.** |

**MISSOURI ACADEMY OF SCIENCE**

**Science Education Section**
**Reynolds Hall Room 306**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | D. Patel, C. Nelson, R. Basha, A. Subhash, D. Johnson, C. Lemmons, S. Kuhnert, and A. Barry, Department of Biology, Missouri Southern State University. **THE ROLE OF UNDERGRADUATE ANATOMICAL EDUCATION IN PREPARING STUDENTS FOR CLINICAL PROGRAM.** |
| 1:50 | E. Sitkowski, G. Wofford, and D. Morrone, Department of Basic Sciences, University of Health Sciences and Pharmacy in St. Louis. **A MOLECULAR BIOCHEMISTRY LAB EDUCATION TOOL ALLOWING FOR FULL-COLOR EXPERIMENTS.** |
| 2:10 | K. Hendrix, Division of Behavioral Sciences, Southwest Baptist University. **DIFFERENCES BETWEEN FAMILIAR AND UNFAMILIAR SYMBOLS IN VISUAL PROBLEM SOLVING.** |
| 2:30 | G. Bhattacharyya, Department of Chemistry and Biochemistry, Missouri State University. **HOW STUDENTS' SENSE-MAKING IN ORGANIC CHEMISTRY MIGHT INFORM THE FEASIBILITY OF INQUIRY LEARNING.** |
| 2:50 | J. Pind and S. Mathis, Department of Psychology & Sociology, Park University. **PRESENTATION OF KNOWLEDGE SEEDS: IS IT AS IMPORTANT AS THE SEED ITSELF?** |

**MISSOURI ACADEMY OF SCIENCE**

**Science Education Section**
**Nixon Hall 1st Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | A. Ford, S. Hromnak and S.L. Donovan, College of Arts and Sciences, Maryville University. **USE OF THE EZ1 BIOROBOT TO SIMULATE HUMAN IDENTIFICATION WITH PLASMIDS THAT INCORPORATES ASPECTS OF WORKING IN A FORENSIC LAB.** |
| B | A. Schab and J. Edwards, Department of Chemistry, Saint Louis University. **GREEN CHEMISTRY SPECTROSCOPY LAB PROTOCOL.** |

**MISSOURI ACADEMY OF SCIENCE**

**Social and Behavioral Sciences Section**
**Reynolds Hall Room 204**

| TIME | AUTHOR/TITLE OF ORAL PRESENTATION |
|---|---|
| 1:30 | T. Roe, and C.E. Boston, Department of Social & Behavioral Science, Lincoln University. **ARCHAEOLOGY OF HOMELESSNESS.** |
| 1:50 | C. Walker, Department of Social and Behavioral Sciences, Lincoln University**. BLACK PIONEERS IN MENTAL HEALTH.** |
| 2:10 | S. Orimaye, and M. Tabet. College of Global Population Health, University of Health Sciences and Pharmacy. **ASSOCIATION BETWEEN U.S. MINORITY STATUS AND POSTPARTUM MENTAL HEALTH**. |
| 2:30 | O. Janssen, and M. Price. Department of Behavioral Sciences, College of the Ozarks. **THE IMPACT OF POSTTRAUMATIC STRESS DISORDER ON THE QUALITY OF SLEEP IN FIRST RESPONDERS.** |
| 2:50 | L. Hogan, M. Kramer, and K. Stem, Department of Human and Behavioral Sciences, College of the Ozarks. **AUTISM SPECTRUM DISORDER AND ACCOMMODATIONS IN EDUCATIONAL AND OCCUPATIONAL SETTINGS**. |
| 3:10 | M. Price, Department of Behavioral Science, College of the Ozarks. **EFFECTS OF VISUAL PRIMES ON PERCEPTION OF FACIAL EMOTIONAL EXPRESSIONS**. |
| 3:30 | L. Fincher and N. Meeks, Department of Psychology, College of the Ozarks. **THE RELATIONSHIP BETWEEN MUSIC, GENRE, AND COLLEGE STUDENTS' STRESS LEVELS.** |
| 3:50 | B. Cowley and H. Rawhouser. Department of Psychology and Sociology, Park University. **A COMPARISON OF GENDER ROLE ATTITUDES BETWEEN YOUNG ADULTS AND MIDDLE-AGED ADULTS.** |

**MISSOURI ACADEMY OF SCIENCE**

**Social and Behavioral Sciences Section**
**Nixon Hall 1st Floor**

| SESSION | AUTHOR/TITLE OF POSTER PRESENTATION |
|---|---|
| A | E.C. Burns and B. Kostic, Psychology Department, Missouri State University. **CLOCK DISPLAYS AND TIME ESTIMATES** |
| A | J. Pind and A. Johnson, Department of Psychology & Sociology. Park University. **THE EFFECTS OF APHANTASIA ON MENTAL ROTATION AND COGNITIVE MAPPING PERFORMANCE.** |
| B | C. Arnold, A. Zeff, C. Collins, and L. Elder, Department of Psychology, Central Methodist University. **THE EFFECT OF SOCIAL COMPARISON THROUGH SNAPCHAT ON RELATIONSHIP SATISFACTION** |
| B | S. Tucker, Department of Psychology, Missouri Southern State University. **TEACHING TO LEARN: FACILITATING THE USE OF RESEARCH-BASED STUDY TECHNIQUES BY UNDERGRADUATE STUDENTS**. |

# Section Abstracts

**Agriculture Section**

**Oral Presentations:**

W. Bartelette, C. Hughes, C. Larson, N. Navarrete-Tindall, A. Sparer, Department of Agriculture and Environmental Sciences, Lincoln University. **NATIVE PLANT TASTING: COMMUNITY RESPONSE TO ECOFARM TOUR.** This research reports the results of a community event aimed at increasing awareness of the Families Integrating Nature, Conservation, and Agriculture (FINCA) program at Lincoln University. The FINCA Eco Farm and Teaching Greenhouse serves the greater Jefferson City community by providing educational classes, tours, and community outreach. The primary goals of the FINCA program are to promote the growth of native plants, improve food security, and create sustainable agricultural practices. We collected survey data from community participants at a FINCA event held on 10-27-22. Participants completed a tour of the facility and then completed a survey. Questions focused on satisfaction with the event and evaluation of 10 native edible recipes available for sampling during the event. Findings indicated that the event was successful, and the recipes were well-liked. However, some participants appeared reluctant to taste the samples provided. Though the survey response rate was low (20%), this preliminary feedback will help members of the specialty crops program better serve the community for future events and make improvements on native recipes.

T. Maidens, Department of Biology, Central Methodist University. **THE IMPACT OF MORAXELLA STRAIN DIVERSITY ON THE ANTIMICROBIAL, COMMERCIAL, AND AUTOGENOUS VACCINATION TREATMENTS FOR INFECTIOUS BOVINE KERATOCONJUNCTIVITIS IN CATTLE.** Infectious Bovine Keratoconjunctivitis results in large economic losses for the cattle industry worldwide. Currently, Infectious Bovine Keratoconjunctivitis is unpreventable, thus requiring continuous research into the mechanisms and factors of the disease. Antimicrobials are used as a global treatment method for Infectious Bovine Keratoconjunctivitis, but no standardized criteria for measurement of susceptibility currently exist leaving a gap in understanding of its efficacy. This paper utilizes the same interpretive breakpoints to compare the susceptibility of *Moraxella bovis* and *Moraxella bovoculi* by year and region, highlighting differences in susceptibility based on regional strains and increasing antibiotic resistance over time. Autogenous and commercial vaccinations are also a common practice in treating Infectious Bovine Keratoconjunctivitis; however, current published literature shows low efficacy levels. Pilin has been identified as playing a critical role in treatment resistance for both *Moraxella bovis* and *Moraxella bovoculi.* This paper examines the genetic differences of the pilin protein of different serogroups of *Moraxella bovis*, as well as PilA, encoded in *Moraxella bovoculi,* to gain a better understanding of the diversity among species and the impact it has on vaccine efficacy. The data reported highlights the necessity for standardized breakpoints of *Moraxella spp.* to ensure effective treatment using antibiotics and prevent multi-resistant organisms. This paper also provides a better understanding of the genetic diversity among pilin-related proteins, while proposing a potential target for vaccines to inhibit the attachment of *Moraxella spp.* to the cornea and prevent the development of Infectious Bovine Keratoconjunctivitis.

**Poster Presentations:**

A. Adeyeye and T. Wuliji, College of Agriculture, Environmental and Human Sciences, Lincoln University. **COMPARISON OF GROWTH PERFORMANCE FOR LAMBS FED ON GRAZING PASTURES ONLY AND GRAZING WITH SUPPLEMENTARY FEEDING.** Post-weaning weight is an important predictor of lamb production efficiency, market value and profitability. Therefore, a periodic supplementary feeding may enhance postweaning growth and average daily gain (ADG). This study was to evaluate the impact of supplementary feeding on growth performance of Katahdin lambs weaned on grazing pastures. Two experimental groups, a control and treatment group each with 36 animals consisted of 18 female and 18 male lambs. Weaned lambs were selected and grazed for six weeks on fescue and white clover pasture during pre-supplementary period (PW1). At end of PW1, treatment lambs were fed 250 g/h/d supplemental pellets for a period of four weeks (PW2) with ad lib pasture grazing whereas control lambs were grazing on pasture only. Weaning weight, live weight (PW1 and PW2), ADG (PW1 and PW2) were recorded 21.1 kg, 25.2 kg, 25.9 kg, 97 g/d and 23 g/d for control lambs compared to 21.1 kg, 25.1 kg, 30.1 kg, 95 g/d and 184 g/d for treatment group. Postweaning feed supplement to grazing lambs have significantly ($P<.05$) increased PW2 weight and ADG compared grazing only. The results suggest that supplementary feeding can improve postweaning growth performance of Katahdin lambs on grazing pasture.

N. Batthula, C. Schroeder, H. Bai, S. Sprague, and O. Perez-Hernandez, School of Agricultural Sciences, Northwest Missouri State University. **EFFECT OF STARTER FERTILIZER NITROGEN AND PHOSPHORUS IN THE EMERGENCE AND GROWTH OF GIANT FOXTAIL.** Starter fertilizer nitrogen (N) and phosphorus (P) is placed near corn seed at planting to nourish the emerging and developing crop seedlings. While starter fertilizer is intended to provide the crop with these nutrients, it can also improve emergence and growth of present weeds, therefore, exacerbate weed problems. The effect of starter fertilizer N and P in the emergence and growth of weeds is unknown. The objective of this study was to determine the effect of N and P starter fertilizers in the emergence and growth of giant foxtail (*Setaria faberi*). Five corn and 100 giant foxtail seeds were planted in each of 8.3 x 8.3 x 8.5-inch pots containing substrate made of sand and a commercial potting mix. Two fertilizer treatments based on N alone, N and P combined, or no fertilizer (untreated) were applied at planting in a randomized complete block design with six replications. Crop and weed emergence were assessed daily until day 33 after planting, and shoot dry weight was measured after harvest (day 34). Foxtail % emergence in the N and N-P treatments was 37.3 and 11.9 higher, respectively, than that in the control. Weed shoot dry weight was 23.86 and 8.9% higher in both treatments, respectively, than that in the untreated control. The apparent large difference in both emergence and biomass in the treatments vs. the control, however, was not significant at the 0.05 level. A second experiment run is underway to estimate the result variability and confirm treatment effect or lack thereof.

R. Johnson[1], B. Odam[1], T. Knoernschild[2], and S. Thapa[1], [1]Department of Agriculture, University of Central Missouri, [2]Channel Seeds, Warrensburg. **SOYBEAN ROOT NODULATION AND GROWTH AS AFFECTED BY DIFFERENT NITROGEN RATES.** As a legume crop, soybeans (*Glycine max* L.) have the potential to associate with Rhizobium bacteria in the soil and fix atmospheric N. This "soybean N credit" concept has existed among growers for years therefore, they seldom use nitrogen for soybeans. However, previous studies indicate that only half (50 to 60%) of the plant N requirement comes from the atmospheric N fixation. This high-

tunnel study was conducted in summer 2023 to investigate the effect of different N rates on root nodulation and plant growth in soybean. Two soybean hybrids were grown under four nitrogen rates (0, 40, 80, and 120 lb/ac) in 32 plastic pots (capacity 2 gallons) filled with natural field soils. The experimental design was randomized complete block design (RCBD) with four replications. Soybean plants were harvested at early flowering growth stage and root nodules were counted. Results showed significantly lower number of nodules in plants treated with nitrogen (92 nodules/plant for control treatments vs. 52-60 nodules per plant for nitrogen treated plants on average). However, added nitrogen increased the biomass by 5-50%, leaf chlorophyll content content by 5-10%, and shoot: root ratio by 20-60%. These results provide basic guidelines for local growers who are interested to use nitrogen in soybean. Further studies are recommended to evaluate the soybean grain yield under different nitrogen rates.

C. Ke[1] and T. Wuliji[2], College of Agriculture and Food Science[1], University of Missouri, College of Agriculture, Environmental and Human Sciences[2], Lincoln University. **EDS - A QUICK AND REAL-TIME MEASUREMENT OF ELEMENTAL DISTRIBUTION IN THE SURFACE SOIL OF FARMLANDS.** Energy-dispersive X-ray spectroscopy (EDS) is a technique to analyze the elemental composition of specimens in tandem to scanning electron microscope (SEM). This study is to evaluate the applicability of EDS for surveying elemental distribution in topsoils. Soil samples were collected from 36 sampling sites including 12 at each of three Lincoln University farms in 2018, 2019 and 2022. Soil samples were processed for subsampling, oven drying, grinding, and sieving with standard sieve set in according to the procedures. COXEM EM-30AX PLUS Scanning Electron Microscope (SEM) fitted with an OXFORD EDS Spectrometer was used for analysis. Duplicate SEM observation and EDS specimens were prepared for each soil sampling site and examined for elemental contents. Three counting measurements (AZtec software) were recorded for each specimen. Twenty elements were pre-selected for quantification. There is no difference in elemental variety or quantity among sampling sites, topographic (hill-site and plain-site) sites within farm, between farms and years. There was a nonsignificant but higher content for AL, C, Fe and Mg in hill-site than plain-site soils, whereas a higher content for Ca, Mo, Na and Si in plain than hill soil. Mean elemental mass measured were Al: 4.49%, As: .00, C: 12.21, Ca: .39, Cl: .01, Co: .02, Cu: 01, Fe: 3.06, K: 1.23, Mg: .44, Mn: .26, Mo: .16, N: 1.33, Na: .51, O: 53.43, P: .09, Se: .00, S: .01, Si: 22.31 and Zn: .04, respectively. Results indicated EDS technique has high repeatability, consistency, and valid real-time quantification for elemental distributions in farmland soil.

M. Mire and G. Zheng, Cooperative Research, Lincoln University. **BIOCONTROL OF ROOT ROT AND STEM CANKER OF INDUSTRIAL HEMP.** Industrial Hemp, *Cannabis sativa* L cv. altair is growing as an economically profitable in Missouri. Like many crops, hemp is at risk of infection from fungal pathogens causing diseases such as root rot and stem canker. It is critical that farmers have strategies in place to mitigate these and emergent diseases. Our goal is to create a biocontrol method that will be successful in the fight against hemp fungal diseases. Microbial endophytes (bacteria or fungi) are beneficial microorganisms that reside within plants, or *in situ*, for their whole life cycle. We hypothesize that microbial endophytes that are antagonistic to hemp pathogens can be isolated from hemp and used as biocontrol agents. Our objective here is to isolate microbial endophytes from the internal hemp seed tissues and evaluate the isolates for inhibitory effectiveness against plant fungal pathogens. Microbial endophytes were isolated and tested for inhibitory effects against a fungus newly isolated from the damaged

tissues of the hemp suffering from root rot. Our results showed that six bacterial isolates displayed repressive properties against the aforementioned fungus on petri dishes, i.e. in vitro. These six isolates were identified as *Paenibacillus polymyxa*, a plant-growth promoting rhizobacteria with a broad host range and a potential biocontrol agent. We will be examining the anti-pathogenic fungus effect of the six isolates *in vivo* (i.e., in hemp), and moving closer to providing an environmentally friendly solution in controlling hemp fungal diseases.

M. Mire and G. Zheng, Cooperative Research, Lincoln University. **GENES ASSOCIATED WITH ENVIRONMENTAL *ESCHERICHIA COLI.*** Environmental *Escherichia coli* (*E. coli*) can maintain their population outside of animal guts and, therefore, they can hamper the interpretation of current *E. coli*-based water quality (fecal pollution) monitoring because they were not indicative of presence of harmful fecal material. The objective of this study was to identify genetic markers for differentiating environmental *E. coli* from enteric ones, the latter truly presenting a fecal pollution. By the whole-genome comparisons, eight genes associated with environmental *E. coli* were identified using publicly available *E. coli* draft genomes of five strains of sedimental source (i.e., environmental *E. coli*) and 80 strains of fecal sources (i.e. enteric *E. coli*), including human, cattle, chicken, and pig origins. The preliminary results of polymerase chain reaction (PCR) assays using 182 *E. coli* strains isolated from the stream water demonstrated that *E. coli* isolates containing the genes were exclusively found in water samples obtained after rain but not from before rain. This may be explained by that sediment *E. coli* might have been stirred up by rain and/or environmental *E. coli* might have been brough into the stream from nearby land through rain off. In other words, the genes may be associated with environmental *E. coli*, which are useful for differentiating environmental *E. coli* from enteric ones and can provide a new tool for accurate water quality monitoring and management.

B. Odam, R. Johnson, B. Nevils, T. Hume, and S. Thapa, Department of Agriculture, University of Central Missouri. **MYCORRHIZAL SEED TREATMENT IMPROVES YIELD AND HARVEST INDEX IN CORN.** The application of mycorrhizal fungi and other bacterial inoculants as seed treatments is considered an effective method to increase crop yields. Mycorrhizal fungi produce branching filaments that act as virtual roots and help to extract more water and nutrients in return of taking sugar from plants. However, this symbiotic relationship between fungi and crop plants is not well considered by local growers for increasing corn yield. A corn field study was conducted in the University of Central Missouri farm in summer 2022 to investigate the effect of mycorrhizal seed treatment in growth and yield of three corn hybrids (P1197, P1222, and P1359). The experimental design was randomized complete block design (RCBD) with four replications. Con seeds were treated with MicoGold® at planting at 2 ounces of product per 50 lb seeds. Data for both the untreated and treated corn were collected by taking measurements of plant height, normalized difference vegetation index (NDVI), and leaf chlorophyll. At the physiological maturity, corn biomass, grain yield, and harvest index (HI) were compared among the treatments. Compared to untreated corn, the treated corn showed larger root systems (visual observation) resulting in significantly ($p<0.05$) higher biomass (6.22 vs. 5.24 ton/acre), grain yield (119.94 vs. 96.98 bu/ac), and harvest index (0.49 vs. 0.46). Therefore, mycorrhizal fungi treatment appeared to be a potential strategy to increase corn yield. Supported by University of Central Missouri, Office of Undergraduate Research.

C. Schroeder, N. Bathula, S. Sprague, Bai, H., and O. Perez-Hernandez, School of Agricultural Sciences, Northwest Missouri State University. **EFFECT OF TOP DRESS FERTILIZER NITROGEN AND PHOSPHORUS IN THE EMERGENCE AND GROWTH OF GIANT FOXTAIL (*Setaria faberi*) AND COMMON LAMBSQUARTERS (*Chenopodium album*).** Top dress fertilizer nitrogen (N) and phosphorus (P) is applied to emerged corn to nourish and promote growth. However, application can also promote growth and emergence of weeds, thus worsen weed problems. This aspect, though recognized, remains poorly understood. The objective of this research is to determine the effect of top dress fertilizer N and P in the emergence and growth of two troublesome weeds of corn: giant foxtail (*Setaria faberi*) and common lambsquarters (*Chenopodium album*). Five corn and 100 weed seeds (50 of each species) were planted in each of 8.3 x 8.3 x 8.5-inch pots containing substrate made of sand and a commercial potting mix. Two fertilizer treatments based on monoammonium phosphate (MAP) and diammonium phosphate (DAP), or no fertilizer (untreated) were top dressed in the pots at the V2 corn stage, and % weed emergence was periodically assessed seven days after treatment application. Treatments were assigned in a randomized complete block design with six replications. Assessments thus far (10 days after treatment application) suggest that % emergence of giant foxtail and common lambsquarters in the MAP and DAP treatments increased by at least 5% compared to that in the untreated control. Assessments of emergence of both weeds will continue until day 20 for a final comparison of treatment effect.

T. Wuliji, R. Lourencon, N. Tu, and D. Davis, College of Agriculture, Environmental and Human Sciences, Lincoln University. **ULTRASOUND SCANNING EVALUATION OF CARCASS TRAITS IN WEANING AND POST-WEANING ORGANICALLY RAISED MEAT SHEEP.** Ultrasound scanning (USS) technique has been routinely used in performance testing of meat animals, such as swine and beef cattle. This study is to evaluate USS application in organic lamb production, selection, and carcass traits prediction. Sixty ewes were bred, pregnancy diagnosed at 40 days post-mating, and their suckling lambs were assigned to two groups, a non-creep feeding (control) and creep feeding (treatment) group. Each group was balanced with sexes and litter size at 30 days old. Lambs had unrestricted suckling dams during pasture grazing or grazing with creep supplementation. There were 28 controls and 32 treatment lambs recorded at weaning 90 d age. Lambs were grazed either on pasture or grazing pasture with creep supplementation till 120 d old. Weaning weight, average daily gain (ADG), and post-weaning weight were 24.0 kg, 226 g/d, and 28.0 kg for treatment ($P < 0.05$) compared to control at 21.3 kg, 196 g/d, and 25.3 kg. However, ADG was not differed in post-weaning creep feeding performance. The USS back fat depth, loineye depth, width, and loineye area were 2.2 mm, 17.9 mm, 45.6 mm and 5.8 $cm^2$ at weaning age of 90 d; and 2.6 mm, 20.9 mm, 48.0 mm, and 7.0 $cm^2$ at 120 d respectively. There was no difference in carcass traits except backfat depth, which was significantly higher for treatment and female. The results indicate USS technique is effective in ram selection and meat sheep performance prediction. Creep feeding lambs increased ADG and weight, therefore, will enhance organic lambs market values.

**Atmospheric Science Science**

**Oral Presentations:**

C.A. Steward, N.I Fox, School of Natural Resources, University of Missouri – Columbia.
**NOWCASTING WITH AN X-BAND RADAR IN MID-MISSOURI.** The MZZU radar is an X-band dual-polarization radar operating at a 9.35 GHz located in central Boone County, Missouri. This radar offers high spatial and temporal resolution coverage, filling the data gap between the National Weather Service radars EAX and LSX. Nowcasting is the short-term prediction of precipitation and thunderstorms, within one to two hours, and a number of nowcasting methods have been tested on data from MZZU. This presentation will cover the methodology of nowcasting, including the processing of radar data, analysis of atmospheric conditions, and prediction algorithms. It will highlight the benefits and limitations of using an X-Band radar for nowcasting in Mid-Missouri, including attenuation, storm motion and storm development over several case studies. The preliminary results of the evaluation of the nowcasting systems, including accuracy and effectiveness in predicting short-term weather, will be discussed. This presentation touch on the potential application for nowcasting as it applies to emergency management, transportation and other industries that rely on weather information. Overall, the presentation will provide insights into the development and implementation of radar nowcasting with an X-band radar in Mid-Missouri and the potential for improving weather and hydrological forecasting in the region.

E. Travis, School of Natural Resources, University of Missouri – Columbia. **ATTEMPTING TO NOWCAST CONVECTIVE INITIATION USING VERTICALLY INTEGRATED DOPPLER-DERIVED DIVERGENCE**. The field of convective nowcasting is largely dominated by spatiotemporal tracking of rainfall features. Rainfall objects are identified and, using past radar imagery, are tracked through time and space. Future tracks are then extrapolated using a derived motion field. Save for computationally expensive techniques, there is little operational forecasters can do to nowcast convective initiation before it occurs. This study will attempt to determine if vertically integrated radar-derived divergence (convergence) fields, in accordance with the mass continuity equation, can be used to isolated areas of interest where convective initiation is likely to occur in the very near future in weakly-forced, unstable environments. These fields will then be compared with the naked eye to reflectivity fields to determine if features are evident prior to the appearance of reflectivity echoes. The results of this study will be discussed in the context of impacts to nowcasting and decision support services (DSS) for the operational meteorology industry.

K. Vigil[a,b], R. Walsh[a], J. Brost[a], M. Foster[a], and T. Nelson[a.c], [a]National Weather Service Operations Proving Ground, [b]Cooperative Institute for Severe and High-Impact Weather Research and Operations, [c]Cooperative Institute for Research in the Atmosphere.
**ESTIMATING TORNADO INTENSITY IN REAL TIME: AN OPERATIONS PROVING GROUND VIRTUAL DEMONSTRATION**. The Storm Prediction Center (SPC) has been working on research that tackles tornado intensity estimation. They have reviewed over 1,000 tornadic events to identify WSR 88D rotational velocity signatures, environmental data, and other factors that correlated with observed (surveyed) tornado intensity. Their research culminated in several published papers and a methodology for estimating tornadic intensity using low-level rotational velocity and Effective Significant Tornado Parameter. Born out of that

research, SPC created a simple web-based tool for their forecasters to use operationally when crafting mesoscale discussions. In July of 2022, The Operations Proving Ground (OPG) partnered with SPC to conduct an evaluation of this methodology during a 4-day virtual demonstration. Our goals were: (1) Expose forecasters to a skillful technique for diagnosing tornado intensity. (2) Evaluate if this methodology improved participant's ability to diagnose tornado wind speeds. (3) Evaluate if this methodology improved consistency of tornado tag application. This demonstration relied upon forecasters identifying rotational velocity. We found that depending on the nature of the event, meteorologists produced a range of rotational velocity values. This range ultimately produced underlying inconsistency in tornado intensity estimations person to person. We will show how the characteristics of the meteorologist (years of experience, experience with tornado warnings, geographic location, and job position) impacted the quality of the tornado intensity estimates, how individuals fared when they had access to the SPC tool versus without, and how access to the SPC tool affected the consistency with which considerable and catastrophic tornado tags were applied.

W. Gilmore, National Weather Service-Little Rock, Arkansas. **THE DECEMBER 10$^{TH}$, 2021 SEVERE WEATHER OUTBREAK: AN ARKANSAS PERSPECTIVE.** During the evening of December 10$^{th}$, 2021, severe thunderstorms developed over portions of Arkansas, and spread northeast into Tennessee and Kentucky. There were many reports of large hail and damaging winds, but long track tornadoes became the primary focus of this outbreak. This review will focus on the Arkansas perspective of this outbreak, discussing the evolution of storms as they developed over central Arkansas, one of which eventually developed into a long-lived cyclical tornado producing thunderstorm over multiple states. A review of forecast and observation data will be presented, including polarized radar data analysis. This study will discuss the challenges the warning forecasters faced during this event, and present some possible best practices to use in future warning situations.

C.C. Buonanno, National Weather Service-Little Rock, Arkansas. **THE WINTER STORM SEVERITY INDEX: AN OVERVIEW AND RECENT APPLICATIONS.** Several approaches have been developed in recent years that combine meteorological data with data from other sciences to deliver potential impacts caused by weather systems. One such tool developed in recent years is the Winter Storm Severity Index (WSSI). This GIS-based tool aims to highlight the overall level of potential societal impacts due to winter storms. This tool also provides measures for consistency in impact messaging and forecasts. An overview of this system will be presented, along with examples applied from recent high impact weather systems.

P. S. Market, School of Natural Resources, University of Missouri – Columbia. **ARE COMMERCIAL IN-CASE DEVICES FOR STRINGED INSTRUMENT HUMIDIFICATION RELIABLE?** The efficacy of a popular, commercially available, in-case humidifier is assessed for a musical instrument of solid wood construction in a commercially available case under typical household conditions. Data collection periods were conducted during which a humidifier was inserted into the body of the instrument, and the air temperature and relative humidity (RH) were measured and recorded: 1) inside the instrument; 2) inside the closed case but outside the instrument, and; 3) in the room, outside the instrument, but within 2 meters of the closed case. The two data collection periods were summer (July-August 2020) and winter (February-March 2021), for a mid-latitude, continental location, with a Köppen Cfa

(humid, subtropical) climate. Data for summer 2020 show a mean increase of 5% RH inside the instrument body cavity above the room background (N=5337). The winter of 2021 showed a similar mean increase of 8% RH inside the instrument body cavity above the room background (N=5039). However, during the U.S. record cold of February 2021, RH differences were as large as 20% higher in the instrument. It is clear that commercially available, in-case humidifiers do work, on average contributing only modest humidification to cased instruments, but performing admirably in anomalously dry conditions.

J. Bongard and P. S. Market, School of Natural Resources, University of Missouri – Columbia.
**ESTIMATING TOPOGRAPHIC INFLUENCE OF OZARK PLATEAU INDUCED COLD-AIR DAMMING THROUGH WRF MODELLING TECHNIQUES.** This presentation centers around the third segment of a larger 3-segment research study devoted to identifying the existence of cold-air damming associated with the Ozark Plateau. Cold-air damming is weather phenomena in which a low-level layer of cold air becomes trapped against the boundary of a topographic feature. The phenomena is commonly associated with the southern Appalachian mountains in the eastern United States and the Front Range of the Rocky Mountains in Colorado. To date, the Ozark Plateau and its subsequent elevations have not been evaluated to determine influences on the local weather patterns and possible creating of these cold-air damming events. The scope of this research is to find and analyze possible times when the Plateau did in fact influence a cold-air damming event. For the third segment of research the Weather Research and Forecasting (WRF) model was utilized to manipulate terrain to determine the extent of influence the Ozark Plateau may have in potential cold-air damming scenarios. Two case studies were chosen for analysis, one a marquee case in which cold-air damming is quite evident, and another in which cold-air damming is occurring but its impact not as prominent as the other case. Terrain is altered in a way that doubles the elevation, flattens the elevation, and reduces the elevation by half of its original scale. These alterations are compared to a control simulation and the analysis and resulting are presented here to help determine the influence of the Ozark Plateau in these anomalous events.

**Biochemistry, Biomedicine, & Biotechnology Section**

**Oral Presentations:**

A. Cortright, and M. Ghosh-Kumar. Department of Biology and Chemistry, Cottey College. **QUANTITATIVE ANALYSIS OF MICROCYSTINS IN WATER BODIES FROM SOUTH-WEST MISSOURI**. Hepatotoxic, water-soluble heptapeptide microcystins (MCs), produced by several genera of aquatic cyanobacteria pose adverse health effects in human and in other animals. Consuming contaminated water and food is the primary source of exposure of microcystins. While the maximal tolerable dose of microcystins in case of chronic human exposure is still under investigation, an inhibitory competitive ic-ELISA was developed to quantify MC-LRs and MC-RRs, the two most potent microcystins, from several water sources in south-western Missouri. The method was able to detect microcystin levels from picomolar to micromolar range in both purified and unpurified water samples. Our results demonstrated that toxin levels varied from 0.0 ng/L to 10.0 ng/L in natural surface water throughout the year with reservoir being the highest level in spring compared to the stream water. On the other hand, toxin concentration of untreated tap water ranged up to 5.0 ug/L (with spatiotemporal variation), which is well above the 10-day drinking water health advisories (0.3 ug/L -1.6 ug/L) published by the EPA in 2015. Further work needs to be done to analyze the sources of this contamination in our local tap water; however, our results reinforce the necessity of better regulation and purification system under the Safe Drinking Water Act. Supported by the STEM grant from Cottey College.

J. Cox and J. Smith. Department of Biomedical Sciences, Missouri State University. **CHARACTERIZATION OF THE OVEREXPRESSION OF RECA HOMOLOGS DMC1 AND RAD51 IN *TETRAHYMENA THERMOPHILA***. Two RecA homologs, DMC1 and RAD51, work to repair DNA double-strand breaks (DSBs) within the cell through the recombination of homologous sections of DNA. While DMC1 works to repair programmed DSBs through meiotic recombination, RAD51 functions to repair both meiotic and non-meiotic DSBs, the latter being repaired through the repair process of homologous recombination. Double-strand breaks can occur through various endogenous and exogenous agents, and when not repaired can cause harmful genomic rearrangements and mutations. Chemotherapeutics are an exogenous agent that work to form DSBs in cancer cells, attempting to inhibit the cells from further spread. However, a hyper-recombinant phenotype is often seen in cancer cells due to the overexpression of RAD51. This leads to drug resistance, the persistence of cancers, and an overall poor patient outcome. To work to prevent this issue, further research is being conducted on the function of RAD51. In the model organism *Tetrahymena thermophila*, an amacronuclear phenotype is observed only at high temperatures, such as 35 °C, when RAD51 is overexpressed. Further evidence shows that this phenotype is more affected from the change in temperature rather than only the temperature itself. This is due to a complication in the elongation of the macronucleus, and due to the continuation of DNA synthesis, results in a macronucleus containing up to 5 times the normal genetic content. When DMC1 is overexpressed, no notable phenotype is observed. When studying the relationship between the mutation and survivability of cells when treated with UV and MMS, no strong correlation was observed.

S. Harris and K. Kim. Department of Biology, Missouri State University. **APOPTOTIC PATHWAY PROTEIN EXPRESSION VARIANCE IN METAL OXIDE AND QUANTUM DOT TREATED HELA CELLS**. Using the HeLa cell line as a cancerous model, apoptotic protein expression was assessed upon various nanoparticle treatments. Utilizing a known chemotherapeutic agent, cisplatin, as a positive control for induction of apoptosis, several metal oxides and quantum dots were investigated for their ability to express apoptotic markers. ZnO, CuO, green CdSe/ZnS, and green InP/ZnS were treated for 24 hours at their IC50 value. Western blot techniques were used to measure protein expression of phosphorylated p53 (ser15), PUMA, and p21 which are involved in signal transduction of apoptosis. CuO, ZnO, and CdSe/ZnS demonstrated considerable p53 activation at 24 hrs compared to the non-treated control. At the IC50 value, CdSe/ZnS quantum dots were the quickest at activating p53 by phosphorylation at the Serine 15 residue. Together, our results provide new insight into the apoptotic mechanism behind these treatments and lead to improved treatments against cancer.

D. James and J. Wang, Department of Biomedical Sciences, Missouri State University. **$P2Y_2$ RECEPTOR INVOLVEMENT IN ENDOTHELIAL CELL PERMEABILITY.** The endothelium lining the luminal surface of the vascular wall is pivotal in hemostasis, organismal homeostasis, and inflammatory response. Interestingly, inflammation is involved in processes of broad disorders and diseases such as atherosclerosis, diabetes, cancer, and vasculitis. Inflammation has a profound effect on increasing endothelial permeability. Previously, our group has shown that the activation of $P2Y_2$ receptor ($P2Y_2R$) increases permeability *in vivo*. However, the direct mechanism is not fully understood. The goal of this project is to determine the molecular mechanism of $P2Y_2R$-induced increase in permeability using murine microvascular endothelial cells (MEC), an *in vitro* model. Our first aim is to measure permeability in response to uridine triphosphate, a P2Y2R agonist, in wild type (WT) and P2Y2R knock out (KO) primary cultured MEC. Endothelial permeability will be assessed by using Transwell Permeable Supports with albumin-fluorescence complex. Fluorescence intensity will be quantitatively measured using spectrophotometry. Identifying the mechanistic involvement of MEC $P2Y_2R$ in regulating permeability will contribute to better understanding of vascular leakage in inflamed tissue and facilitate the development of potential therapeutic treatment of diseases associated with inflammation.

K. Kendrick, S. Moore, C. Barron, and R. Ulbricht. Department of Biomedical Sciences, Missouri State University. **INFLAMMATION, SEX, AND TISSUE DEPENDENT GENE EXPRESSION AND RNA EDITING IN MICE.** Inflammation occurs as a result of insult or infection within the body. Individual cells respond to inflammation by upregulating genes that help mediate the immune response. One of these genes is ADAR1. ADAR1 helps regulate the immune response but also catalyzes a process called RNA editing. RNA editing alters the sequence of select mRNAs to alter the proteins they encode. The result is altered function of the protein, often in a way that benefits the cell. Our goal was to determine the inflammation-dependent affects ADAR1 function. Since we know that the effects of inflammation vary between different organs of the body and between sexes, we examined ADAR1 function in heart, brain, and muscle in male and female mice after the introduction of an inflammation-inducing agent called LPS. We found that editing in the heart and brain was unaffected. But RNA editing of FLNB in skeletal muscle was increased 5% by LPS treatment but was unaffected in females. Another RNA editing target, FLNA was unaffected by the treatment, but showed a sex-dependent difference in editing. These results

show that the effects of inflammation may selectively affect the function of FLNB in muscle. Furthermore, expression of inflammatory factors ADAR1, TNFα, and MDA5 was induced by LPS treatment, as expected, but TNFα and MDA5 expression was induced more in females than males. Our work suggests that the impact of sex on inflammatory factors may also indirectly affect the rate of RNA editing of select transcripts in select tissues.

I. Lee, C. Rippe, A. Brown, and C. Lupfer. Department of Biology, Missouri State University. **CUL3 NEGATIVELY REGULATES NLRP12-MEDIATED INHIBITION OF THE NF-κB SIGNALING PATHWAY.** Nod-like receptor family pyrin domain-containing protein 12 (NLRP12) is mainly known for its inhibitory function on NF-κB signaling in innate immune cells, and more recently, for its ability to regulate chemokine signaling and ubiquitination of the immune receptor RIG-I. Through a yeast 2-hybrid screen, the Lupfer lab previously discovered that NLRP12 interacts with other ubiquitin-associated proteins including CUL3. This research was conducted to investigate the interaction between NLRP12 and CUL3 in human cells and examine the role in regulating NF-κB signaling. Co-immunoprecipitation, followed by western blot analysis and confocal microscopy confirmed the interaction in HEK293T. Then, we wanted to know how the interaction affects NF-κB activation. HEK293T cells that express TLR2 were co-transfected with NLRP12 and CUL3 and treated with peptidoglycan (1 μg/mL) for 0, 0.25, 0.5, 1, and 4 hours. Then, NF-κB activation was assessed by western blot for IκBα phosphorylation. Although NLRP12 suppressed NF-κB activation, the co-transfected cells did not show a significant difference from our control transfected cells. Furthermore, IL-8 levels were higher in co-transfected cells. Finally, we examined NLRP12 by coimmunoprecipitation and western blot and observed that CUL3 increased the ubiquitination of NLRP12. These data suggest that CUL3 negatively regulates NLRP12, preventing it from inhibiting NF-κB signaling by ubiquitinating NLRP12 itself. Supported by Missouri State University.

E. Liimatta, E. Schmoll, and J. Smith. Department of Biomedical Sciences, Missouri State University. **CHARACTERIZATION OF THE NOVEL UV RESISTANCE PHENOTYPE IN *TETRAHYMENA THERMOPHILA* WITH RAD23 DELETED.** Nucleotide Excision Repair (NER) is an essential process which when mutated results in diseases such as Xeroderma Pigmentosum and Cockayne Syndrome. The NEF2 complex, made up of proteins RAD4 and RAD23, is indispensable in recognizing bulky lesions in the genome caused by mutagens and UV radiation. RAD4 has been shown to both be degraded and not work as effectively if RAD23 is not present. However, research on this protein is lacking. The current research has mainly concerned Saccharomyces cerevisiae, and the deletion of RAD23 has shown to lead to a decrease in cell survivability when exposed to UV radiation. However, in recent years novel research has shown that deletion of RAD23 in the ciliated organism Tetrahymena thermophila leads to an unexpected ~150% increase in cell survivability following UV treatment. This result is hypothesized to be caused by an unknown function of RAD23 in the cell cycle. If RAD23 contains this function then its deletion could imbalance the cell cycle causing the cell to not undergo apoptosis when damaged. Tetrahymena may showcase this function better than Saccharomyces due to its dimorphic nuclei and polyploidy nuclear nature. Survivability assays testing homologous recombination in the same cell lines have been performed. Preliminary data supports the hypothesis of RAD23 having a cell cycle function. A novel role of RAD23 in the cell cycle would be important knowledge leading to possible new drug targets used to treat skin cancer as well as targeted gene therapy for people suffering from Xeroderma Pigmentosum and associated disorders.

C. Tong[a], N. Kanwar[a], B. Seelig[a], and D. Morrone[b], [a]Department of Biochemistry, Molecular Biology, and Biophysics, University of Minnesota [b]Department of Basic Sciences, University of Health Sciences and Pharmacy in St. Louis. **ENGINEERING AN ARTIFICIAL RNA LIGASE THROUGH NUCLEIC ACID BINDING DOMAIN ADDITION.** Naturally evolved extant enzymes often make use of multiple domains in addition to a catalytic domain. Protein evolution can proceed not only through point mutations, but also through addition of domains to a catalytic domain. Borrowing from this natural approach of domain acquisition, we sought to improve catalytic activity in a previously isolated artificial RNA ligase that was selected and evolved from a randomized pool of DNA. That earlier work used mRNA display to select and evolve an artificial enzyme catalyzing the 5'PPP to 3'OH ligation of a splinted piece of RNA, a reaction for which there is no known natural enzyme. Despite the novelty of this RNA ligase enzyme, it was found to have low ligation activity. To improve the activity of this artificial RNA ligase, we engineered different combinations of fusion-domain variants with the ligase. These fusion domains ranged from 4 to over 250 amino acids in length and were combinations of various nucleic acid binding domains or motifs placed at the N or C termini of the artificial RNA ligase. All the chosen fusion domain partners were based on naturally occurring sequences of amino acids. We hypothesized that an increase in substrate binding through the addition of nucleic acid binding domains could increase catalytic activity. Among our engineered fusion-partner variants we found a range in effect, and some designs increased catalysis several-fold. However, fusion-partner approaches that increased catalysis in DNA ligases were found to be unsuccessful at increasing catalysis with RNA ligases. These results demonstrate the feasibility of applying simple features of natural evolution to protein engineering. Supported by NIH GM108703; Simons Foundation 340762; NASA 80NSSC21K0595.

O. Okafor and K. Kyoungtae. Department of Biology, Missouri State University. **THE EFFECT OF QUANTUM DOTS ON ENDOCYTOSIS, EISOSOME, AND VACUOLE ORGANIZATION**. Our recent RNA sequencing analysis of yeast treated with red CdSe/ZnS-COOH QDs identified several differentially expressed genes, including *DID2, SEG1, SEG2, COS10,* and *APS2*. Based on the findings, we hypothesize that QDs may directly or indirectly affect cargo sorting at the late endosome and vacuole, cell cycle regulation, eisosome organization, and endocytic vesicle maturation. Although mRFP-Cps1, a cargo destined for the vacuole, was properly targeted to the vacuole, we unexpectedly found a severe fragmentation of vacuole in the QD-treated yeast cells. We also observed increased recruitment of Pil1-GFP, an eisosome marker in a similarly treated condition. Finally, we found that Sac6-GFP, an actin-binding protein at the endocytic site, exhibits an extremely slow turnover rate in the presence of QDs. In conclusion, this study provides novel insights into the cellular and molecular mechanisms behind QD-mediated cytotoxicity in fungal yeast cells.

P. Sheridan, D. Hirst, C. Jerome, M. Govardhan, T. Nguyen, and A. Barry. Department of Biology, Missouri Southern State University. **DISCOVERY OF CHILAIDITI'S SYNDROME DURING DISSECTION OF AN 88-YEAR-OLD MALE WHOLE BODY DONOR.** Chilaiditi's syndrome is a rare intestinal disorder characterized by the anterior interposition of the colon between the liver and right hemidiaphragm. The condition is estimated to be present in 0.025-0.28% of the population, with the prevalence in males being four times that of females. Patients with Chilaiditi's syndrome are generally asymptomatic, but common symptoms include

abdominal pain, vomiting, and indigestion. The etiology of Chilaiditi's Syndrome is unknown. However, current theories include dolichocolon, laxity of the falciform ligament, diaphragmatic paralysis, and increased intraabdominal pressure from ascites. Many cases are believed to be misdiagnosed due to the presentation and radiological similarities to pneumoperitoneum. During an undergraduate cadaver dissection, an 88-year-old male whole-body donor (WBD) was found with the qualifying aspects of this condition. WBD underwent a whole-body computed tomography (CT) scan prior to dissection. CT scan demonstrated an atypical course of the colon, revealing a segment of the transverse colon distended with gas between the liver and right hemidiaphragm positioned at the right atrium level. Dissection of the abdominal cavity confirmed CT scan findings revealing interposition and displacement of the transverse colon. In addition, the sigmoid colon was discovered in the right lower quadrant, forming a "pseudotransverse" colon. The colon was 188 cm long, 30.5 cm longer than a typical colon in a male. Histological samples of the transverse colon wall indicated a high level of inflammation and destruction of the mucosa. Proper knowledge surrounding this syndrome is imperative for effective treatment of its complications and the differential diagnosis of pneumoperitoneum.

**Poster Presentations:**

Asa Borup. Department of Chemistry, Missouri Southern State University. **OPTIMIZATION & SYNTHESIS OF PROPARGYLIC ETHERS FOR USE IN THE SYNTHESIS OF METABOTROPIC GLUTAMATE RECEPTOR ANTAGONISTS.** Recent studies have found elevated concentrations of glutamate, an excitatory neurotransmitter, in the blood and certain regions of the brain of those affected with autism spectrum disorders (ASD). It is theorized that hyper-glutamate concentrations in specific regions of the brain could potentially contribute to some ASD. Therefore, inhibition of the glutamate receptor is a potential mechanism for treating ASD, though there are currently no glutamate receptor antagonists approved for the treatment of ASD. A series of potential allosteric antagonists of the metabotropic glutamate receptor 5 (mGluR5) has been designed. The synthesis of these inhibitors involves the [3+2] cycloaddition of aryl-substituted benzyl azides and aryl-substituted propargylic ethers. 4-bromophenol was used as the preliminary substrate for the synthesis of the first propargylic ether. Using a microwave reactor, a variety of reaction conditions were attempted in order to optimize the synthesis. Later, the reactions were attempted with different substituted phenols. Reaction progress was monitored using gas chromatography. Using a solution of tert-butoxide in tert-butanol led to complete reaction of the starting reactants and produced 1-bromo-4-(prop-2-yn-1-yloxy)benzene. Using these optimized conditions, the synthesis of a small library of substituted aryl propargyl ethers is reported

E. Braun and N. Lee. Department of Biology, Missouri State University. **IDENTIFICATION OF QUANTUN DOT BINDING PROTEINS.** Quantum dots (QDs) are semiconductive nanoparticles with unique optical and electrical properties. QDs have a wide range of applications from solar energy cells to medical imaging. While using QDs can be beneficial, they are known to be toxic to living organisms. Furthermore, recent literatures have shown that QDs are endocytosed by cells and distribute to various organelles. Thus, it is essential to study the interaction between quantum dots with proteins to have a more rounded understanding regarding the mechanism of QDs' toxicity. In our study, we used the budding yeast *Saccharomyces cerevisiae* as a model organism to investigate the interaction between QDs and proteins. Specifically, we wanted to see

which yeast proteins can bind to QDs. Ultimately, it was found that QDs can interact with several proteins *in vitro*, including those that are essential for translation, mitochondrial formation, transcription regulation, Golgi to multi-vesicular body and actin cytoskeleton. To confirm these results, we assessed the decreased mobilities of these proteins in native gels upon interaction with quantum dots. Overall, our results revealed that QDs are able to bind with yeast proteins, hinting that QD-protein interactions might be another mechanism for QD toxicity.

M. Brummett, Z. Zimny, and A. Agah. Department of Chemistry, Park University. **NEOPLASTIC RESPONSE EVALUATION USING THE DISC BIOASSAY.** Agrobacterium tumefaciens is a soil microbe that induces a neoplastic response in a wide variety of plant species. The bacterium produces tumors that appear to be histologically similar to those found in human. Agrobacterium tumefaciens contains a tumor inducing (Ti) plasmid that is essential for the delivery of the pathogen into the host genome consequently transforming normal plant cells into autonomous tumor cells. The essential regions of the Ti plasmid include six major operons Vir A, VirB, Vir C, VirD, VirE and VirG encoding for virulence genes; and the transfer DNA region, a section of the Ti plasmid that is transferred via conjugation into host plant cells. The molecular events by which Ti plasmid is integrated into the host genome remain elusive. Agrobacterium tumefaciens has proven to be an efficient DNA delivery system for production of biomedically important macromolecules and therapeutics. In the current study, we have utilized the disc bioassay to evaluate the tumorigenic response in various plant tissues. Our data indicate that the neoplastic response induced by Agrobacterium tumefaciens varies significantly amongst the panel evaluated.

C. Dattel*, S. Hira*, A. Mahroke, E. Hayes, S. Reddy, A. Parker, and J. Staudinger. Kansas City University- Joplin. **SUBSTANCE USE DISORDER, THE ORAL MICROBIOME, AND ASSOCIATED MEDICAL AND DENTAL HEALTH OUTCOMES: FUTURE OPPORTUNITIES TO PREDICT AND PREVENT DISEASE IN AN UNDERSERVED POPULATION.** * Authors contributed equally to project. Substance use disorder is an ongoing health issue throughout the United States and the Four States region, likely contributing to prevalent chronic dental and medical diseases seen in this region. The data presented here have broad social and economic implications in light of the fact that these patients affected by substance use are often overlooked in the healthcare industry. Our findings provide key insight and social context for future physicians and dental healthcare providers, while engaging with this uniquely vulnerable population of individuals in our region. We highlight exciting near-term biomedical research opportunities for students at KCU across our programs using the newly acquired Next-Generation Sequencing (NGS) capabilities at this university in Joplin, Missouri. This NGS platform will be used to determine the extent to which identified dysbiosis of the oral microbiome can be used to predict and ultimately prevent poor health outcomes in people with substance use disorder. The long-term desired outcome of these studies will be to provide interdisciplinary research opportunities for students, thereby shaping the careers of our regional future healthcare providers and help improve the well-being of people in our community. Supported by Internal KCU Faculty Award.

J. Drecker, H. Matheney, M. Havlicek, and A. Hulme. Department of Biomedical Sciences, Missouri State University. **SPTBN1 INVOLVEMENT IN REVERSE TRANSCRIPTION OF HIV-1 IN CHME3 CELLS.** Human Immunodeficiency Virus 1 (HIV-1) is a lentivirus that infects CD4+ cells. When left untreated, the virus will attack the immune system leading to Acquired Immunodeficiency Syndrome (AIDS). While there is no cure available, treatments can slow disease progression. HIV-1 utilizes host proteins to complete viral replication. SPTBN1 is a molecular scaffolding protein. Dai and Gallo's studies show that SPTBN1 knockdown inhibits HIV-1 infection. However, the viral replication steps that SPTBN1 impacts are not known. Previous work has shown that SPTBN1 knockdown delays HIV capsid uncoating but does not impact viral fusion kinetics. The uncoating and reverse transcription steps of HIV replication can influence each other. Therefore, the goal for this study is to analyze the impact SPTBN1 knockdown has on the reverse transcription of HIV-1 in microglial cells. Knockdown SPTBN1 cells will be tested for completion of reverse transcription with a GFP reporter virus. Cells will then be exposed to a reverse transcriptase inhibitor at different time intervals. If SPTBN1 affects reverse transcription, then knockdown cells will show delayed infection compared to the control. This study will better describe how SPTBN1 influences HIV replication and could be helpful in developing future therapeutical targets for HIV-1 patients.

K. Franklin, R. Jani, N. Gugnani, and A. Burris. Department of Biology and Environmental Health, Missouri Southern State University. **EFFECT OF AMINO ACID DEPRIVATION ON PROTEASOME LOCALIZATION AND MITOCHONDRIAL MORPHOLOGY.** Large protein complexes, called proteasomes, are integral to many cellular processes including degradation of misfolded or damaged proteins. This is essential as accumulation of these proteins can contribute to diseases, like cancer and Alzheimer's. Proteasomes function in both the nucleus and cytoplasm; however, under various cellular stresses, like glucose starvation, the proteasome leaves the nucleus and enters into cytoplasmic granules. This translocation can be caused by various nutrient stresses as well as when aerobic respiration and ATP synthesis are blocked by chemical inhibitors. This suggests that proteasome localization and function is affected by ATP production and metabolic processes carried out in the mitochondria whose morphology is also affected upon starvation. Amino acids feed into respiration as a nutrient source, so this project aims to determine if a lack of certain amino acids cause altered mitochondrial morphology or proteasome localization. A strain of *Saccharomyces cerevisiae* containing a GFP fluorescent tag on mitochondrial protein CIT1, as well as an mCherry tag on proteasome subunit Rpn1, was used to monitor fragmentation and localization following threonine and phenylalanine starvation. For preliminary results, cell growth conditions have been optimized and non-starved cells show mitochondrial morphology as tubules and proteasomes enriched in the nucleus.

K. Getchell*, M. Shah*, K. Barnes, C. Tindell, and J. Staudinger. Kansas City University- Joplin. **VALIDATION OF A SALIVARY CORTISOL ELISA ASSAY IN THE BIOMEDICAL RESEARCH LABORATORY (BMRL) AT THE MISSOURI SOUTHERN STATE UNIVERSITY-KCU RESEARCH CONSORTIUM (MKRC).** * These authors contributed equally to the work. Cortisol is the most abundant circulating steroid and the major glucocorticoid secreted by the adrenal cortex. When used as a medication, it is known as hydrocortisone. Salivary cortisol is frequently used as a biomarker of the psychological stress response. However, psychobiological mechanisms, which trigger the hypothalamus-pituitary-adrenal axis (HPA) can only indirectly be assessed by salivary cortisol measures. The measurement of cortisol can help

identify (**1**) bodily changes that are stressor-specific, (**2**) people at risk for the development of stress-related disorders, and (**3**) the efficacy of interventions aimed at stress reduction. Competition occurs between an unlabeled antigen (present in standards, controls, and patient samples) and an enzyme-labeled antigen (conjugate) for a limited number of antibody binding sites on the microplate. The washing and decanting procedures remove unbound materials. After the washing step, the enzyme substrate is added. The enzymatic reaction is terminated by the addition of the stopping solution. The absorbance is measured on a microtiter plate reader. The intensity of the color formed is inversely proportional to the cortisol concentration in the sample. A set of standards is used to plot a standard curve from which the amount of cortisol in patient samples and controls can be directly read. These studies lay the foundation for future studies that seek to determine the extent to which mind-body interventions will reduce stress levels in various study subjects including student-athletes, first responders, and those individuals with post-traumatic stress disorder in our local community. Supported by Internal KCU Faculty Award.

A. Brawley, H. Goehl, J. Griffin, N. Lopez, M. Patel, S. Reardon. Department of Biology, Culver-Stockton College. **ANNOTATION OF MYCOBACTERIOPHAGE HASHROD.** The phage Hashrod is a siphoviridae bacteriophage identified from the host *Mycobacterium smegmatis Mc²155*. It was extracted from a soil sample at Merrimack College in Andover, Massachusetts and was annotated by students at Culver-Stockton College in Canton, Missouri. HashRod is a temperate phage in the A cluster, A3 subcluster, and is 50,905 base pairs in length. Auto-annotation was carried out using the DNA Master built-in databases, Glimmer and Genemark, using bioinformatic prediction models. The genomes were further annotated to determine if there were any genes in need of addition or deletion, their putative function, and start and stop codons. Annotation databases included: NCBI Blast, PhagesDB, Genemark coding potential, HHPRED, Phamerator, and Starterator. HashRod had 3 tRNAs, and 90 genes, with 36 in the forward direction, and 57 in the reverse direction. The majority of the genes in the Hashrod genome encode products of no known function, Lysin A, Lysin B, major and minor tail protein, scaffolding protein, tail terminator, capsid maturation protease, and portal protein were among the common gene products encoded. Additionally, a few membrane proteins were also identified. Bacteriophages can play an essential role in the medical field as they can be used to treat antibiotic-resistant bacterial infections. This process is called phage therapy and it is not a common treatment plan because it is in its early stages and phages are very host specific. Overall, by discovering more phages this treatment might become a more readily available and viable option.

M. Gregory, R. Moon, P. Brooks, J. Smith, and A. Brodeur. Department of Biomedical Science, Missouri State University. **HYPOCHLOROUS ACID AS AN ANTIMICROBIAL TREATMENT PREVENTING INFECTION IN COMPOUND FRACTURES.** Compound fractures are susceptible to bacterial infection due to environmental exposure. Irrigation of the fracture is a common method to prevent infection. There is not yet a clinical practice guideline in terms of the type of irrigation solution to be used. The goal of this work is to explore if hypochlorous acid irrigation solution is effective at killing bacteria, while being non-toxic to human osteoblasts, and to determine the therapeutic window for use of hypochlorous acid in irrigation of compound fractures. Hypochlorous acid is commonly used in cleaning solutions, wound treatment, and is naturally produced by the human body as part of a natural immune response. Some sources in the literature suggest that hypochlorous acid may cause cellular damage and change the way in which the cell functions. First, we generated cultured osteoblast cells, which

will serve as the model for exposed cells in compound fractures. Next, we incubated osteoblasts in hypochlorous acid at various concentrations to determine the maximum concentration that will result in osteoblast cell death. Finally, we investigated at what concentration (ppm) hypochlorous acid inhibits the growth of opportunistic pathogens such as: *E. coli*, *Pseudomonas Aeruginosa*, and *Staphylococcus Aureus*.

N. Gugnani, R. Jani, K. Franklin, and A. Burris. Department of Biology and Environmental Health, Missouri Southern State University. **EFFECT OF NUTRIENT DEPRIVATION ON PROTEOSOME TRANSLOCATION IN A PETITE YEAST STRAIN.** Petite yeast strains are unable to grow when provided nonfermentable carbon sources such as glycerol. This slow-growing phenotype can be caused by various mutations, such as those in either the mitochondrial or nuclear genome and can sometimes be caused by lack of mitochondria altogether. Evidence suggests that the genetic manipulation of proteasome subunits and accessory proteins can produce petite mutants. The proteasome is a large multi-subunit complex which degrades intracellular proteins to prevent them from accumulating in the cell and causing disease. Proteasomes function in the nucleus and cytoplasm and it has been shown that when wild-type cells are subjected to stress conditions, like nutrient starvation, the proteasome is exported out of the nucleus. Chemical inhibition of mitochondrial function can also cause proteasome export, but the fate of proteasomes in a petite strain subjected to nutrient starvation has yet to be explored. The aim of this project is to track proteasome dynamics in a petite yeast strain. Preliminary results in non-starved cells show that the proteasomes are localized to the nucleus in both wild-type cells and the petite mutant.

J. Hart, C. Punzo, and K. Walton. Department of Biology, Missouri Western State University. **THE EFFECTS OF PREBIOTICS ON THE SUSCEPTIBILITY TO DEXTRAN SODIUM SULFATE-INDUCED COLITIS IN MICE.** Inflammatory bowel disease (IBD) encompasses two chronic inflammatory diseases of the colon. We induced colitis in six mice with eight days of oral administration of dextran sodium sulfate (DSS), a widely used animal model of IBD. Seven days before the DSS treatments, three of the six mice were treated with fructooligosaccharide (FOS), a prebiotic fiber molecule, to observe their susceptibility to DSS colitis induction. Two mice in a separate control group received neither DSS nor FOS. At the end of DSS treatment, colon tissue was collected for RNA analysis and histology. Preliminary results from RT-PCR and quantitative PCR for several pro-inflammatory cytokines and tight junction proteins indicated that there was not a significant difference between the FOS-treated group and the DSS only group. This suggest that FOS may not be beneficial to reduce inflammation in IBD patients.

S. Hira[a], A. Parker[a], S. Giang[a], C. Dattel[a], E. Goodrow[a], A. Mahroke[a], K. Hillyer[a], K. Bierman[a], K. Dawson[a], B. Stevens[a], C. Reagen, J[a]. O'Keefe[a], J. Mazhil[a], H. Maher[c], H. Eckhart[b], J. Eldred[b], D. Beck[b], G. Budd[b], K. Boyington[b], A. Morgan[b], E. Gonzalez[b], K. Rose[b], M. Armstrong[b], M. Smith[b], N. Gilstrap[b], M. Bailey[b], R. Smith[b], N. Fry[b], & E. Roman[b], and J. Staudinger[a]. [a]Kansas City University, Department of Basic Science, [b]Missouri Southern State University, Department of Social Work, [c]High-Rise Yoga. **IMPROVING HEALTH OUTCOMES IN STUDENT ATHLETES AT MSSU, A PARTNER INSTITUTION IN JOPLIN MISSOURI.** The Missouri Southern State University (MSSU)- Kansas City University (KCU) Research Consortium (MKRC) presents an interdisciplinary research study. This study seeks to determine the extent to which clinical yoga improves stress levels, both perceived and measured, in MSSU student athletes

by engaging the women's soccer team as study participants. Health outcomes related to the stress response were measured via the biomarker cortisol as measured using ELISA and saliva as a biosample. Student doctors collected study participant vital sign measures including heart rate, body temperature, blood pressure, respiratory rate, oxygen saturation, height, and weight. Perceived stress was measured using self-report questionnaires and scales that seek to quantify aspects of psychosocial and mental health parameters. KCU-COM student doctors collected vital signs at specific time points throughout the study. These vital signs are indirect measures that reflect the stress response. This study also sought to strengthen the interface with an important community partner in Joplin through interaction with faculty in the Social Work Department and their senior level students who were paired with our student doctors at KCU as a team. The desired outcome of this study will likely inform the extent to which the practice of clinical yoga improves the well-being of student athletes at this university, and in general, folks in the community. Supported by Internal KCU Faculty Award.

D. Hirst, U. Nguyen, P. Sheridan, C. Evenson, D. Patel, S. Kuhnert, K. Kilmer, and A. Barry. Department of Biology, Missouri Southern State University. **THE CATECHOLIMINERGIC COMPONENT WITHIN CERVICAL VAGUS NERVE INFLUENCES HEART REMODELING: A PILOT STUDY.** The parasympathetic and sympathetic divisions of the autonomic nervous system control cardiac functions. Increased sympathetic outflow is involved in cardiac remodeling leading to the development and progress of congestive heart failure. Concurrently, parasympathetic activity may exert a protective effect on the heart. The Vagus Nerve (VN) is known as a principal source of parasympathetic fibers to the heart. However, the presence of catecholaminergic fibers, presumably postganglionic sympathetic, has been detected through immunohistochemical assessment of the VN with anti-tyrosine hydroxylase (TH) antibody. The present study aimed to evaluate the correlation between the quantity of TH+ fibers within the cervical VN and the degree of heart remodeling. Cervical VN samples were collected bilaterally from 6 embalmed cadavers (male n=3, females n=3) at superior and inferior cervical ganglia levels for histological examination. All samples were validated for TH reactivity. Heart dimensions and wall thickness were measured before collecting myocardium for histological processing. Samples were harvested from both ventricles, interventricular septum and stained with trichrome to validate the presence of Connective Tissue (CT). All slides were photographed for quantitative analysis using ImageJ. The linear regression showed a significant positive correlation between the thickness of the right ventricular wall and the number of TH+ fibers in the left VN ($p=0.02$). A trend towards increased CT within both ventricles and TH+ fibers within the right VN was apparent. The sympathetic component within VN can lead to augmented sympathetic outflow to the heart and reduction in the cardioprotective function of parasympathetic influence, thus, increasing cardiovascular risk.

R. Jani, K. Franklin, N. Gugnani, and A. Burris. Department of Biology and Environmental Health, Missouri Southern State University. **EFFECT OF GLYCEROL AND RAFFINOSE ON PROTESOME LOCALIZATION FOLLOWING NITROGEN AND GLUCOSE STARVATION.** Proteasomes are large, multi-subunit complexes that degrade dysfunctional and misfolded proteins. Proteasomes can be divided into two major subcomplexes, the regulatory particle (RP) and the core particle (CP). When yeast (*Saccharomyces cerevisiae)* cells are under stress, such as nutrient deprivation, the proteasome is translocated from the nucleus. When cells are starved of both nitrogen and glucose, the proteasome leaves the nucleus and coalesces into foci

in the cytoplasm called proteasome storage granules (PSGs) which also form when starved of glucose alone. This indicates that the signaling response of glucose starvation overrides that of nitrogen starvation as proteasomes in nitrogen-starved cells are sent to the vacuole for degradation through autophagy This study aims to determine whether proteasomes are sent to PSGs or the vacuole when cells are initially grown in a carbon source other than glucose (YPD). Yeast cells were grown in either YPR or YPG and then transferred to media lacking both nitrogen and glucose. Fluorescent microscopy was used to track the movement of GFP-tagged proteasomes, using both a subunit of the RP (Rpn1) and the CP (α1). This work determined that proteasomes localize to PSGs during nitrogen and glucose starvation, regardless of the initial carbon source.

K. Kim, S. Dhaliwal, C. Crawford. Department of Biology, Missouri State University. **THE MECHANISM OF YEAST DYNAMIN RECRUITMENT TO THE LATE ENDOSOME.** Yeast protein Vps1, a homolog of human protein dynamin, is involved in regulating Golgi-to-endosome traffic and the retrieval of Vps10 from the late endosome. Vps1 has been shown to interact with membrane lipids of Golgi bodies and endosomes *in vitro*. However, the biochemical mechanism of Vps1 recruitment to organelle membranes *in vivo* remains poorly understood. To investigate the mechanism, we expressed a number of Vps1 fragments that are N-terminally fused with mRFP in *vps1*Δ background; GTPase, Middle, GED, PRD, GTPase-Middle, and Middle-GED. Biomarkers for endocytic sites, late Golgi, and late endosomes were tagged with GFP. Levels of colocalization of the GFP-fused markers with mRFP-fused Vps1 variants were quantified using fluorescence microscopy. The full-length Vps1 displayed partial colocalization with the Golgi and late endosomes, with a higher level of overlap with late endosomes, whereas none of the truncated Vps1 variants significantly overlapped with these organelles. In addition, these Vps1 fragments were not functional for the sorting of CPY the cargo at the Golgi and for the retrieval of Vps10 at the late endosome, suggesting that intact full-length Vps1 protein is essentially required for facilitating these cellular events. All Vps1 mutants carrying a point mutation at a presumed membrane binding residue (R465, P564, K591, and S599) as well as the point mutant at a ubiquitination site (K561) were properly recruited to the late endosome, invalidating their potential role in Vps1 recruitment. Currently, we quantitate the level of colocalization between the late endosome and Vps1 C-terminal truncation mutants to reveal the essential length of Vps1 required for Vps1 recruitment at the late endosome.

C. Knight and J. Wang. Department of Biomedical Sciences, Missouri State University. **EFFECT OF $P2Y_2$ RECEPTORS ON LEUKOCYTE BEHAVIOR IN VIVO UNDER ACUTE INFLAMMATION IN TRANSGENIC MALE MICE.** $P2Y_2$ receptors, G-protein coupled receptors and transmembrane proteins, are present on most cells in the body and hold a wide variety of roles. It has been shown that under resting conditions, $P2Y_2$ receptors suppress the movement of leukocytes but it is unknown how inflammation will alter this in the body. The objective of this project is to determine the effect of $P2Y_2$ receptors on leukocyte behavior in vivo under acute inflammation using Intravenous microscopy (IVM) in post-capillary venules of the cremaster skeletal muscle. LPS will be injected into the scrotum of transgenic male mice to cause localized acute inflammation. Leukocytes that are conjugated with Rhodamine 6G injected through the tail vein are visualized with a IX81 Olympus florescence microscope. We predict to observe increases in recruitment, rolling, and adhesion of leukocytes when compared to a control group. If this is the case, it could suggest that the $P2Y_2$ receptors expressed on both endothelial cells and leukocytes regulate the leukocyte response during inflammation. With better

understanding of $P2Y_2$ receptor role in inflammation, we will have better control of an inflammatory response by potentially diminishing harmful effects of inflammation on normal tissue. Supported by Missouri State University.

N. Le[a], J. Routh[a], C. Kirk[a], Q. Wu[b], R. Patel[b], C. Keyes[b], K. Kim[a]. [a]Department of Biology, Missouri State University, [B]Jordan Valley Innovation Center. **THE INTRACELLULAR TRAFFICKING OF CDSE/ZNS QDS AND ITS IMPACT ON YEAST ACTIN DYNAMICS.** Quantum dots (QDs) are nanoparticles with unique optical properties that make them highly attractive for various biomedical applications. However, a number of recent research has shown the negative impact of QDs on cells. Therefore, it is essential to study the interaction between quantum dots with living cells to understand the mechanism of QDs' toxicity. In our study, we used the budding yeast *Saccharomyces cerevisiae* as a model organism to study the intracellular trafficking of cadmium selenide-zinc sulfide quantum dots (CdSe/ZnS QDs), as well as their impact on yeast cellular dynamics. We found that QDs enter yeast cells using clathrin-receptor-mediated endocytosis and distribute to the late Golgi/ trans-Golgi network. Furthermore, our RNA sequence analysis revealed that QDs treatment led to the alteration of many genes, including genes that participate in mitochondrial function and metabolism, vesicular trafficking, cell wall integrity, transcription regulation, and translation regulation. Our data also showed that QD treatment negatively impact yeast polarized growth and caused a minor delay in the endocytosis process of yeast. Furthermore, we found that CdSe/ZnS QD treatment caused an increase in the F-actin level, slightly elevated the level of coronin protein expression, significantly reduced profilin protein expression, and had no impact on the level of cofilin protein. Thus, our data suggest that CdSe/ZnS QDs favor the assembly of filamentous actin. Overall, our research provides a novel toxicity mechanism of CdSe/ZnS QDs.

N. Nalley, S. Antonopoulos, and P. Durham. Department of Biology-Jordan Valley Innovation Center, Missouri State University. **EFFECTS OF PRENATAL AND POSTNATAL COPPER OXIDE NANOPARTICLE EXPOSURE ON DISTAL COLONS AND MICROBIOME.** Nanoparticle use and waste is increasing, potentially contaminating sources of drinking water. Ingestion of metal nanoparticles by adult animals is associated with digestive system pathology. However, there is a knowledge gap regarding metal nanoparticle exposure during fetal development. To investigate the effects of prenatal and postnatal exposure to copper oxide nanoparticles (CuO NPs), male and female Sprague Dawley rats consumed CuO NPs via their drinking water from time of breeding throughout gestation. After birth, pups were allowed to nurse for 21 days while the mother continually ingested CuO NPs. Weekly pup weights were recorded. Pups were dissected between days 18-20 to study changes in distal colon morphology and microbiome composition in response to CuO NP exposure *in utero* and during nursing. Distal colon, fecal, and cecal samples were collected. The morphology of the colons was evaluated using immunohistochemistry. Fecal and cecal sample DNA was isolated and 16S next-generation sequencing was used to identify the types of bacteria. CuO NP exposure caused no major differences in pup weight or changes in colon morphology based on staining for type I and III collagen. However, prenatal and postnatal exposure mediated different changes in the microbiome at the phylum level in male and female offspring. In summary, while no major morphological changes were observed in the colon, the addition of CuO NPs to the diet of the parent rats caused slight dysbiosis in the microbiome of the offspring, which may predispose them to digestive system diseases later in life. Supported by ERDC (W912HZ-22-C0014).

R. Pecka, C. Fry, M. Baum, A. Piskulic, M. Surls, H. Whitacre, and A. Hulme. Department of Biomedical Sciences, Missouri State University. **SPTBN1 AND ACTIN STAINING IN MICROGLIAL CELLS TO BETTER UNDERSTAND HIV REPLICATION.** Human immunodeficiency virus (HIV) is a viral infection that weakens the immune system by decreasing the amount of active CD4 cells. If left untreated, the immune system is not capable of protecting the individual from opportunistic infections. The early stages of HIV replication are still unclear within the science community. The purpose of this study was to investigate the role of the cellular protein Spectrin β Nonerythrocyte 1 (SPTBN1) in early stages of HIV replication and localization within CHME3 microglial cells. The Dai study found that lowering expression of SPTBN1 in macrophages led to HIV-1 resistant cells. In this study, knockdown of SPTBN1 caused a partial depolymerization in the actin cytoskeleton, which may contribute to the overall resistance to HIV-1. The goal of our study is to optimize fluorescent microscopy techniques to visualize SPTBN1 and actin in CHME3 microglial cells. We found congregations of SPTBN1 protein distributed throughout the cells utilizing 2X antibody staining. In 0.25X phalloidin stained cells, we clearly visualized the actin fibers. In the future, this technique can be used to determine if HIV-1 colocalizes with SPTBN1 and actin during early replication steps and the effect of SPTBN1 knockdown on HIV-1 infection. Collectively, these results will lead to a better understanding of what host cell features HIV-1 uses for viral replication.

M. Scharnhorst, S. Antonopoulos, and P. Durham. Department of Biology-Jordan Valley Innovation Center, Missouri State University. **INVESTIGATION OF COPPER OXIDE NANOPARTICLES ON CRYOPRESERVED TRIGEMINAL GANGLION USED TO ESTABLISH PRIMARY CULTURES OF NEURONAL AND GLIAL CELLS.** Heavy metal nanoparticles used in a variety of industries can leach from devices and contaminate the surrounding environment, posing a threat to human health. Divalent copper nanoparticles (Cu NPs) have been reported to be toxic to diverse cell types by causing DNA damage and oxidative stress. The goal of our study was to investigate the effect of Cu NPs on trigeminal ganglion neuronal and glial cell viability, testing the hypothesis that neurons would be more sensitive to Cu NPs. To test our hypothesis, cryopreserved trigeminal ganglion were used to establish primary cultures that were incubated overnight with different concentrations of copper oxide (CuO) and cell viability determined. To better understand CuO-induced cell toxicity, expression of proteins implicated in cell stress and inflammation were investigated by immunocytochemistry. Cryopreservation of the trigeminal ganglion did not result in a decrease in cell viability of neurons (Aδ or C-fiber), satellite glia, or Schwann cells, with cell ratios similar to *in vivo* ganglion. Overnight incubation with CuO (20 mg/L) was moderately toxic to glia but did not cause a decrease in neuronal viability. Expression of the MAP kinase P-ERK was increased in neurons and glia primarily when incubated with 20 mg/L CuO. However, levels of the MAP kinase phosphatase MKP1 were markedly increased only in neurons at 20 mg/L. Findings from our study provide evidence that CuO at 20 mg/L is more toxic to trigeminal glia than neurons, possibly because neurons express higher levels of the anti-inflammatory and neuroprotective protein MKP-1. Supported by ERDC (W912HZ-21-2-0014).

D. Silva, S. Antonopoulos, and P. Durham. Department of Biology-Jordan Valley Innovation Center, Missouri State University. **COPPER OXIDE NANOPARTICLES CAUSE TOXCICITY, STIMULATE EXPRESSION OF P-ERK AND P-P38, AND INHIBIT ATF2 AND C-JUN PROMOTER ACTIVITY IN THE WIDR HUMAN COLON EPITHELIAL CELL LINE.** Several industries are increasing their use of divalent copper nanoparticles (Cu NPs) in the manufacturing of devices, which increases the likelihood of Cu NPs leaching into the environment and causing contamination of drinking water and, thus, negatively impacting human health. However, there is little information regarding the potential toxic effects of ingestion of divalent Cu NPs via contaminated drinking water on epithelial cells of the digestive track at a cellular and molecular level. The goal of this study was to determine the effect of overnight exposure to Cu NPs on cell viability, protein expression, and gene expression in the WiDr human colon epithelial cancer cell line. Cytotoxicity was measured using the CellTiter Proliferation and LIVE/DEAD Assay after overnight incubation with copper oxide (CuO), chloride, and nitrate at several concentrations. Changes in protein expression caused by CuO were determined by immunocytochemistry while promoter activity was investigated via transient transfection and luciferase reporter assay. Dose-dependent decreases in cell viability were observed with all forms of Cu NPs. Increased expression of the pro-apoptotic proteins P-ERK and P-p38 were observed with the 20 mg/L CuO concentration. Promoter activity of the transcription factors ATF2 and c-Jun were significantly decreased by 20 mg/L CuO. Our results provide evidence that Cu NPs dose-dependently reduce cell viability of a human colon epithelial cell line. Based on our findings, the cytotoxic effects of Cu NPs involve increased expression of the apoptotic proteins P-ERK and P-p38 and suppression of transcription factors that mediate cell survival. Supported by ERDC (W912HZ-22-C0014).

**Biology Section**

**Oral Presentations:**

T. Roy, Department of Biology, Missouri Western State University. **UTILIZATION OF HERBARIUM SPECIMENS TOWARDS PLANT BIODIVERSITY CONSERVATION RESEARCH.** Recent studies have estimated that ~39% of plant species are at a risk of extinction. In the field of plant biodiversity conservation research, botanists have traditionally relied on field collection and in-situ observation and collection of data for their studies. However, rising costs of air travel and gas prices worldwide have led to researchers at small PUIs looking for alternatives to traveling to field sites to conduct research. Many botanists are now delving into utilizing natural history collections, particularly herbarium preserved plant specimens and digitized collections for their research. Natural history collections including digitized herbarium specimens can prove to be immensely useful in gathering data on range extent, population size, and population trends over time, and can prove to be a crucial source for gathering comprehensive data on assessing a taxon's extinction risk. My research focuses particularly on how utilization of herbarium specimens including digitized collections can play a pivotal role for plant biodiversity conservation research and teaching in today's world, with a highlight on MWSU's Leo A. Galloway herbarium.

T. Boman and M. Perkins, Department of Biology and Environmental Health, Missouri Southern State University. **A LONGITUDINAL STUDY TO ESTABLISH ANNUAL CONCENTRATION OF MICROPLASTICS OF TURKEY CREEK, SPRING RIVER WATERSHED, MISSOURI.** Microplastics are an environmental issue of growing concern. Research on microplastics has been heavily focused in marine environments and the research conducted in freshwater systems has been mostly focused on larger rivers or lakes. A preliminary study in the winter season of 2021-2022 determined presence of microplastics in Turkey Creek, a small urban stream in the Spring River Watershed. Our study continued the assessment of the seven sample locations over a year to determine if quantity or type of microplastics present was affected seasonally or by increased anthropogenic impact near sampling locations (i.e. urban and rural). Grab samples, 1-L, were collected mid channel, biweekly if possible, at baseflow conditions. Microplastics were detected in 82% of samples. A range of 0-26 microplastics was found among sites, across seasons. Plastic fibers made of 99.5% of microplastics detected. We did not detect significant difference among sites based on sample location. We did detect significant seasonal differences across site data with winter having a higher average load compared to other seasons. Our study concludes that microplastic pollution exists in small waterways on an annual basis with a large contribution coming from microplastics fibers and that season variability may exist across concentrations, albeit sample size was limited.

C. Bennett and M. Kilmer, Department of Biology and Environmental Health, Missouri Southern State University. **EFFECTS OF MICROPLASTIC EXPOSURE ON SURVIVAL, DEVELOPMENT AND REPRODUCTION IN *DAPHNIA MAGNA*.** Microplastic pollution and its effects remain relatively understudied in freshwater systems, despite research showing their prevalence in these habitats. We exposed *Daphnia magna*, a freshwater microcrustacean, to polyethylene microplastic beads to determine how these plastics might enter the organisms (ingestion vs. absorption) and how they affect survival, development and reproduction. Neonates (<24 h old) were reared under one of three conditions: no microplastics, low

microplastics (2 mg/L) or high microplastics (20 mg/L). Organisms were monitored for 21 days. All exposed organisms accumulated microplastics in their digestive tract, while those in high concentrations also accumulated microplastics in respiratory structures. There was a significant reduction in survival for organisms exposed to high amounts of microplastics compared to no microplastics ($p$=0.0001). While not significant, there did seem to be a slight effect on development, with date of first reproduction activity being delayed as concentration of microplastic increased. There was also a difference in total reproductive output between no and high plastic treatments ($p$<0.0001) and low and high plastic treatments ($p$<0.0001), though the average number of reproductive events was consistent across treatments. The effects on reproduction were most pronounced in earlier reproductive events but largely disappeared by the fifth brood. This pilot study shows that organisms do readily accumulate microplastics, and that they can affect survival, development and reproduction. A quantification of minimum concentrations required to produce these effects would be useful in understanding their potential impact in natural populations. This research was funded by a Student Research Grant from Missouri Southern State University.

J. Radey and M. Kilmer, Department of Biology and Environmental Health, Missouri Southern State University. **EFFECTS OF ALTERED WATER TEMPERATURE ON SURVIVAL AND REPRODUCTION OF *DAPHNIA MAGNA*.** *Daphnia magna* is a commonly used ecotoxicological testing organism and is typically cultured and tested in water temperatures of 20-25°C. However, variations in water temperature can impact aquatic organisms causing unexpected responses. Organisms tested under increased temperature conditions typically demonstrate increased sensitivity to pollutants but the effect of temperature alone on organisms is unclear. In this study, we raised *D. magna* under varying water temperatures for both short-term (48-hr) and long-term tests (17-day), to better understand the impacts of water temperature. For 48-hr exposure, the required temperature increase was substantial, with temperatures of 36°C required to cause 100% lethality. Exposures of 17-days showed that, while organisms survived longer than 48 hours at lower water temperatures, they still suffered delayed mortality. Between 32-35°C, tests achieved 100% lethality between 5 and 9 days of age, with a clear trend between reduced temperature and increased survival. However, organisms did not reproduce, despite achieving sufficient age. At lower temperatures (28-31°C), organisms survived and reproduced, but reproductive outputs were altered, compared to standard testing conditions (20-25°C). These results show us that temperature alone could be enough to negatively affect aquatic organisms. The addition of pollutants, even at concentrations deemed safe at typical testing temperatures, could have increasingly negative effects on these organisms. If aquatic environments change as predicted, due to climate change, it may be important to alter current testing protocols to allow for altered sensitivities of test organisms. This project was funded by a Student Research Grant from Missouri Southern State University.

A. Pendel and A. Lough, Department of Biology, Central Methodist University. **USING NESTED POLYMERASE CHAIN REACTION TO IDENTIFY FISH MISLABELING.** Fish mislabeling is a legal and health issue that is prevalent in the United States, but few studies have been conducted in Missouri. In previous projects, Dr. Lough and her students found that, when testing Yellowfin tuna (*Thunnus albacares*) samples, the primers they used came back with poor sequencing data. As part of a continuous research project, we modified the previously used procedure for identifying fish mislabeling by developing new primers to be used in nested PCR

and DNA sequencing. First, the internal primers were tested using different PCR reaction mixes. Then the internal primers were tested using the original primers' PCR product as the DNA sample. After the internal primers were successfully tested, we used them in sequencing reactions for eight different tuna samples collected during previous research projects and genetics classes. The sequence data from two samples was of too low quality to analyze. After comparing the sequence data of the remaining samples to the Yellowfin tuna reference genome, three samples were confidently identified as Yellowfin tuna. Two samples are likely Yellowfin but need to be further investigated. One sample was found to be mislabeled. Notably, one sample was able to be sequenced successfully for the first time because we used the internal primers. Dr. Lough will continue using nested PCR for future fish mislabeling experiments. Supported by Central Methodist University's Division of Science, Mathematics, and Computer Science.

**Poster Presentations:**

D. Garten, E. Loder, S. Antonopoulos, and P. Durham, Department of Biology-Jordan Valley Innovation Center, Missouri State University. **IDENTIFICATION AND PREVENTION OF FRESHWATER BIOFOULING ON FLEXIBLE SENSOR SUBSTRATES.** There is an increasing demand for development of sensors that continuously monitor freshwater safety and quality. Developing sensors with flexible substrates is of interest due to their malleability, cost effectiveness, and durability. The accuracy and performance of sensors submerged in water for long times can be greatly reduced by biofouling. The goal of this study was to identify via 16S and 18S rRNA next generation sequencing (NGS) prokaryotic and eukaryotic microorganisms that adhered to submerged flexible substrates and investigate coatings to prevent biofouling. Substrates including cyclic olefin copolymer, polyethylene terephthalate, and Kapton were suspended in aquariums filled with river, pond, or well water from the Springfield Missouri region and maintained at ~85°C to simulate summer conditions. Biological samples were mechanically removed after 6 months, and isolated DNA used for NGS analysis to identify adherent microorganisms and determine relative abundance. The possible anti-fouling effects of coatings including ethanol, chitosan, collagen, eggshell membrane, hydrolyzed eggshell membrane, and lignin that were applied as a thin layer was investigated using qPCR on samples from substrates submerged for 2 weeks. Proteobacteria were the most abundant bacteria on all substrates and water sources. The most prevalent eukaryotic biofouling organisms were diatoms in river water, green algae in pond water, and fungi in well water on all substrates. None of the coatings made a substantial difference in the amount of biofouling of the substrates. Future studies will be initiated to identify biofouling microorganisms on freshwater samples maintained at 45ºC and other antifouling strategies. Supported by ERDC (W912HZ-21-2-0019).

G. Dieringer and L. Cabrera R., Department of Natural Sciences, Northwest Missouri State University. **POLLINATION AND BREEDING SYSTEM IN *PENSTEMON PALLIDUS* (PLANTAGINACEAE).** The study on *Penstemon pallidus* provides insights into the plant's pollination biology and floral ecology, highlighting the importance of bee visitors to the plant's reproduction. The findings show that the flowers are protoandrous, with a three-day lifespan, and the stigma becomes receptive on the second and third days. This suggests that the timing of bee visits is critical to the plant's successful reproduction. The study also notes that while a variety of bees visit the flowers, they deposit relatively few pollen grains per visit. Therefore, multiple visits are required over the two-day receptivity period to achieve full seed production. This

finding underscores the important role of bees in the reproductive ecology of *Penstemon pallidus*. Furthermore, the study suggests that the combination of few pollen grains deposited per visit and a 48-hour fertilization interval creates a situation where pollen-tube competition is possible. This phenomenon may result in offspring of higher quality, indicating the potential for an evolutionary advantage for the plant. Overall, the study sheds light on the complex interplay between plant and bee in the ecology and evolution of the breeding system. The findings provide valuable insights into the importance of pollinators for plant reproduction and suggest potential implications for plant evolution. Support by Northwest Missouri State University.

T. Cook[a], C. Root[a], C. Lindqvist[b], and T. Roy[a], [a]Department of Biology, Missouri Western State University, [b]Department of Biology, University of Buffalo. **THE ECONOMIC, CULTURAL, AND CONSERVATIONAL IMPORTANCE OF THE "LAMIOID MINTS".** The angiosperm family Lamiaceae (or the "Mint" family) is a very speciose group of plants. Lamioideae is its second-biggest subfamily and comprises plants with a variety of benefits that have a lasting relationship with our economy, medicine, and cultures. Members of Lamioideae also face severe conservation challenges (especially the "Hawaiian mints"). Lamioideae is believed to have originated in Eastern Asia and migrated to the new world either through the Bering Land Bridge or through the North Atlantic Land Bridge sometime around the mid-Miocene period. Members of Lamioideae have since diversified and now occupy a large part of temperate North America, starting from the maritime provinces of Canada in the north to Mexico in the south, further diversifying to South America and the Hawaiian Archipelago. New world species of mints include those belonging to the tribes Stachydeae and Synandreae. Some of the Missouri native species include *Synandra hispidula*, *Physostegia virginiana*, as well as a few species from the genus *Stachys*. To date, our lab has composed a series of databases detailing the availability and locations of both fresh and preserved target specimens within the Lamioideae group and produced introductory phylogenetic trees outlining distinct tribes within the Lamioideae subgroup.

C. Root, T. Cook, and T. Roy, Department of Biology, Missouri Western State University. **A DEEP DIVE INTO THE GENUS *SILPHIUM*.** The genus *Silphium*, better known as the "Rosin-weeds", belongs to the sunflower family *Asteraceae. Silphium* is native to North America and has species that stretch across the eastern United States, parts of Canada, and the midwest. Missouri is home to four native species of *Silphium*. *Silphium* has been identified as a potential source of biofuels. *Silphium* was last studied in 2000 and therefore requires reevaluation with modern DNA analysis methods. We utilized the bioinformatics programs MrBayes on XSEDE and BioEdit to help us understand whether signatures of evolution would vary among different species, taxonomical sections, and subsections within the group based on the data we derived from nucleic and chloroplast markers. Combining data from a variety of loci has allowed us to develop a better understanding of the relationships present between members of the *Silphium* genus.

M. Castagna, J. Burrow, C. Stewart, and A. Russell, Department of Biology, Missouri State University. **TAKE IT OR LEAF IT: IS LEAF SHAPE A RELIABLE POLLINATOR LEARNING CUE?** A century of research demonstrates that pollinators use diverse floral cues to find food rewards. However, floral cues are not always reliable, as often occurs when unrewarding plant species mimic the floral cues of co-occurring rewarding plant species. When floral cues are unreliable, pollinators should learn to use other non-floral cues instead. Here we examined whether and when generalist bees (*Bombus impatiens*) would learn to associate differences in leaf shape with a pollen reward. We expected bees would rely more on leaf shape when learning petal color was more difficult, and vice versa. We therefore assigned bees to either of two treatments, differing in terms of how much artificial flowers differed in petal color; each treatment differed in leaf shape in the same way. As expected, bees learned much faster when petal color differed greatly (29%). Yet when petal colors differed little, bees had a harder time learning petal color and did not show evidence of having learned leaf shape. Our results suggest that an inability to learn a non-floral cue (e.g., leaf shape) may reflect an unexplored and significant constraint on bee learning and memory that plants may exploit. This research is funded by the Society of Integrative and Comparative Biology Grant in Aid of Research and the Missouri State University Department of Biology.

D. Miles, H. Whaley, A. Faust, and L. Kissoon-Charles, Department of Biology, Missouri State University. **WINTER TEMPERATURES DRIVE CHANGES IN AQUATIC VEGETATION IN AN OZARK SPRING-FED POND**. Fluctuating water depths promote algae growth and cause shifts in dominant aquatic plant growth forms (i.e., submerged to emergent). Many impoundments in the Ozarks are spring-fed and experience fluctuations in water depth. It is not well understood how changes in water depth can impact aquatic vegetation in these systems. William's pond, a spring-fed pond in the Ozarks, experienced lower than average water levels for almost 2 years due to a dam malfunction. To determine how aquatic vegetation responded to changes in water depth, we assessed changes in vegetation cover before and during the dam malfunction, and after the dam was fixed. Smaller water volumes might result in higher concentrations of nutrients that lead to excessive algal growth. Therefore, we hypothesized that decreasing water depth will lead to increased filamentous algae cover and subsequently decreased submerged aquatic vegetation (SAV) cover. In winter of 2020 and winter of 2021, water depth was below average, and this coincided with a 63% decrease in SAV cover and a 46% increase in filamentous algae cover. In summer of 2020 and summer of 2021, water depth remained below average, however, SAV cover increased by 7% and filamentous algae cover increased by 8%. In winter, the influence on SAV cover and subsequent changes in species composition could be due to shading by increased floating filamentous algae and changes in water volume. During the below average water years, impacts to vegetation were greater in winter than summer. This is probably due to differences in water temperature and volume.

M. Gibson and A. Elias, Department of Biology, Missouri Western State University. **FRESHWATER FISH SPECIES IDENTIFICATION USING DNA BARCORDING.** The goal of this project is to use molecular techniques for accurate species identification of fish caught in ponds on Missouri Western State University campus. Some of the nine campus ponds are stocked for recreational fishing, and the ponds vary in biotic and abiotic factors. Research on species combinations and fish densities is important for determining fish-stocking policies. While some fish are more easily identified in the field, sunfish and their hybrids can be phenotypically

difficult to distinguish, so identification can be done using DNA sequencing. This idea is also referred to as DNA barcoding which involves using a short, standardized DNA region that is known to distinguish species. Multiple techniques were used to identify and confirm the species of fish sampled across the ponds. Hybrids can only be identified by using nuclear genes. The nuclear gene, internal transcribed spacer 1 (*ITS1*) was sequenced and interestingly displayed product number variation, which may correspond with species and be useful as a screening method. Once validated, this non-lethal molecular assay will allow for rapid species identification. Collected sequence data from this and other genes will be leveraged for determining the relatedness of fish between and within ponds using phylogenetic methods. Accurate fish identification, particularly differentiation of sunfish hybrids from bluegill (*Lepomis macrochirus*), is important for not only adaptive management and survey information, but also for ecological questions. Supported by Gold Fridays PORTAL program at MWSU.

B. Blede and S. Lankford, Department of Biological and Clinical Sciences, University of Central Missouri. **ACCLIMATION TO ELEVATED TEMPERATURE RESULTS IN CONFOUNDING RESULTS IN LAKE STURGEON (*ACIPENSER FULVESCENS)*.** Habitat loss and a limited temperature tolerance are likely two of the most important limiting factors to lake sturgeon distribution. These conditions likely become challenging in the southern reaches of the population, where individuals are exposed to increased river fragmentation, channelization, and water temperatures. However, very little is known about the physiological impact of elevated temperature in this species. The available literature investigated responses to temperatures well below the temperatures experienced in the southern limits of lake sturgeon range, which are reported to reach 33-35°C. To address this gap in knowledge, the metabolic impact of acclimation to 15°C, 20°C, and 25°C water on juvenile lake sturgeon was investigated. The oxygen consumption rate was monitored, both during rest (routine metabolic rate; RMR) and after a forced swimming activity (active metabolic rate; AMR). The metabolic scope of performance (MS) was calculated, along with key growth indicators, to determine if acclimation temperature negatively impacts the metabolic potential of a juvenile lake sturgeon. No significant difference between RMRs of fish acclimated to different temperatures was found, but a significant difference ($p<0.05$) was found between the AMR, with the highest reported rate being 0.245mg oxygen/hr/g. Secondly, no significant difference was found between the MS of fish acclimated to different temperatures. However, other organismal level metrics like decreased percent survivability (97.78% vs 61.36%, respectively), final weight, reduced condition factor, and hepatosomatic index suggest the fish acclimated to 25°C were negatively impacted by the high temperatures.

C. Bell, M. Firsching, C. Redman, S. Vogt, and C. Ganong, Department of Biology, Missouri Western State University. **MULTIANNUAL TRENDS IN AQUATIC MACROINVERTEBRATE DIVERSITY IN MISSOURI WESTERN STATE UNIVERSITY CAMPUS PONDS.** Macroinvertebrates can be important bioindicators (organisms that indicate ecosystem health) in many aquatic ecosystems. Our objective was to explore trends in macroinvertebrate abundance, richness, and diversity both within and between nine human-made ponds on the Missouri Western State University campus over multiple seasons (fall 2020-spring 2023). We used a standardized D-net sampling protocol to collect benthic macroinvertebrates. Here we (1) present an analysis of patterns in aquatic macroinvertebrate abundance, richness, and diversity over a 2.5-year period both within and between these nine

ponds, (2) discuss the possible contributions of different watershed features to these observed patterns, and (3) compare our results to data from other urban pond studies. These data provide baseline information on site-specific and overall seasonal/interannual patterns in macroinvertebrate community structure in this urban pond ecosystem.

A. Kinzel, Department of Natural Sciences, Northwest Missouri State University. **A COMPARISON OF PLASTIC CONSUMPTION BETWEEN TWO DARKLING BEETLE SPECIES.** In the face of plastic pollution, strategies for bioremediation are important. Superworms (*Zophobas* sp.) and mealworms (*Tenebrio molitor*) have been found to possess gut enzymes able to degrade various plastics. I hypothesized that when plastic consumption is compared between an equal mass of each species, *Zophobas* sp. will have a higher rate of plastic consumption compared to *T. molitor*. For a period of 21 days, equal masses of mealworms and superworms were observed consuming Styrofoam®. The plastic was weighed twice a day using a milligram scale to determine the rate of consumption for each species. The data per day was plotted, and a trendline supplied the rate of consumption (the slope of the line). Slope values for the five trials were analyzed using a t-test. Average slopes of both species found that mealworms consumed 0.0039 grams per day, while superworms consumed 0.0029 grams per day. With a significant difference of 0.001 grams per day, *T. molitor* is the most efficient when equally massed ($t=2.57$, $df=8$, $P=0.0331$). Companies looking to use darkling beetles to decrease their plastic footprint should introduce mealworms into their disposal process as they consume a higher rate of plastic when compared to *Zophobas* sp.

H. St. Dennis[a], C. Bigler[a], N. Cummins[a], E. Ludwig[a], D. Duvernell[a], R. Hrabik[b], [a]Department of Biological Sciences, Missouri University of Science and Technology; [b]Missouri Department of Conservation. **MOLECULAR GENETICS AND PHYLOGEOGRAPHY OF *NOTROPIS DORSALIS*.** North American river systems exhibit diverse communities of freshwater fish, which are among the most diverse in the world. This diverse speciation is due in part to the extensive impact of Pleistocene era glaciation, which drove northerly distributed species freshwater species to seek refuge in more southern habits during maximum glaciation. Once the glaciers retreated, the species redistributed back to more northern habitats of their drainages. Some broadly distributed northern species such as the Bigmouth Shiner, *Notropis dorsalis*, may comprise multiple divergent and geographically separated lineages. *N. dorsalis* is a species of minnow native to small streams throughout central North America, occurring throughout tributaries of the Missouri River, upper Mississippi River, and tributaries of Lake Michigan and Lake Erie. All known populations of *N. dorsalis* exhibit homogeneous morphology. We hypothesized that geographically separate populations would contain genetically distinct groups known as cryptic species. Using molecular genetics, it was possible to compare genetic variations in *N. dorsalis* samples. We created two phylogenies. Our first phylogeny was constructed through sequencing the cytochrome B gene, a highly variable region of mitochondrial DNA. Our second phylogeny was constructed through sequencing the *S7RP* gene. This study has yielded promising data in the form of six distinct clades, each corresponding to a distinct geographic region and watershed. Supported by Missouri S&T College of Arts Sciences and Education: Opportunities for Undergraduate Research Program and Missouri Department of Conservation.

R. Mailey, J. Zhu, O. Buschhaus, J. McGhee, A. Campbell, and J. Campbell, Department of Natural Sciences, Northwest Missouri State University. **PCR AMPLIFICATION OF LARGE REGIONS OF THE MITOCHONDRIAL DNA OF BULLFROGS (*LITHOBATES CATESBEIANA*) FROM NODAWAY COUNTY, MO.** Bullfrogs (*Lithobates catesbeiana)* are an important frog species native to Missouri that can carry a pathogenic chytrid fungus (*Batrachochytrium dendrobatidis).* Chytrid fungi can cause significant disease and death due to it being a cutaneous disease affecting how frogs breathe. As potential carriers of this fungus, it is important to understand the degree to which local populations move across the landscape. Information relative to gene flow patterns is limited for these frogs in the northwest Missouri region. Based upon deposited sequences from other countries, we designed an array of PCR primers with the goal of amplifying the entire mitochondrial genome. Most primer pairs successfully amplified mtDNA fragments ranging from 400 bp to 15 kbp in length. We plan to use next-generation sequencing to obtain a complete mitogenome from a subset of the larger amplicons. Supported by the NWMSU College of Arts & Sciences UGR Fund.

A. Agunbiade, C. Coretti, H. Shoemaker, A. Kempf, J. Potter, S. Powell, and M. Grantham, Department of Biology, Missouri Western State University. **SEQUENCES IN A FRESHWATER VIROME FROM AN URBAN POND MAP TO SALMON GILL POXVIRUS**. Viruses are the most abundant biological entities on the planet, and they have been shown to play important roles in ecosystems, especially marine ecosystems. However, the characterization of viruses in freshwater ecosystems has been slower than the characterization of freshwater ecosystems. The advent of metagenomics has opened new avenues for the identification of virus sequences in those ecosystems. For this study, we focused on urban ponds that exist on the MWSU campus. We characterized the freshwater virome in one pond using a MinION sequencer and are analyzing the resulting data. One virus sequence that we identified in our dataset was similar to salmon gill poxvirus (SGPV), a virus first identified in farmed Atlantic salmon in the 1990s. To our knowledge, this virus has not been identified in freshwater in the US, so current investigations are focused on trying to determine whether our sequences actually represent evidence of SGPV in our campus ponds or whether these sequences represent uncharacterized viruses that are related to SGPV. Supported by Gold Friday's PORTAL Program/Department of Biology, MWSU.

S. Buehre, M. Grantham, T. Roy, Department of Biology, Missouri Western State University. **SARS COV-2 OMICRON VARIANT EVOLUTION IN MAJOR CITIES ACROSS THE UNITED STATES.** The virus SARS CoV-2 is characterized by its coating, and is known to continuously evolve through genetic mutations or viral recombination. According to the CDC, the variants of concern include Omicron, which contains seven lineages. Omicron was first identified in South Africa, and has traveled across the world. The research conducted is comparing the spread and evolution of the Omicron and potential new sub lineages in major cities across the United States. There are new and emerging variants that are prevalent in different areas of the United States, which have the ability to impact one region more than another. This study is aimed at investigating how the latest variant of SARS CoV-2 is evolving as it spreads domestically in major United States cities. Overall, our results suggest that the Omicron variant of the SARS CoV-2 is under the influence of evolutionary mechanisms like natural selection, demographic expansion, etc.

I. Dimaggio[a], T. Santana Baez[a], E. McHugh[a], D. Monismith, Jr.[b], J. Campbell[a] and A. Campbell[a], [a]Department of Natural Sciences, Northwest Missouri State University, [b]Independent researcher. **COMPARATIVE GENOMICS OF THE BACTERIAL GENUS *XENOPHILUS*.** Due to lead-mining in the Tri-State Mining District, soils in this area remain highly contaminated with Pb, Zn and Cd. Cd-resistant bacteria were isolated from soils near Picher, OK, and identified by sequencing of the 16S rRNA gene. Selected isolates were subjected to whole-genome sequencing to further characterize their metal-resistance mechanisms. Isolate EM38 was demonstrated to be a new species of the genus *Xenophilus* using average-nucleotide identity analysis. This genus has only three named species and limited genomic data available. Therefore, we purchased and sequenced genomes of two of the recognized *Xenophilus* species and used Kbase to conduct a pangenome analysis of all *Xenophilus* genomes. This comparison found that the nine *Xenophilus* genomes share 1810 core functions and have a total of 5305 predicted functions. Genes that could be useful in resistance of Cd and other heavy metals, such as components of the Co/Zn/Cd efflux system, were found in all *Xenophilus* genomes. Supported by the NWMSU College of Arts & Sciences UGR Fund.

Z. Zayour, J. Campbell, and A. Campbell, Department of Natural Sciences, Northwest Missouri State University. **BIOINFORMATICS ANALYSIS OF THE POTENTIAL PATHOGENENICITY AND HOST ASSOCIATION OF ORAL AND RUMINANT SELENOMONADS**. Few published papers address the *Selenomonas* genus, even though it is sometimes associated with oral diseases (e.g. periodontitis) in humans. Therefore, this genus and its significance in both the human mouth and cattle microbiomes was studied, focusing on its potential pathogenicity and looking for any host-associated genes. A total of 45 sequences of different selenomonads were downloaded from IMG, and their Average Nucleotide Identities (ANIs) were used to build a phylogenetic tree. This tree was then compared to NCBI's data, which showed a clear distinction between oral and ruminant selenomonads. The KBase website tool was then used to study the two groups' virulent properties and search for any host-association genes. These analyses demonstrate the potential pathogenicity for the genus *Selenomonas* in addition to its level of dependency on its host organism. Supported by the NWMSU College of Arts & Sciences UGR Fund.

C. Stewart, A. Russell, B. Mirza, and R. Afagwu, Department of Biology, Missouri State University. **HOW FLOWER LONGEVITY AFFECTS EPIPHYTIC BACTERIA ABUNDANCE AND COMMUNITY COMPOSITION.** Floral longevity is critical to plant reproductive ecology, as it affects the time during which pollinators may successfully visit flowers. Because flower tissues are metabolically expensive, plants often modify flower longevity as these metabolic costs change. Diverse and abundant epiphytic microbial communities biochemically interact with floral surfaces and might thereby change the metabolic costs of floral tissues, particularly if these microbial communities shift. Yet how floral microbial communities change over the lifespan of a flower is not known. In this study, we investigated (1) if flower bacterial communities changed in abundance and diversity as flowers aged, and whether (2) shorter or longer-lived flowers accumulated microbes at different rates. Buds of five different plant species were tagged to determine flower age from anthesis. Opened flowers were washed and plated on media to quantify bacterial abundance, followed by PCR to determine bacterial community composition. Results showed that shorter-lived flowers accumulate epiphytic bacteria faster than longer-lived flowers. Community composition and diversity

investigation is ongoing. These results suggest that shorter-lived flowers may tolerate more bacteria and/or that longer-lived flowers possess mechanisms which reduce bacterial colonization and growth. We discuss how the microbial communities of aging flowers may affect pollination.

W. Durstock, S. Urushidani, and B. Mirza, Environmental Services Department, Missouri State University. **A MICROBIAL SOURCE TRACKING STUDY TO IDENTIFY FECAL CONTAMINATION IN A KARST WATER SYSTEM.** Waterborne pathogens originating from human fecal material of infected individuals are one of the major areas of health concern in karst environments where water can easily flow from old leaky septic tanks and broken sanitary sewer lines into rivers and streams. The current study was focused on temporal monitoring of fecal indicator bacteria (FIB) in Sequiota Spring. Based on an initial Microbial Source Tracking (MST) study, we observed a high abundance of human fecal indicator bacteria (HFIB) (up to 110,000 cells/L water) in July 2020. The city of Springfield initiated a detailed assessment and repair plan for the upstream sanitary sewer lines as a remediation solution. Through this remediation effort, the HFIB significantly decreased (55 times reduction) in June 2022. We also assessed the waterfowl fecal indicator bacteria, which were low (~300 cells/L), and remained unchanged from the year 2020 to 2022. This suggests that the sewer repairs completed in the recharge area of Sequiota Spring were a primary cause of the reduction in HFIB. This study demonstrated a successful remediation effort in reducing human fecal contamination to reduce potential health risks at this site. Supported by Missouri State University and Springfield City Utilities.

C. Roman, B. Edwards, and B. Mirza, Department of Biology, Missouri State University. **SELECTION OF *BRADYRHIZOBIUM* AND *SINORHIZOBIUM* IN SOYBEAN ROOT NODULES WITH DIFFERING pH ENVIRONMENTS.** Soybeans can nodulate with different rhizobial genera. Previous field studies suggested that under acidic soil condition, it prefers *Bradyrhizobium* as a root nodule endophyte, and under alkaline soils *Sinorhizobium* dominate as a root nodule endophyte. So far, the role of soil pH and the age of the host plant in selecting rhizobial strains for root nodule endophytes is unknown. In the current greenhouse study, we planted soybean in acidic, alkaline, and neutral sterilized sand and plants were inoculated at different plant growth stages with various cell densities of *Bradyrhizobium japonicum* and *Sinorhizobium* strain USDA 191. Using Next-DNA sequencing we assessed the relative distribution of rhizobial endophytes with soybean root nodules. We observed a preferred selection of *Bradyrhizobium* over *Sinorhizobium* under different pH conditions regardless of their abundance in rhizosphere soil. Currently, we are assessing data from the root nodules and rhizospheres of plants that were inoculated at different plant growth stages to determine if the age of the host plant plays any role in the selection of rhizobial endophytes. This study can be useful in identifying potential rhizobial strains for developing superior bioinoculants under different soil pH conditions.

D. Garten, S. Antonopoulos, S. Woodman, and P. Durham, Department of Biology-Jordan Valley Innovation Center, Missouri State University. **DIETARY GRAPE SEED EXTRACT SUPPLEMENTATION INHIBITS NOCICEPTION AND MEDIATES GABAERGIC CHANGES IN A PRECLINICAL MODEL OF CHRONIC TMD**. Temporomandibular joint dysfunction (TMD) is a prevalent orofacial disorder characterized by chronic pain and associated with peripheral and central sensitization. The aim of this study was to investigate changes in GABAergic proteins in the trigeminal ganglion and spinal cord, and levels of glial fibrillary acidic protein (GFAP) in astrocytes in a preclinical model of TMD and in response to grape seed extract (GSE) supplementation. Based on results from our prior studies, we hypothesized that GSE would inhibit nociception, increase expression of proteins involved in GABA synthesis, upregulate GABA receptors, and suppress activation of astrocytes. The three experimental groups consisted of naïve, chronic TMD, and chronic TMD animals with GSE supplementation via their drinking water. To induce chronic TMD pathology, female Sprague-Dawley rats were injected with the inflammatory agent complete Freund's adjuvant (CFA) to cause sensitization prior to prolonged jaw opening. GSE suppressed trigeminal nociception to mechanical stimulation with von Frey filaments. GFAP levels were elevated in response to TMD pathology and GSE caused a reduction in GFAP expression. In the trigeminal ganglion, neuronal levels of GAD 65/67 and GABAB, which are implicated in pain inhibitory pathways, were decreased in the TMD model compared to controls. These protein levels were increased in neurons of the GSE supplemented group compared to levels in the TMD animals. These results provide evidence that GSE functions to inhibit activation of astrocytes and stimulates expression of GABAergic proteins to suppress development of central and peripheral sensitization in a chronic TMD model. Supported by Missouri State University.

E. Loder, S. Antonopoulos, and P. Durham, Department of Biology-Jordan Valley Innovation Center, Missouri State University. **GRAPE SEED EXTRACT PREVENTS GUT MICROBIOME DYSBIOSIS AFTER PRENATAL AND POSTNATAL DIETARY EXPOSURE TO COPPER OXIDE NANOPARTICLES.** Nanoparticle use is increasing in several industries, increasing the likelihood of ground water contamination and human exposure. Ingestion of nanoparticles in drinking water may alter the gut microbiome and cause dysbiosis, which is implicated in the pathology of inflammatory diseases including ulcerative colitis, Crohn's disease, and diabetes. While most studies focus on the effect of nanoparticle exposure on adult organisms, the goal of our study was to investigate gut microbiome changes in offspring of rats after prenatal and postnatal dietary exposure to copper oxide nanoparticles (CuO NPs). We also investigated if dietary supplementation with grape seed extract (GSE) could prevent CuO NP-induced dysbiosis. Sprague-Dawley male and female rats were exposed to CuO NPs (2 mg/L), GSE (0.05%), neither, or both via their drinking water. Fecal and cecal samples were collected from the offspring, DNA isolated, and used for 16S next generation sequence analysis. Changes in the bacteria population, indicative of dysbiosis, were seen in both fecal and cecal samples from male and female rats. Inclusion of GSE prevented the CuO NP-induced microbiome changes and increased the abundance of *Bacteroides acidifaciens*, which is a bacterial species reported to be protective against diabetes and obesity. Our findings suggest that exposure to CuO NPs causes mild dysbiosis and hence, chronic early life exposure to CuO NPs may increase the risk of diseases of the digestive system. Further, dietary inclusion of the nutraceutical GSE, which is highly enriched in polyphenols, may be beneficial in preventing CuO NP-mediated dysbiosis. Supported by ERDC (W912HZ-21-2-0014).

A. Mesz, T. Santana Baez, E. McHugh, D. Monismith, Jr., A. Campbell, and J. Campbell, Department of Natural Sciences, Northwest Missouri State University. **PHYSIOLOGICAL AND BIOCHEMICAL CHARACTERIZATION OF NOVEL SPECIES OF *MITSUARIA* AND *XENOPHILUS*.** *Mitsuaria* EM25 and *Xenophilus* EM38 were isolated from Pb-, Zn- and Cd-contaminated soils from Picher, Oklahoma, using Cd-amended media. Analysis of average nucleotide identities of genomes of these isolates and recognized species of these genera indicated that our isolates represent novel species (<95% identity). The optimal growth temperature (35C), pH (7), salinity (1%) and medium (MOPS-buffered TYE) of EM25 differed from recognized species of *Mitsuaria.* The optimal growth temperature (35-40C), pH (6), salinity (1%) and medium (TYE) of EM38 differed from recognized species of *Xenophilus.* Fatty-acid compositions and carbon-source utilization profiles are also being collected to further distinguish our isolates from close relatives. Supported by the NWMSU College of Arts & Sciences UGR Fund.

A. Postlewait[a], Z. Locke[a], D. Moser[b], S. Hamilton-Brehm[c], and J. Campbell[a], [a]Department of Natural Sciences, Northwest Missouri State University, [b]Division of Earth and Ecosystems Sciences, Desert Research Institute, [c]Department of Microbiology, Southern Illinois University. **ISOLATION OF *ACIDOVORAX, SPHINGOMONAS* AND *SEDMINIBACTERIUM* FROM TERRESTRIAL WATER IN THE NEVADA DESERTS.** Desert microbes are relatively unexplored. Few people have attempted cultivation of aquatic desert bacteria, leaving more than 95% of all species uncultivated. Terrestrial water samples were collected in 2014 from the Oasis Valley, Devil's Hole, and Crystal Springs sites in Nevada. Isolates were enriched using anaerobic and aerobic media specifically developed for arid microbes. 16S rRNA genes were used for sequencing to identify and compare these isolates to other species. Our isolates were assigned to the genera *Acidovorax, Sphingomonas,* and *Sediminibacterium*. Two of the *Sediminibacterium* isolates are potentially novel. Supported by the NWMSU College of Arts & Sciences UGR Fund.

Z. Locke[a], A. Postlewait[a], D. Moser[b], S. Hamilton-Brehm[c] and J. Campbell[a], [a]Department of Natural Sciences, Northwest Missouri State University, [b]Division of Earth and Ecosystems Sciences, Desert Research Institute, [c]Department of Microbiology, Southern Illinois University. **CULTIVATION OF *PSEUDOMONAS, ALKALIHALOBACILLUS, SPHINGOPYXIS* AND *MESORHIZOBIUM* FROM SUBSURFACE WATER IN THE NEVADA DESERT**. The subsurface has been regarded as a major unexplored habitat for prokaryotes, and many of these microbes have yet to be cultivated in a lab setting. Several deep, subsurface-water samples from the Pahute Mesa-Oasis Valley area, near the Nevada National Security Site, were used for enrichments using a selection of synthetic media that attempted to simulate the natural conditions of the groundwater. Isolates were identified using DNA sequencing of 16S rRNA genes, then compared to sequences deposited in online databases. Initial results have identified isolates from the genera *Pseudomonas, Alkalihalobacillus, Sphingopyxis* and *Mesorhizobium*. Supported by the NWMSU College of Arts & Sciences UGR Fund.

**Chemistry Section**

**Oral Presentations:**

Arjun Chaudhary[1,2] and Ram K. Gupta[1,2], [1]Department of Chemistry, Pittsburg State University, Pittsburg, KS 66762, USA, and [2]National Institute for Materials Advancement, Pittsburg State University, Pittsburg, KS 66762, USA. **SUNFLOWER OIL-BASED ADHESIVE FOR WOOD APPLICATION AS AN ALTERNATIVE TO PETROLEUM-BASED WOOD ADHESIVES.** Petroleum-based compounds are generally utilized in industries for getting higher mechanical properties for the substrates applied on the wood as adhesives, where the process of synthesis release toxicity in the environment and causes health issues. Because of this reason, scientists are trying to make biobased compounds and products. This research used a bio-based polymer (sunflower polyol) to make polyurethane (PU) resin. During the synthesis of polyol, an epoxidation reaction was done, followed by a ring-opening reaction. The presence of hydroxyl groups was confirmed with Fourier transform infrared spectroscopy (FT-IR) and hydroxyl value determination test to confirm the polyol formulation. After that, hydroxyl groups of polyol were reacted with diisocyanate to make crosslinked polyurethane. With the hot-press technique, variation in time and temperature was done to find the ideal situation and highest tensile results. Where, without the addition of any filler, the highest tensile result was observed at 5.66 MPa. Furthermore, silicon dioxide ($SiO_2$), cellulose microcrystalline (MCC), and titanium dioxide ($TiO_2$) were introduced as a filler to improve bonding strength. With the introduction of $SiO_2$ filler, 86.25% improvement was observed with 10.49 MPa in bonding strength. Along with tensile strength, fillers also made a significant change in hydrophobicity. Compared to the control sample, a 51% increment in contact angle was observed with a 99.23° result.

Rishabh Srivastava[1,2], Himanshu Chaudhary[2], and Ram K. Gupta[2], [1]Department of Physics, Pittsburg State University, Pittsburg, KS 66762, USA, and [2]National Institute for Materials Advancement, Pittsburg State University, Pittsburg, KS 66762, USA. **FACILE SYNTHESIS OF METALLIC-$P_2O_7$ ON NICKEL FOAM FOR TUNED MORPHOLOGICAL AND ELECTRONIC ENHANCEMENT TOWARD BIFUNCTIONAL ELECTROCATALYST AND SUPERCAPACITOR APPLICATION.** The world's energy demands are in niches and environmental concerns are reinforced to a bigger challenge. Therefore, the production of clean energy and designing efficient energy storage devices to conserve surplus energy for sustainable use in the future have brought water-splitting and supercapacitors into existence, respectively. Thereby, transition metal-based phosphates have garnered tremendous significance as it offers more active sites and multiple oxidation states for faradic redox reactions. Herein, $NiP_2O_7$, $CoP_2O_7$, and $FeP_2O_7$-based nano-composites are grown on conductive nickel sheets of definite size which can effectively enhance the electrical transport of charges and storage. Herein, Metal-based $P_2O_7$ nanoparticles are successfully synthesized on nickel foam by using a hydrothermal route. The synergistic effect between metal and P corroborates significant improvement in the catalytic activity as well as the electrochemical charge-storing ability of the material. Therefore, $NiP_2O_7$ exhibits outstanding oxygen evolution reaction, and hydrogen evolution reaction with the least overpotential of 220, and 241 mV to draw a current density of 10 $mA/cm^2$. The nanocomposite was further examined under the prelims of the supercapacitor and found that the $NiP_2O_7$ outcast the highest specific capacitance with the optimized cyclic stability. Such a strategy for fabricating nanocomposite is efficient to produce and store energy economically and feasibly.

M. H. Dahanayake[1] , Z. Wu[1, 2, 3], X. Chen[3] , R. Weerasooriya[1] and A. C. A. Jayasundera [2, 4, 5], [1]National Institute of Fundamental Studies, Hanthana, Kandy, Sri Lanka, [2]Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka, [3]Industry and Equipment Technology Institute, Hefei University of Technology, PR China, [4]Department of Chemistry, Faculty of Science, University of Peradeniya, Sri Lanka, [5]Division of Mathematics and Science, Missouri Valley College, Marshall, MO, 65340, USA, **LIFE-CYCLE ASSESSMENT ON ECOTOXICITY IMPACT OF MICRO- AND NANO-PLASTICS IN A GROUNDWATER TREATMENT SYSTEM**, Plastics are widely used in making water desalination plants, but excessive use of glue during fabrication can cause water flow blockage in pressure-driven membranes. A life-cycle assessment (LCA) compliant-predictor model was used to assess the impact of micro-nano-plastics (MNPs) such as polyethylene, polystyrene, polyvinyl chloride, and polypropylene on groundwater treatment plants. A literature review was conducted to gather ecotoxicity data of MNPs for calculating ecotoxicological effect factor (EF) using USEtox software. Reliable literature sources were used to obtain extrapolation factors for data conversion. 53 ecotoxicity values (50 % effect concentration, EC50) of 14 species were included in the assessment, with polyethylene and polystyrene being the most common materials tested. *Daphnia magna* was the most represented with 29 (52 %) data points. No significant impact of particle type or shape was observed on a particular organism, but differences were seen among polymer types when comparing species. The EF generated from the data was 320 $PAF.m^3.kg^{-1}$, but data limitations may affect the accuracy of statistics-driven conclusions. There are several limitations to this method: since there is a general privation in information, ecotoxicity data of marine species are included in the calculation of freshwater EFs and vice versa; chronic data needs extrapolation; uncertainty from compiled data with varying test procedures and exposure concentrations. More studies are urgently needed to fill gaps, especially for chronic toxicity of freshwater species and common plastic additives. Different ecotoxicity factors for each material should be calculated in future when more data are available.

J. Durbin, A. McGovern, Department of Chemistry, Central Methodist University. **EFFECTS OF POLYLACTIC ACID ON SALTWATER QUALITY**. Polylactic acid (PLA) is a type of plastic used for 3D printing objects and structures. Of particular interest, PLA can be used to generate artificial coral in order to maintain ecosystems as coral is being treated or restored. Previous studies show that the decomposition of PLA in water results in a lower pH. Different biocomposites of PLA have been produced which may mitigate the environmental impact of PLA in the ocean. This study looks at the effects of these biocomposites on saltwater quality as they decompose.

G. Mebratu, S. Burchett, Department of Chemistry, Central Methodist University. **GRIGNARD SYNTHESIS OF THE RECRUITMENT PHEROMONE OF THE EUROPEAN ELM BEETLE AND ALARM PHEROMONE OF VARIOUS ANT SPECIES**. Pheromones are chemical substances released by organisms, which act through chemical signalling. They elicit a specific behavioral response or physiological change in other organisms of the same species. There are two primary types of pheromones, releasers, and primers. Releaser pheromones trigger and immediate behavioral response. Primer pheromones elicit physiological changes, there may be a delay in the observation of these changes. These compounds are naturally occurring and a common form of communication in insects. Pheromones can be classified as sex pheromones,

recruitment pheromones or alarm pheromones. This project focuses on the synthesis of recruitment pheromone of the European elm beetle, and the oxidation of this compound then produces the alarm pheromone used by various ant species over a period of 3 days. In a two-day process 4-methyl-3-heptanol is synthesized through a Grignard reaction. This is the recruitment pheromone of the European elm beetle. On the 3rd day, 4-methyl-3-heptanol is oxidized with sodium hypochlorite producing 4-methyl-3-heptanone, the alarm pheromone of ant species.

K. Miles[1], R. Brown[2], and K. Woelk[1],[1]Department of Chemistry, [2]Department of Chemical Engineering, Missouri University of Science and Technology. **MATERIALS' PROPERTIES ANALYZED BY TRANSVERSED MAGNETIC RESONANCE RELAXATION STUDIES.** Nuclear Magnetic Resonance (NMR) spectroscopy is a well-known analytical technique that uses the excitation of nuclear spins for solving chemical structures and conformations. Relaxometry is an emerging field of NMR spectroscopy where information is gained about interactions of nuclear spins with their surroundings. In NMR relaxometry investigations, the time it takes for phase-correlated, transverse magnetization to lose its correlation (i.e., transverse relaxation time or spin-spin relaxation time) provides insight into the viscosity, local mobility, or other properties based on molecular motion and intermolecular forces. The CPMG (Carr-Purcell-Meiboom-Gill) relaxation technique is the most common method for extracting transverse relaxation times with NMR spectroscopy. A modified CPMG sequence was developed to allow for the evaluation of multiple relaxation coefficients in one experiment. Several sets of CPMG experiments are used to support ongoing research projects at Missouri S&T. For example, relaxation experiments were conducted to investigate new, aged, and rejuvenated asphalt samples as well as the industrial production of methanol from natural gas. The deterioration of asphalt is a major infrastructure problem and its rejuvenation an important field of research and development. The investigation into the methanol synthesis is expected to provide insights into the reactivity of gaseous molecules with the catalyst that facilitates the methane-to-methanol conversion. The relaxometry results are expected to assist in improving the conversion yields of this large-scale industrial catalytic reaction.

A. McGovern, B. Roy, G. Thurmon, and S. Burchett Department of Science and Mathematics, Central Methodist University. **IMPACTS OF 3 DIMENSIONALLY PRINTED POLYLACTIC ACID STRUCTURES ON DAMSEL FISH BEHAVIOR AND WATER QUALITY.** A previous study showed that implementing 3D Printed coral-like structures made of polylactic acid did not impact the water quality when placed on a reef in the ocean. The goal of this study was to determine if the polylactic acid would leach into the water and if reef fish (Dascyllus trimaculatus and *Chrysiptera parasema*) would interact with the polylactic acid structures the same way they would interact with live rock. Each tank had three damsels and three structures. The pH was monitored in tanks daily and PLA was set out in saltwater in advance to ensure the PLA structures could be removed before they caused damage to the fish. It was determined that the fish still preferred the polylactic acid structures over the filter and pumps in the tanks. The pH difference between the two tanks was significant ($p<0.05$). Based on the results of this study it is not recommended that polylactic acid structures be implemented for use in the ocean due to their tendency to break down and lower the pH of the water, potentially harming live corals already present in the area.

**Poster Presentations:**

R. Herndon [1], G. Riddle [2], and K. Woelk[3]. [1] Department of Civil engineering, [2] Department of Physics, [3]Department of Chemistry, Missouri University of Science and Technology. **WHERE THE RUBBER MEETS THE ROAD**. Asphalt is a relatively inexpensive material commonly used for road pavements. However, asphalt pavements age through exposure to air and UV radiation, causing them to lose elasticity. This increase in brittleness can lead to cracks and potholes. Several pavement treatments are in use for rejuvenating aging asphalt to reduce cracking and increase the pavement lifetime . Modern, sustainable treatments include the use of pyrolysis oils from used car tires. However, it is not clear whether pyrolysis oils truly rejuvenate asphalt or whether they provide a superficial treatment without a long-term effect. Nuclear Magnetic Resonance (NMR) relaxometry is a scientific area that provides insight into the molecular environment of organic materials. NMR relaxometry will be used to investigate the organic binder in asphalt to establish a performance measure for the quality and durability of road pavements. Because NMR relaxometry probes into the molecular environments, the results of this project will be different from current asphalt performance tests that measure bulk properties such as strength, elasticity, or viscosity. It is expected that NMR relaxometry results provide an advanced, complimentary predictor for the long-term stability of new, aged, and rejuvenated asphalt.

J. Centrella and L. Strawsine, Department of Chemistry, Westminster College. **TWO ADVENTURES IN CHEMICAL ANALYSIS OF CONTAMINATED ENVIRONMENTAL WATERS**. Heavy metals in aquatic environments causes major dysfunction by bioaccumulating, deforming organisms, and degrading populations. Finger Lakes State Park was once an active coal mine, now suspected to have lingering heavy metals. Lake water was analyzed via Flame Atomic Absorption Spectroscopy (FAAS) to quantitate lead and cadmium. Lead was quantitated by standard addition in the range of 1.801 to 0.068 parts per million (ppm), which is higher than the US Environmental Protection Agency's (EPA) action level of 0.015 ppm of lead in drinking water. Similarly, cadmium was calculated to range above 0.005 ppm, the US EPA's action level for cadmium in drinking water. In addition to heavy metal contaminants in Finger Lakes, deadland near Stinson Creek raised concern of pollution in the local community. Henceforth, this creek and nearby stream run-offs were analyzed for pH, DO, and conductivity. Samples from near the deadland had more alkaline pH values as well as elevated conductivities in comparison to samples from upstream and downstream the site. Upon further analysis, a diamine is the suspected identity of the pollutant on the basis of the two $pK_a$ values (11.86 and 8.50) revealed by an acid-base pH titration, peaks associated with N–H stretching in an infrared (IR) spectrum, and ultraviolet-visible (UV-Vis) spectroscopy of Ramini chemical tests for amines. This research was supported through the Fall 2022 Deans Research Grant from Westminster College.

H. Bahn, A. Hermelink, Z. Mayes, K. Woelk, Department of Chemistry, Missouri University of Science and Technology. **INVESTIGATING INDUSTRIAL METHANOL PRODUCTION WITH NUCLEAR MAGNETIC RESONANCE.** Methanol ($CH_3OH$) is an important raw material and precursor chemical for industrial and laboratory processes. It is commonly produced industrially by the syngas route that converts natural gas through steam reforming into a mixture of carbon monoxide, hydrogen gas, and water vapor. This mixture is converted to methanol, which is an exothermic reaction but comes at the expense of a negative entropy balance. The syngas-to-methanol conversion is commonly facilitated at the active sites of the solid catalyst $Cu\text{-}ZnO/Al_2O_3$ but yields only 7% of the desired product methanol in a single turnover reaction. Calculations based on thermodynamic data suggest that the conversion should be as effective as 55%. Nuclear Magnetic Resonance (NMR) spectroscopy in a specialized toroid-cavity pressure probe was used to elucidate the interactions of hydrogen molecules with the catalyst's active sites. Toroid-cavity probes can record NMR data in situ and at the temperature and pressure conditions used in industrial processes, such as in the methane-to-methanol conversion. A gas mixture of 10% $H_2$ and 90% $N_2$ was combined with the catalyst at pressures between 7 atm and 50 atm, and NMR spectroscopy and relaxometry experiments conducted. The spectral NMR data were analyzed using a Langmuir adsorption approach, and relaxation data were evaluated by a computational, iterative refinement algorithm to extract relaxation coefficients for the $H_2$ gas samples. While relaxation data shows one relaxation coefficient for the hydrogen gas, and thus are inconclusive, the signal intensities point to a substantial adsorption of $H_2$ molecules on the active sites of the catalyst.

E. Eguaosa, M. Siebert, Department of Chemistry and Biochemistry, Missouri State University. **FINDING SUSTAINABLE ALTERNATIVES FOR PETROLEUM: THEORETICAL INVESTIGATIONS ON THE CRACKING PROCESS OF METHYL LINOLEATE.** Due to the rapid depletion of the world's fossil fuel supply, particularly petroleum products, prices have already doubled and are predicted to continue to rise as the world's population grows and energy consumption increases. While biodiesel is a viable renewable alternative, its production costs are high, and it performs poorly at low temperatures. Our goal is to enhance conventional biodiesel by utilizing pyrolysis to produce low molecular-weight compounds with high energy densities. To achieve this, it is crucial to understand the pyrolysis path at the atomic scale to engineer sufficient reactants that will maximize the desired energy-producing molecules' yield. To accomplish this, we analyzed 100 *ab initio* trajectories of methyl linoleate, and monitored significant bond-breaking and bond-forming events, their times, and their positions in the molecule. These results were then compared to an in-house computer-automated analysis method that we are developing. In addition, quantum chemical techniques were employed to compute the thermodynamic properties of the resulting fragments.

B. Hiller, L. Gilbert-Saunders. Department of Chemistry, Missouri Southern State University. **THE EFFECTS OF BENZALONIUM CHLORIDE ON *MEDICAGO SATIVA* AND *ELODEA CANADENSIS.*** Benzalkonium chloride, which is used in disinfectants, detergents and some soaps, is a chemical used widely to kill bacteria, viruses, and fungi. Due to its structure, benzalkonium chloride belongs to a class of Quaternary Ammonium Compounds (QACs). Unfortunately, 75% of the QACs commonly used are later detected in wastewater treatment systems, with benzalkonium chloride making up the majority (Zhang, et. al, 2010). These chemicals can be extremely toxic to aquatic wildlife and plants by causing genetic damage to both and low fertility among wildlife (Ferk, et. al, 2007). Elodea (*Elodea canadensis)* and Alfalfa (*Medicago sativa)* were used to study the absorption of benzalkonium chloride. Analysis was performed on the growth of the Elodea sprigs and both plants were studied to quantify the weight/volume % (wt/vol%) of benzalkonium chloride absorbed into the living plant tissue. Results showed the presence of benzalkonium chloride in water uptake at various concentrations did affect plant growth for Elodea with a p-value of 0.00136. However, the results for the absorbed benzalkonium chloride analyzed by gas chromatography were varied according to species and concentrations introduced (in wt/vol%). The p-value of the Elodea was 0.2706 which demonstrates there was not a statistical significance in the concentrations used. With Alfalfa, the absorption of benzalkonium chloride was unique for each concentration, with a p-value of $1.17 \times 10^{-16}$, indicating statistical significance. Thus, the Alfalfa samples had an increase in benzalkonium chloride absorption when exposed to higher concentrations with up-take water exposure. Funding by the Whitmire Foundation.

S. E. Akindele, D. J. Echezona, C. A. Castelblanco Riveros, and M. J. Meziani, Department of Natural Sciences, Northwest Missouri State University, 800 University Drive, Maryville, MO 64468, USA. **EFFICIENT AND SIMPLE SYNTHESIS OF COMPOSITE RESIN INCORPORATING SILVER AND MAGNETIC NANOPARTICLES AND THEIR ANTIBACTERIAL ACTIVITY.** Efficient and facile routes for the immobilization of silver (Ag) and magnetic ($Fe_3O_4$) nanoparticles in anion exchange resin beads with different loading are 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 of Ag and $Fe_3O_4$ incorporated into the resin beads having an average diameter on the order of 10 nm with a few nanoclusters of 20-100 nm. The nanoparticles were homogeneously distributed throughout the resin. The resin nanocomposites 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 long term storage at room temperature, reusability in repeated reactions, and reduces the risk of environmental contamination.

Josie R. Glenn[a], J. E. Isert[a], Gamil A. Guirgis[b], and G. S. Grubbs II[a], [a]Department of Chemistry, Missouri University of Science and Technology, [b]Department of Chemistry and Biochemistry, College of Charleston. **STRUCTURAL DETERMINATION OF 1-ETHYLSILACYCLOPENTANE.** The rotational spectrum of 1-ethylsilacyclopentane (1-ESCP) was collected using a Chirped-Pulse Fourier Transform Microwave (CP-FTMW) spectrometer at the Missouri University of Science and Technology in Rolla, MO. This project was completed in collaboration with Dr. Gamil Guirgis of the College of Charleston in Charleston, SC, who synthesized 1-ESCP. The spectrum was collected in the 5.0 – 19.0 GHz region of the electromagnetic spectrum. Two low energy conformers - one axial and one equatorial - were identified using theoretical calculations. Each conformer was observed in the experimental spectrum, and Hamiltonian parameter fits for each assignment will be presented.

S.J. Adeoye and Dr. M.R. Siebert, Department of Chemistry and Biochemistry, Missouri State University. **A THEORETICAL STUDY INTO THE PYROLYSIS OF BIODIESEL.** Skyrocketing energy demands have impacted the availability of fuel nationwide and raised concerns about the adverse effect of the extraction and refining of crude oil in the environment. This has pushed investigations into other forms of alternative energy. The aim of this work is to discuss the kinetic modeling of simulating methyl stearate, among other FAMEs, which have been sourced from vegetable oils such as soybean and rapeseed oil. The pyrolysis process is studied at an atomic level to understand the chemical kinetic mechanisms in the hopes of engineering viable fuels. Herein, we computationally simulate the pyrolysis process of methyl stearate (a saturated component of biodiesel from soybean and canola oils) by using an in-house database of ab-initio trajectories describing intramolecular processes by observing the jobs for significant bond breaking and forming events, the type of fragment formed, and the time such an event occurred. We also employed programs that use density functional theory to determine the thermodynamic properties of significant pathways in the pyrolysis process. These investigations showed significant agreement between experimental studies when compared to each other.

J. E. Isert[a], C. Saiz[a], W. H. Rice[a], G. Guirgis[b], and G. S. Grubbs[a], [a]Department of Chemistry, Missouri University of Science and Technology, [b]Department of Chemistry and Biochemistry, College of Charleston. **THE ROTATIONAL SPECTRUM AND STRUCTURAL DETERMINATION OF 1-ETHYL-1-FLUOROSILACYCLOPENTANE.** The rotational spectrum of 1-ethyl-1-fluorosilacyclopentane (1E1FSCP) was collected and assigned in the 5.0 - 19.0 GHz region of the electromagnetic spectrum. In collaboration with Dr. Gamil Guirgis of the College of Charleston, the title molecule was synthesized in Charleston, SC and rotational spectra were recorded on a chirped-pulse Fourier transform microwave (CP-FTMW) at the Missouri University of Science and Technology in Rolla, MO. The placement of a fluorine atom on the silicon atom inside the five-member ring has an influence on the types of transitions observed. The experimental method, comparison to theoretical calculation, and structural determination will be discussed.

**Computer Science & Mathematics Section**

**Oral Presentations:**

J. Adams, H. Ali, S. Barker, H. Sadiq, J Smith and J. Woodard, University of Health Sciences and Pharmacy. **PREDICTING DEPRESSION AND ALZHEIMER'S DISEASE USING MACHINE LEARNING TECHNIQUES: MODEL ACCURACY AND EVALUATION.** Earlier studies evaluate the predictive capacity of machine learning models which use variables to anticipate disease presence. This research evaluated the efficacy of those models using a subset of the Centers for Medicare and Medicaid Services (CMS) Limited Use Dataset containing 4,000 patients with equal distribution across gender and disease outcomes. Disease outcomes included mild depressive disorder (MDD), and Alzheimer's disease (AD). Five variables of interest were then selected for use in the predictive model. Outcome variables were identified using the International Classification of Diseases (ICD) codes. Training and test sets were constructed to include 3,000 and 1,000 randomly selected patients from the primary data set respectively. A logistic regression classification technique then produced two models differentiating beneficiaries by presence of disease. Next, data was fit into the model using the training set. The model then predicted outcomes using the test set from which a subset accuracy score was developed. Models were then evaluated using the area under the receiver operating characteristic (AUC-ROC) curve. Depression was prevalent among beneficiaries below 65 years of age (36.9%). However, AD was prevalent among adults who were above 75 years of age (70.2%). The Depression model resulted in an accuracy score of 76% and an AUC of 82%. The AD model resulted in an accuracy score of 65% and an area under the curve of 70%. These findings suggest that the AD model could benefit from changes in variable selection. Supported by the College of Global Population Health, UHSP.

L.Stumpf, Department of Engineering and Information Technology, University of Missouri. **USER EXPERIENCE AND USER INTERFACE DESIGN STUDY: THE IMPACT OF GAMIFICATION ON LEARNING MANAGEMENT SYSTEMS FOR STUDENTS WITH LEARNING DISABILITIES**. Prior research studies concluded that gamifying e-learning websites for students with learning disabilities has been effective in helping them retain course material and achieve course objectives. These previous studies also include a literature review that was conducted on students and teachers from Indonesia that implemented a user experience and user interface focused e-learning site to understand user design benefits. Building upon this research, a gamified e-learning web application called Noggin Games was created using the user experience design software Figma. The application, Noggin Games, was created to understand the impact user experience and user interface design has when applied to a gamified learning system. This study aims to be used in future studies testing the effectiveness of gamified content for students with learning disabilities.

**Conservation Section**

**Oral Presentations:**

J. D. McGhee, Department of Natural Sciences, Northwest Missouri State University. **SUMMER POPULATION PARAMETERS OF THE GRAY TREEFROG COMPLEX IN NORTHWEST MISSOURI.** Effective monitoring efforts and robust parameter estimates are necessary for proper conservation management of amphibian populations. I used a PVC pipe sampling method to estimate summer survival, temporary emigration, and capture rates in six Gray treefrog complex (*Hyla versicolor/H. chrysoscelis*) breeding sites. I monitored treefrogs using 16 PVC pipes per site, checking pipes twice a week from May through August 2015–2019. I then compared 19 hypothesized models regarding the parameters by $QAIC_c$. Model selection favored models with time-constant weekly survival ranging from 0.86–0.96, Markovian movement, and similar capture and recapture rates ranging from 0.62–0.82 annually. Compared to other studies my results suggest low summer survival, substantial fidelity to the sampled areas during the summer, and minimal trap response.

C. Burandt, T. Wilson, N. Walker, F. Supnet, and A. Newton, Department of Biology, Missouri Western State University. **SURVEY OF POLLINATOR ANIMALS ON A RECENTLY RESTORED CAMPUS PRAIRIE.** Northwest Missouri was once dominated by prairies, which included their associated wildlife. Today, less than 2% of the world's natural prairies remain. The loss of this habitat is linked to the loss of beneficial organisms. The restoration of prairie habitats should result in the increase of native vegetation and associated invertebrates and vertebrates. In January 2020, a 30-acre area of land on Missouri Western State University's (MWSU) campus was converted into a restored prairie. The John Rushin Teaching and Research Prairie was established through a collaboration between the Missouri Department of Conservation and faculty in the Department of Biology at MWSU. In our research, we study plant-arthropod relationships. Our aim is to determine if arthropods that would be expected to inhabit a naturally formed prairie are found in our campus-restored prairie. Our focus is on pollinator animals – species that travel to different flowers resulting in pollination. Understanding the biodiversity of these organisms will help us determine the success of the prairie. We set up video cameras on various prairie plants starting in late spring 2022 and extending through summer and fall of the same year. We identified the pollinator animals that were seen on camera to the most accurate taxonomic classification that the footage allowed. Here we present the data from the pilot year of research.

A. Bair and J. B. Kimmons, Department of Natural Sciences, Park University. **DIETARY ASPECTS OF AN URBAN TURTLE COMMUNITY IN A MISSOURI RIVER TRIBUTARY: A STABLE ISOTOPE AND FECAL APPROACH.** Urban streams are influenced by a wide variety of anthropogenic resources. Rush Creek (Platte County, Missouri), a tributary of the Missouri River, has both agricultural and urban inputs in its watershed. Healthy streams should support a robust community of aquatic organisms. In 2021 and 2022, we started monitoring the aquatic turtle community of Rush Creek to determine species composition, morphometrics, and diets within this urban stream. In 2021, four turtle species were collected: red-eared slider (*Trachemys scripta*), western painted turtle (*Chrysemys picta*), common snapping turtle (*Chelydra serpentina*), and spiny softshell turtle (*Apalone spinifera*). Stable isotope analysis of $\delta^{13}C$ and $\delta^{15}N$ of turtle nails showed trophic relationships among species.

Softshell turtles fed at the highest trophic level, while painted turtles occupied the lowest trophic level. Snapping turtles and red-eared sliders had a generalist diet with isotope values falling between soft shelled and painted turtles. In 2022, fecal analysis was incorporated with $\delta^{13}C$ and $\delta^{15}N$ stable isotope of nails. Indigestible material in feces (bones, seeds, and exoskeletons) could show why specialists diets of softshell and painted turtles are widely different, while giving insight into why generalist diets of snapping turtles and sliders span a wider trophic range.

J. Messick, Department of Biology and Environmental Health, Missouri Southern State University. **USING DRONES TO ESTIMATE BLACKBIRD DENSITY.** This work represents ongoing efforts to evaluate drones (remotely piloted or unmanned aircraft) as tools for collecting ecologic data. The objective of the current project is to determine the accuracy and precision of using drones to estimate the density of red-winged blackbirds (*Agelaius phoeniceus*). The primary study area is a 2-ha cattail (*Typha spp*.) marsh bordered by Joplin Creek in Murphy Boulevard Park, Joplin, MO (centered at 37.073639 N 94.488558 W). Drones equipped with visible spectrum and infrared cameras were used. Variables related to the drone and sampling methods include flight altitude, camera angle, ground sampling distance, and time of flight. Drones are inferior to traditional methods of counting territorial males but worked well to estimate the size of roosting or flocking birds. Programmed flight patterns facilitated sampling replication, and the cost of operating a drone is significantly less than traditional manned aircraft.

J. Thomas and J. Willand, Department of Biology and Environmental Health, Missouri Southern State University. **ASSESSING FLORISTIC QUALITY OF REMNANT PRAIRIE PLANT COMMUNITIES IN SOUTHWEST MISSOURI.** Tallgrass prairie is an endangered ecosystem, with < 0.1% of the original extent remaining in Missouri. The remnants that remain are small, fragmented, and isolated on the landscape. Field surveys were conducted three times in 2022 (late spring, mid-summer, late-summer) to assess the floristic quality of plant communities in two remnant prairies near Asbury, MO. Field sampling was conducted along three 50 m transects in each remnant, and $1m^2$ sampling frames were placed every 5 m along alternating sides the length of the transect. Visual estimates of plant cover were taken and Daubenmire cover values (1-100%) were assigned to all plant species rooted within sampling frames. The collected data was used to calculate floristic quality indices (FQI), Shannon diversity indices (H'), species richness (*S*), and frequency. Both of the sampled remnants had FQI values around 30, indicating high floristic quality. We encountered > 55 plant species in each remnant, and Shannon diversity indices were > 2.85 for both remnants, supporting the results of the FQI values. The most frequently encountered species in both remnants were *Dichanthelium acuminatum*, *Euthamia gymnospermoides*, *Helianthus mollis*, *Orbexillum pedunculatum*, and *Parthenium integrifolium*. In 2023 we will continue to assess floristic quality in remnant prairies by sampling three more remnants.

**Poster Presentations:**

D. Ashley[a], M. Mills[a], C. Ganong[a], D. Drake[a], C. Chevalier[a], and D. Woods[b], [a]Biology Department, Missouri Western State University, [b]Ozark Underground Laboratory. APPLIED **LEARNING EXPERIENCES WITHIN THE CONTEXT OF KARST CONSERVATION, MANAGEMENT AND EDUCATION.** Staff of The Ozark Underground Laboratory have participated as environmental consultants in karst topography for more than 65 years. Tumbling Creek Cave is located near Protem, MO at the site of the OUL. Tumbling Creek Cave is a registered National Natural Landmark and contains the highest biodiversity of any North American cave west of the Mississippi River. Tumbling Creek Cave has been a major feature in karst educational programs provided by OUL. MWSU faculty and students first visited the OUL in 1992 to participate in a karst hydrology workshop. Since that time, more than 70 visits to the lab have been scheduled by faculty seeking applied learning experiences in the Missouri Ozarks for our students. Many of the visits involve participation in educational workshops in karst hydrology which include surface tours of karst features and underground tours in TCC. Many of the trips have given students applied learning experiences in monitoring populations of cave biota and surface populations of invertebrates, mammals, reptiles and amphibians. Three of these trips involved student members of The Wildlife Society who have volunteered more than 500-person hours participating in a glade restoration project. This presentation will describe the facilities and surface features at the OUL and overview the applied learning experiences of our students.

V. Farber[a], and M. Kilmer[b], [a]Joplin High School, [b]Department of Biology and Environmental Health, Missouri Southern State University. **GENERATIONAL EFFECTS OF EXPOSURE TO POLYETHYLENE MICROPLASTICS ON THE AQUATIC MICROCRUSTACEAN, *DAPHNIA MAGNA*.** Microplastics are an emerging environmental concern and are known to cause health issues in aquatic organisms exposed to them. Effects on freshwater organisms remain relatively understudied. In this study, we used *Daphnia magna*, a freshwater microcrustacean, to examine sublethal effects of exposure to polyethylene microplastics across two generations of organisms. Initially, neonates were reared in chambers containing either 0 mg/L or 10 mg/L of microplastics. Organisms were reared until production of a third brood of offspring. While total reproductive output did not vary between treatments, the average size of offspring produced was significantly smaller in the microplastics treatment (0.868 mm vs. 0.818 mm). Next, offspring from the plastic-exposed group were collected and raised under the same conditions (0 mg/L vs. 10 mg/L plastics) to see if the effect persisted, even when the exposure was removed. Again, total reproductive output was consistent between treatments, but offspring were significantly smaller in the plastics exposed group (0.725 mm vs. 0.76 mm,). Interestingly, even though the 2$^{nd}$ generation organisms raised in water were larger than those exposed to plastic, all 2$^{nd}$ generation offspring were smaller than first generation offspring (0.843 mm vs. 0.716 mm). This indicates that the effects of exposure to plastics may persist between generations even if the exposure to plastics is reversed. While it is unclear how long this effect might last, or if it would intensify with repeated exposure, this study does indicate that even limited exposure to microplastics may have persistent reproductive effects in these organisms.

**Geography Section**

**Poster Presentation:**

S. Rector[1] and C. Blodgett[2], [1]Department of Classics, Archaeology, and Religion, [2]Department of Geography, University of Missouri – Columbia. **DEVELOPING A WORKFLOW FOR PROCESSING UAV-BASED ARCHAEOLOGICAL LIDAR DATA.** This project examines processing light detection and ranging (LiDAR) point cloud data obtained from a custom-built unmanned aerial vehicle (UAV) LiDAR sensor tested at the first century CE Roman site of Antiochia ad Cragum in southern Turkey during the 2022 summer field season. The custom LiDAR unit was mounted on a DJI M600 UAV, and seven flights were conducted covering an area of approximately 12 hectares. The UAV was operated from an altitude of 40 m with a forward velocity of 5 m/s during data collection. Archaeological LiDAR surveys in the Mediterranean Basin are hampered by steep, sloping terrain, and low dense scrub which can prevent the laser from reaching the ground. These factors can hinder the generation of bare-earth digital elevation models (DEM) from the LiDAR point cloud. These DEMs are of interest to archaeologists engaged in archaeological prospection, site survey, and cultural heritage management, so developing workflows to convert the georeferenced point cloud data from the sensor (level 1 data) to a DEM (level 2 data) is critical. This presentation will discuss ongoing research to develop a workflow for processing the custom UAV LiDAR data from a raw point cloud to analysis ready products for use in archaeology.

**Geology & Geosciences Section**

**Oral Presentations:**

C.E. Boston[a], M. Taylor[b], and T. Taylor[b], [a]Department of Social & Behavioral Sciences, Lincoln University, [b]Independent Scholar. **APPLICATIONS FOR INFRARED SCANNING IN HISTORICAL ARCHAEOLOGICAL RESEARCH**. Noninvasive survey techniques are vital to expediting archaeological excavations and conserving archaeological resources. Numerous noninvasive techniques exist, and each carries with it specific uses, benefits, and consequences. The purpose of this study was to test the applications of infrared scanning in historical archaeological research, a relatively new and rarely used noninvasive survey technique. Infrared scanning utilizes temperature variations at and just below the surface of the topsoil to detect archaeological artifacts and features. While previously used to identify large features and artifacts at prehistoric sites this technique has not been used extensively with smaller features and artifacts or at historic period sites. Infrared scanning at the Don Carlos site, a historic site in mid-Missouri, was conducted, and the results were not as fruitful as expected, demonstrating the limitations in this technology in locating smaller features and artifacts. The results, while not as expected, did narrow down locations of some artifacts, thereby expediting excavation to a small degree. The implications, limitations, and future possibilities of infrared scanning in historical archaeological research will be further addressed.

J. McDaniel and D. Gouzie, Department of Geography, Geology and Planning, Missouri State University. **Analyzing Potential Chemical Variability and its Relationship to Engineering Properties in the Bentonville Formation, Springfield, Missouri**. The Bentonville formation is regionally extensive through Iowa and Missouri and can be roughly-correlated into Arkansas and Oklahoma. This formation is a surficial rock unit in most of the Springfield plateau. It has been studied extensively in Northeast Missouri, Iowa, and Illinois (Banner et al., 1988; Choquette et al., 1991; Hoenig, 2019). Most of these studies looked at the lateral variability of depositional facies with only a few geochemical studies. In southwest Missouri there are a limited amount of geochemical studies. In the Springfield Plateau, many karst features exist which appear to relate to the hydrology within the Bentonville formation and its units (Dodd, 2007). This relation may be caused by the amount of chert variability or lithological changes both vertically and horizontally, going from a major crystalline limestone to a crinoidal packstone. Another change is seen in surface streams, where beds of the Bentonville formation appear to serve as aquicludes at certain points in the stream, suggesting vertical variability alongside horizontal change. This project will use geochemical methods to investigate chemical variability in the Bentonville formation. The project will also include LA Abrasion tests to compare chemical differences to the formation's abrasiveness. Based on literature, it might be possible to observe differences in B/Ga ratios. Anecdotally from local quarry operators suggest that LA Abrasion tests indicate vertical variations, offering a possible chemical reason for the differences. Analytical methods will include Inductive Coupled Plasma Mass Spectrometry and LA Abrasion (ASTM Method C131), expanding as necessary.

**Poster Presentations:**

D. DeHart, J. McDaniel, and T. Dogwiler, Department of Geography, Geology and Planning, Missouri State University. **ASSESSMENT OF HISTORICAL AND CURRENT REGIONAL GEOMORPHIC PARAMETERS IN OZARK STREAMS TO SUPPORT BANK STABILIZATION.** Using historical imagery analysis and current stream survey data we document the range and magnitude of change in stream channel morphology in representative streams within the Ozarks over the past 80 years. These results will be used by the US Army Corps of Engineers to develop broadly applicable guidance for ecological lift and bank stabilization that will streamline the permitting process for landowner bank stabilization projects. Aerial imagery from the 1940s to present was used to digitize plan view channel features. In-channel surveys are used to collect additional data about bedform composition, flow parameters, and bed material. Drone-based aerial surveys are used to generate high resolution orthophotography and digital elevation models of the current channel conditions. Our preliminary data from South Dry Sac streams shows that the width has changed since the 1950's to today by at least 4 meters with some change in sinuosity. More recently, sinuosity has changed from 1.018 to 1.005 since 1950 to 2015. The only area changes sensed from aerial photos is an increase in tree density and housing on the downstream left side of the river. All data was compiled into a Geographic Information System that will streamline sharing, collaboration, and future analysis of channel morphology. US Army Corps of Engineers SOI: W81EWF-22-SOI-0035

A. Momberg[1] and D.Gouzie[2], Department of Geology, Geography, and Planning, Missouri State University. **CAN BOOKS BE TOXIC?** Some recent studies have found that some books have arsenic in their covers and Missouri State University, Meyer Library, Special Collections Department was curious if some of their own books may also contain arsenic. We tested to see if there was any arsenic in the fabric that was used to cover the book. We specifically looked at books that were covered in fabric that is a green or otherwise known as a "Paris Green" color. The arsenic was used to get the bright green color and was also used in carpeting, wallpaper, book covers and more. A handheld XRF was used to test small spots on the covers and this allowed us to see what elements are present. This research could change the way that these books are stored to make it safer for the librarians handling them. Preliminary data suggests that books that were produced in the early 1800's until the early 1900's have on average a higher arsenic content within their covers.

**Physics & Engineering Section**

**Oral Presentations:**

S. Bhardwaj[1,2] and R. Gupta[2,3]. [1]Department of Physics, Pittsburg State University, Pittsburg, Kansas 66762, USA. [2]National Institute of Material Advancement, Pittsburg State University, Pittsburg, Kansas 66762, USA. [3]Department of Chemistry, Pittsburg State University, Pittsburg, Kansas 66762, USA. **$NI(OH)_2$ AND NIO-BASED MOF AS EFFICIENT ELECTRODE MATERIALS FOR OVERALL WATER SPLITTING AND SUPERCAPACITOR.** There are various forms in which human uses energy in daily life. From applications that require a high energy density to long-term storage in a stable manner, the requirements for energy usage result in the development of Energy Storage Devices like batteries, supercapacitors (SCs), and fuel cells. Herein, we synthesis nickel hydroxide and oxide (Ni-MOF)-based electrodes for high performance SC and efficient electrocatalysts which can modify the reaction rate for hydrogen production for later use in fuel cell applications. The Ni-MOF is receiving considerable attention due to its high energy storage capacity and electrochemical stability. The hydroxide Ni-MOF-160 shows the highest specific capacitance ($C_{sp}$) of 603 F/g along with 2.93 kW/kg and 26.62 W.h/kg of power and energy density. Also, the same Ni-MOF-160 shows the lowest overpotential for oxygen evolution reaction (OER), 330 mV, and 126 mV for hydrogen evolution reaction (HER) to reach a current density of 10 $mA/cm^2$. Furthermore, it will offer a facile way to rationally design and synthesize the MOF-based electrodes for robust, stable SC and efficient fuel cells.

D. Marsh and R. Bajracharya. Department of Chemistry and Physics, Missouri Southern State University. **STUDENT AND EXPERT UNDERSTANDING OF INFINITY AND APPLICATIONS AT THE MATHEMATICS-PHYSICS INTERFACE.** Many standard text book examples in physics use the concept of infinity to quantify scales of physical quantities. Physics students are commonly given examples and problems with infinite distance, infinite mass, infinite potential energy, and infinite time. We are investigating how students' deal with the infinity concept in their solutions of problems in mathematics and physics. We report results from individual semi-structured interviews with novice and advanced physics students, where they are required to use the concept of infinity to solve problems. We compare these results with individual semi-structured interviews with mathematics experts. We found differences in the ways experts and students interpret and implement the concept of infinity. Students have several difficulties with the implementation and interpretation of the concept of infinity. These difficulties are due to either insufficient understanding of the underlying mathematical concept, differences in how it is interpreted and implemented in mathematics and physics, or inappropriate implementation to physics. We also found that student difficulties stem from the fact that in mathematics infinity is used as an abstract upper bound.

G. Ochoa[1], S. Kulkarni[2], O. Girish[3], H. Hernandez[4], J. Lu[5], C. Russell[6], S. Risin[7], and R. Freed[8]. [1]Western Kentucky University. [2]Dougherty Valley High School. [3]Walters Middle School/Mountain House High School. [4]Victor Valley College. [5]Irvine High School. [6]Missouri Valley College. [7]University of California at Berkley. [8]Institute for Student Astronomical Research. **MEASUREMENTS OF THE POSITION ANGLE AND SEPARATE FOR WDS 14082+3645 WITH SPECKLE INTERFEROMETRY AND OPTICAL TELESCOPES.** This study explores the detection and identification of volatile organic compounds (VOCs) in human breath for disease diagnosis and emanating from explosives for military applications. Several VOCs found in human breath, like acetone and acetaldehyde, are associated with diseases such as diabetes, lung cancer, and acute respiratory distress syndrome (ARDS). For explosives detection, specific nitrogen-containing analogues like pyridine are used. An Owlstone-FTIR system, in tandem with an optical sensor interrogator, is used to establish a benchmark calibration system of VOCs for novel sensors such as Metal-Organic Framework (MOF) single crystals and porous glass microspheres. The results of this study have important implications for disease diagnosis and military applications. This study aims to provide concise and informative insights into the application of VOC detection systems for a multitude of uses.

**Poster Presentations:**

E. Allen, M. Davis, T. Spudich, R. Gerald, and J. Huang. Department of Electrical and Computer Engineering, Missouri University of Science and Technology, Rolla MO 65409-0040, USA. **SPECTROSCOPIC AND INTERFEROGRAPHIC METHODS DEPLOYED IN TANDEM FOR DETECTING VOLATILE ORGANIC COMPOUNDS USED TO DIAGNOSE DISEASES AND IDENTIFY EXPLOSIVE MATERIALS.** This study explores the detection and identification of volatile organic compounds (VOCs) in human breath for disease diagnosis and emanating from explosives for military applications. Several VOCs found in human breath, like acetone and acetaldehyde, are associated with diseases such as diabetes, lung cancer, and acute respiratory distress syndrome (ARDS). For explosives detection, specific nitrogen-containing analogues like pyridine are used. An Owlstone-FTIR system, in tandem with an optical sensor interrogator, is used to establish a benchmark calibration system of VOCs for novel sensors such as Metal-Organic Framework (MOF) single crystals and porous glass microspheres. The results of this study have important implications for disease diagnosis and military applications. This study aims to provide concise and informative insights into the application of VOC detection systems for a multitude of uses.

**Science Education Section**

**Oral Presentations:**

D. Patel, C. Nelson, R. Basha, A. Subhash, D. Johnson, C. Lemmons, S. Kuhnert, and A. Barry, Department of Biology, Missouri Southern State University. **THE ROLE OF UNDERGRADUATE ANATOMICAL EDUCATION IN PREPARING STUDENTS FOR CLINICAL PROGRAM.** Anatomy has survived the test of time, remaining a key pillar of medical education. Over the last two decades, the compression of anatomical course hours has been reported and has resulted in a lack of adequate anatomical knowledge in physicians and medical students. Comprehensive anatomical-based and clinically-focused undergraduate premedical education can contribute to student success in reaching core pillars such as compassionate patient care, medical knowledge, and communication skills. More specifically, the cadaveric study of anatomy in undergraduate programs provides an opportunity to utilize a multi-faceted approach by integrating gross anatomy, histology, and pathology, as well as developing teamwork, observational, and leadership skills. For the last ten years, MSSU has offered an Advanced Human Dissection (AHD) course, utilizing the "patient-first" approach. The objective of the present study was to assess students' perception of the usefulness of cadaver-based anatomy education at the undergraduate level. A Likert-scale survey evaluating the benefits of cadaver-focused learning was administered to MSSU students who completed AHD course and are currently attending medical or dental schools (n=36). Open-ended student responses were analyzed qualitatively. All respondents rated the undergraduate human dissection laboratory as the most helpful tool in learning anatomy and reported confidence regarding their preparedness for clinical programs. The cadaveric study of anatomy thus should be considered as a prerequisite for medical education.

E. Sitkowski, G. Wofford, and D. Morrone, Department of Basic Sciences, University of Health Sciences and Pharmacy in St. Louis. **A MOLECULAR BIOCHEMISTRY LAB EDUCATION TOOL ALLOWING FOR FULL-COLOR EXPERIMENTS.** Previously we developed an engineered version of fluorescent proteins fused with a dihydrofolate reductase enzyme (mCherry-DHFR). This DHFR-fusion protein made for a nearly ideal teaching tool in the biochemistry lab, and we observed some gains in student learning and satisfaction. However, this first-generation molecular tool suffers in that the enzymatic activity of DHFR was not a colorimetric assay. Instead, students would monitor NADPH depletion on a spectrophotometer with an assay that remained colorless. Also, this assay required the addition of two substrates, further complicating kinetic studies for students. Building upon this project, we sought to develop a biochemistry lab education tool to facilitate the learning of protein expression, purification, and enzymology. Accordingly, we wanted this tool to have four broad properties: 1) it is highly expressed, stable, and soluble; 2) its expression and purification can be monitored visually; 3) its catalytic activity can be monitored visually and kinetic parameters obtained; 4) it is economical. Our first version of the mCherry-DHFR tool only had the first two properties. Our new approach made use of an engineered mCherry-GUS fusion that now satisfies all the criteria we are looking for in a molecular teaching tool. The mCherry-GUS is well-expressed, soluble, stable, easily purified to near homogeneity with a single 6His tag, and catalyzes several colorimetric assays with readily available substrates. Thus, students can easily obtain kinetic parameters of these substrates. We have found our mCherry-GUS fusion protein to be an ideal teaching tool for biochemistry lab education.

K. Hendrix, Division of Behavioral Sciences, Southwest Baptist University. **DIFFERENCES BETWEEN FAMILIAR AND UNFAMILIAR SYMBOLS IN VISUAL PROBLEM SOLVING.** This study aimed to further the research on symbol recognition in adults. Specifically, it aimed to investigate the difference in recognition speed between unfamiliar, logographic, Chinese symbols and animal symbols. This was accomplished using two online versions of the classic, Chinese game Mahjong. In Condition 1, participants matched animal tiles while in Condition 2 participants matched the original Chinese symbols. After completing the puzzles, the participants completed an online, QuestionPro survey consisting of demographics, relevant language background, and puzzle-solving tactics. Results will compare the two conditions on mean matching time. The current study describing the difference between the processing speed of familiar and unfamiliar symbols could serve to settle a dispute between Piaget and Vygotsky's cognitive developmental theories. Vygotsky believed that the world was recognized through symbols, whereas Piaget believed that thought preceded the development of symbols.

G. Bhattacharyya, Department of Chemistry and Biochemistry, Missouri State University. **HOW STUDENTS' SENSE-MAKING IN ORGANIC CHEMISTRY MIGHT INFORM THE FEASIBILITY OF INQUIRY LEARNING.** Inquiry-based instruction continues to be an important alternative to traditional lecture-based science education. In this model, a common strategy to help students construct new knowledge is to give them experimental data or other information and allow them to inductively arrive at the target concept. Students are thus expected to discover new concepts through this process-oriented approach. For over 60 years, electron-pushing mechanisms are the predominant method by which instructors teach reactions and mechanisms in organic chemistry. Electron-pushing mechanisms represent the step-by-step pathway, or process, by which reactants of a chemical process are transformed into products. The mechanistic approach is like inquiry-based instruction in that both employ process-based strategies to arrive at specific goals. In that regard, and only that regard, inquiry-based instruction and the mechanistic approach to teaching organic chemistry may present similar cognitive challenges to students. The consensus from the forty-plus research studies that have investigated students' use of electron-pushing mechanisms in a variety of task types is that students almost exclusively focus on the structural representations of the reactant(s), intermediate(s), and product(s) involved in the mechanisms instead of the underlying mechanistic processes. As such, students use the product, *i.e.* the goal, of each step to infer and make sense of the mechanisms, *i.e.* the processes. Using this and other evidence, I assert that neither the mechanistic approach to teaching organic chemistry nor certain forms of inquiry-based instruction may be cognitively feasible for learning new concepts.

J. Pind and S. Mathis, Department of Psychology and Sociology, Park University. **PRESENTATION OF KNOWLEDGE SEEDS: IS IT AS IMPORTANT AS THE SEED ITSELF?** Brown and Siegler (1996) proposed a priming technique called 'seeding the knowledge base' to improve quantitative estimations. The technique asks participants to make estimations. Then a knowledge seed is presented to help, and the rest of the questions are presented. There have been some mixed results for this technique. Our study reports on two knowledge applications. Using an online survey hosted on Amazon MTurk, we asked participants to complete two estimation question sets – one for coffee consumption among 10

different medical specialists and the other for the number of US serial killers across five decades (1960-2000). A total of 65 participants qualified for the 10-question coffee-consumption estimation set. An example question is, 'How many cups of coffee do General Surgeons consume per year?' For the first five questions, participant estimations were significantly different from the fact 4 out of 5 questions (20% accuracy). A seed fact was then presented and the final questions were presented. The estimations improved significantly in this second set (1 out of the 5 estimations was significantly different, ~80% accuracy). This manipulation improved performance. A total of 65 participants qualified for the second task – estimating the number of US serial killers across five decades. After initial responses, a knowledge seed was presented and the participants re-estimated the same decades. The knowledge seeds significantly improved performance overall with moderate effect sizes. Our results support the 'seeding of the knowledge base' to improve estimation performance.

**Poster Presentations:**

A. Ford, S. Hromnak, and S.L. Donovan, College of Arts and Sciences, Maryville University. **USE OF THE EZ1 BIOROBOT TO SIMULATE HUMAN IDENTIFICATION WITH PLASMIDS THAT INCORPORATES ASPECTS OF WORKING IN A FORENSICS LAB.** Laboratory experiences that simulate human identification are limited to a handful of commercially-available, costly kits that lack scientific rigor. The goal of the laboratory exercise was to simulate human identification that combines aspects of working in a crime lab including DNA extraction, quantitation, amplification, and electrophoresis. DNA plasmids were used to represent individuals. All plasmids tested had the ampicillin resistance gene (AMP) which served as an internal control. Other plasmids had a green fluorescent protein (GFP) reporter or lacked this gene. Since the limit of detection is about 50 bp difference for agarose gel electrophoresis, ten PCR primer pairs for GFP ranging from 250-700 bp and six primer pairs for AMP ranging from 200-450 bp were designed in 50 bp increments. As a proof of concept, purified plasmid was spotted directly to sterile cotton swabs for purification using the EZ1 BioRobot, amplified using AMP and GFP primers, and separated on an agarose gel. Amplification of all primer pairs gave expected results except GFP 450, GFP 700, AMP 250, and AMP 300. To mimic human cells plasmids were transfected into a mammalian tissue culture cell line. Transfected cells were harvested, and different volumes were added to sterile cotton swabs for purification and downstream processing. The data suggest it is feasible to use this approach to incorporate robust laboratory skills in a mock human identification laboratory exercise.

A. Schab, J. Edwards, Department of Chemistry, Saint Louis University. **GREEN CHEMISTRY SPECTROSCOPY LAB PROTOCOL.** Spectrophotometric analysis of multicomponent solutions can be used to give students hands-on learning experiences with Beer's Law. These labs utilize the spectrographic qualities of common transition metal and ion solutions to quantify concentrations of different chemical species. Multicomponent solutions of Copper and Cobalt are often utilized because of their bright blue and pink colors, respectively. The concentrations of different chemical species in one solution can be determined by manipulating Beer's Law, utilizing a Spec 20, and referencing standard calibration curves. Unfortunately, these labs require production of large amounts of toxic Cobalt and Copper solutions. In this study, a safe and cheap spectroscopy protocol was created using the food dyes Tartrazine (Yellow) and Fast Green. A series of standard calibration curves with different ranges between 0 to 50 ppm were tested for accuracy. The calibration curve with the 3 to 15 ppm range

provided the most accurate prediction of unknown food dye solutions. This study suggests that Tartrazine (Yellow) and Fast Green compounds have a lower limit of quantification at 3 ppm and an upper limit of quantification at 15 ppm. Standard calibration curves using solutions outside of the 3 to 15 ppm range are detectable by Spec 20s, but cannot be quantified as accurately and fall outside the linear dynamic range. This protocol can eliminate the use of caustic and expensive transition metal solutions to teach chemistry students basic analytical spectroscopy techniques with a Spec 20.

**Social and Behavioral Sciences Section**

**Oral Presentations:**

B. Cowley and H. Rawhouser. Department of Psychology and Sociology. Park University. **A COMPARISON OF GENDER ROLE ATTITUDES BETWEEN YOUNG ADULTS AND MIDDLE-AGED ADULTS.** Definitions of gender and sex are social constructs that change as society and culture evolve. When such definitions change this creates stress and eventual change to belief systems. Such dynamics also result in changes to gender roles and recently gender roles have trended to more egalitarian views towards the male and female dichotomy. A survey was created to measures gender role attitudes in young and middle-aged adults. Young-aged adults consisted of 18-25 years and middle-aged adults consisted of 45-65 years. There were 335 respondents. The initial hypothesis was that younger adults would demonstrate a more egalitarian view than older adults. Generally, both younger adults (ages 18-25) and middle-aged adults (45-64) showed more egalitarian gender role than traditional gender role attitudes. Surprisingly there were times when younger adults scored more traditional scores to older adults.

L. Fincher and N. Meeks, Department of Psychology, College of the Ozarks. **THE RELATIONSHIP BETWEEN MUSIC, GENRE, AND COLLEGE STUDENTS' STRESS LEVELS.** Many studies within the last 10 years have focused on the anxiolytic (anxiety-reducing) effects of classical music on the listener, often using populations with high-stress levels such as dementia patients and university students. This study will investigate music's anxiolytic effect based on different music genres: including classical, jazz, country, pop, rap, and rock, and will collect data through an online survey. The population will consist of male and female students attending a small, private, liberal arts college in southwest Missouri. The survey will utilize Perceived Stress Scale to quantify student stress levels and average music-listening time as well as collect qualitative data such as the preferences of music genres. These inquiries will potentially reveal if the stress-reducing effects of music are specific to the classical genre, or if they are a benefit shared by the contemporary genres of today.

L. Hogan, M. Kramer, and K. Stem, Department of Human and Behavioral Sciences, College of the Ozarks. **AUTISM SPECTRUM DISORDER AND ACCOMMODATIONS IN EDUCATIONAL AND OCCUPATIONAL SETTINGS**. We conducted a review of several physiological research studies investigating the neurology of individuals with autism spectrum disorders (ASD). The current field of autism research lacks preventative considerations by focusing on behavioral expressions in adolescent or adult individuals with ASD. This study establishes greater understanding of the characteristics of these individuals by exploring both developmental and physiological components of this disorder. Based on this analysis, we propose improvements for accommodations in both educational and occupational settings for individuals with ASD.

O. Janssen, and M. Price. Department of Behavioral Sciences, College of the Ozarks. **THE IMPACT OF POSTTRAUMATIC STRESS DISORDER ON THE QUALITY OF SLEEP IN FIRST RESPONDERS.** Existing literature revealed that significant levels of first responders experience some form of sleep disturbance and that sleep quality and PTSD symptoms may be correlated. 97.6% of firefighters reported sleep disturbances and 73.6% had symptoms consistent with PTSD. PTSD symptoms during the day also preceded a decrease in sleep quality ($p < .001$) and sleep length ($p= .017$) over the previous night. Nightmares and insomnia were found to increase overall PTSD symptoms during the following days ($p < .001$). This study is designed to discover if there is a significant difference between the sleep quality of first responders with PTSD and those without PTSD. This study will first responders in evaluate southwest Missouri by utilizing self-report questionnaires to measure PTSD symptoms and sleep quality. PTSD Checklist for DSM-5 (PCL-5), Pittsburg Sleep Quality Index, and Patient-Reported Outcomes Measurement Information System (PROMIS) will be used to gather information for testing. Results will be analyzed using ANOVA. If the hypothesis is supported then we suggest longitudinal studies be designed to examine the long-term effects of PTSD on sleep quality. We also suggest a further study on the potential influence of sleep quality on PTSD symptom severity.

S. Orimaye, M. Tabet. College of Global Population Health, University of Health Sciences and Pharmacy. **ASSOCIATION BETWEEN U.S. MINORITY STATUS AND POSTPARTUM MENTAL HEALTH**. We performed a two-year cross-sectional analysis of the 2018-2019 National Survey of Children's Health (NSCH) data to examine the period prevalence of postpartum mental health and its association with U.S. minority status. We restricted the NSCH data to children who were within one year of age (0-12 months) and selected three *Child and Family Health* measures, which include (1) *poor mental status of mothers*, (2) *received emotional support with parenting*, and (3) *coping with daily demands of raising children*. We stratified the three measures by race and ethnicity of the mother and calculated the rate per 1,000 mothers for each measure. Using Odds Ratio, we estimate the association between the racial/ethnic group and each mental health measure, with White mothers as reference. Of the 1,915 mothers, 66.1% were White, 14.1% Hispanic, 13.2% were Multi-racial/Other, and 6.6% were Black. The mean age of mothers was 30.4±5.4 years. Minority mothers showed higher rates of poor mental health status per 1,000 mothers compared to White mothers. Black mothers had the highest rates of poor mental health for all three measures (54.3, 188.0, and 16.8 per 1,000 mothers, respectively). Black mothers showed increased odds of poor postpartum mental health status, with 60% to 3.7 times higher odds of poor postpartum mental health status than their White counterparts across the three measures.

M. Price, Department of Behavioral Science, College of the Ozarks. **EFFECTS OF VISUAL PRIMES ON PERCEPTION OF FACIAL EMOTIONAL EXPRESSIONS**. The purpose of this study was to measure the effects of different visual stimuli on the perception of facial expressions. A survey was created utilizing Google Forms in which participants were randomly divided into three groups. The control group viewed 10 photos of emotionally-neutral faces to create a baseline of perceived emotion associated with each face. Groups A and B viewed photos of 10 negative or positive image primes followed by photos of the emotionally-neutral faces to investigate whether the primes changed the perceptions of faces. Participants also completed the 10-Item Personality Inventory and the Positive and Negative Affect Schedule (PANAS-GEN). Empirical results helped further the understanding of the effects of visual imagery, such as those used in current technology, on perceptions.

T. Roe, C.E. Boston, Department of Social & Behavioral Science, Lincoln University. **ARCHAEOLOGY OF HOMELESSNESS.** Homelessness is an endemic problem across the United States. No single state is without a homeless population, including Missouri. Through the use of archeological survey methods, the needs of the homeless can be better understood in order to provide those individuals with the opportunity to improve their situation. This paper aims to take an archeological approach to explore the needs of the homeless in Central Missouri. A project addressing those specifics needs of the homeless within Central Missouri will then be formulated based on the research. This project will then be presented to community members and organizations with the ultimate goal of implementing a program that serves the needs of the members of this often-overlooked population within our communities.

C. Walker, Department of Social and Behavioral Sciences, Lincoln University. **BLACK PIONEERS IN MENTAL HEALTH.** This presentation spotlights the pioneering contributions of African-Americans who have been largely overlooked by mainstream psychology dating back to the early 20$^{th}$ century. This presentation is based on a literature review, not an empirical study. It will examine the racist history that has permeated psychology as a whole and allowed these figures to go unnoticed for so long. Significant figures who made landmark contributions will be recognized, such as Bebe Moore Campbell, Robert Lee Williams, Beverly Greene, Inez Beverly Prosser, Solomon Carter Fuller, and many more. By emphasizing their work, the presentation underscores the importance of recognizing the value of Black mental health leaders, who are better equipped to target and address the specific mental health issues affecting African-Americans. Additionally, this presentation acknowledges the undervalued professionals whose groundbreaking work has helped shape the current state of Black psychology.

**Poster Presentations:**

C. Arnold, A. Zeff, C. Collins, and L. Elder, Department of Psychology, Central Methodist University. **THE EFFECT OF SOCIAL COMPARISON THROUGH SNAPCHAT ON RELATIONSHIP SATISFACTION.** Previous research has shown that frequent use of social media is associated with lower levels of life satisfaction (e.g., Keles et al., 2020). One explanation for this phenomenon is that users engage in upward social comparison, comparing themselves to idealized images posted by others. This experimentally been shown with body image (Kleemans et al., 2018), but not in other domains. The present study experimentally examines the effect of social comparison in an original context – romantic satisfaction. All participants were shown Snapchat posts that were manipulated to indicate that the person posting

was either satisfied or dissatisfied with their romantic partner. Participants then were asked questions about their own romantic relationship and completed the Relationship Assessment Scale (RAS). It was hypothesized that those who saw the happy Snapchat post would indicate lower satisfaction with their own relationship due to upward social comparison. This hypothesis was partially supported. Although condition did not significantly predict scores on the RAS, those who saw the happy post scored significantly lower on the item "How good is your relationship compared to most?" ($p < .05$). This indicates that college students do use social media as a source of comparison. Although this does not necessarily create discontent, it is likely that repeated exposure to social media could create warped expectations toward romantic partners.

E.C. Burns and B. Kostic, Psychology Department, Missouri State University. **CLOCK DISPLAYS AND TIME ESTIMATES**. Clocks are necessary for timekeeping in modern life but very little research has explored the differences between analog and digital displays. Some previous research has suggested that digital displays are easier to read, but Paivio's (1978) results suggest that analog displays may be preferable for spatial tasks. The current study seeks to explore how estimates of time compare when dealing with analog and digital displays. Participants were students recruited from an introductory psychology class. They were randomly assigned to either an analog-display or digital-display condition. Then, on individual computers, participants estimated the amount of time left until the next hour by clicking and dragging a red circle on a slider without ticks. The procedure involved 36 trials in a random order. Results showed no significant difference in the accuracy of the estimates in the analog and digital display condition. However, participants were slightly faster to respond when viewing digital displays. Future research will explore time estimates under conditions of divided attention

J. Pind and A. Johnson, Department of Psychology & Sociology. Park University. **THE EFFECTS OF APHANTASIA ON MENTAL ROTATION AND COGNITIVE MAPPING PERFORMANCE**. Aphantasia is a condition characterized by the inability to voluntarily generate mental images or visual memories and was first coined by Adam Zeman, a cognitive neuroscientist in 2015. We were interested the relationship between Aphantasia level (measured by the VVIQ) and performance on the Mental Rotations Test (MRT) and the US Abbreviations Task (USAT). The MRT has been extensively used, but the USAT has not. The USAT presents participants with an outline map of the continental US and they are asked to write in the two-letter state abbreviation of each state as large as possible being 100% confident that they would fall inside the state's boundary. We identified a small sample of 6 adults (5 Females/ 1 Male) who appear to have Aphantasia. Individually we administered the VVIQ and the MRT and US Abbreviations Task. The mean VVIQ was 81.67% (48.75% - 100%). The mean MRT performance was 40.28% and for the US Abbreviations task the overall Accuracy was 47.31% and Confidence was 11.4%. A Pearson product movement test between VVIQ and MRT was not significant. However, VVIQ was significantly correlated with overall USAT Accuracy, $r(4) = -0.9482$, $p=0.004$. VVIQ scores were not correlated with USAT Confidence scores. USAT Accuracy and Confidence followed a positive linear trend across the number of sides present on the outline map with 0-sided states showing the lowest performance. These results validate the efficacy of the VVIQ to identify Aphantasia and provide evidence that tasks that rely on mental imagery, i.e., USAT, are negatively impacted.

S. Tucker, Department of Psychology, Missouri Southern State University. **TEACHING TO LEARN: FACILITATING THE USE OF RESEARCH-BASED STUDY TECHNIQUES BY UNDERGRADUATE STUDENTS**. Psychologists have long known the important role that practice testing and spaced learning play in long-term retention of materials. However, it remains unclear how to increase the use of these techniques in such a way that translates into improved learning outcomes in the classroom. In the current study, 34 undergraduate students completed a brief demonstration of random fact-learning, either before their second or third course exam. During the demonstration, each fact was presented on a computer screen twice, but spacing between the two presentations varied and recall was required for half the facts, while the others were simply re-presented. The students then completed a multiple-choice test over the facts and were asked to elaborate on how helpful the spacing and practice test techniques were. To indicate whether the demonstration translated into classroom learning outcomes, growth on unit exam scores was analyzed. There was a statistically significant interaction between unit exam timing and demonstration timing, $p$=.03. Improvement on unit exam scores depended upon timing of the demonstration, with each group showing significant gains only after completion of the demonstration. Surprisingly, however, students did not report using these two techniques more often following completion of the demonstration. Findings suggest that college students—and likely younger students—may improve their study strategies following a simple, brief, and measurable experience, but they may not be fully aware of these improvements.